

02



Industria y Comercio

S U P E R I N T E N D E N C I A

Delegatura de propiedad Industrial

División de Nuevas Creaciones

PCT
SOLICITUD

PATENTE DE INVENCION

05-91265

21. EXPEDIENTE No.

54. TÍTULO METODO PARA REDUCIR LA FORMACION DE ACRILAMIDA EN ALIMENTOS
PROCESADOS TERMICAMENTE

51. CLASIFICACIÓN INTERNACIONAL

71. SOLICITANTE FRITO LAY NORTH AMERICA INC. f/k/a RECOT INC.

DOMICILIO TEXAS, ESTADOS UNIDOS DE AMERICA

74. APODERADO JAIME EDUARDO DELGADO VILLEGAS

22. BOGOTÁ, D. C.,

1
+
209

SUPERINDUSTRIA Y COMERCIO
Radicación : 10097263 00000000 Folios: 209
Fecha (IMP): 2005-09-09 15:51:56
Framite : 011 PCT-PAIENT 3/9 FASE NACI 411 PRESENAC
Residencia: 2000 DIVISION DE NUEVAS CREACIONES

FORMULARIO ÚNICO DE SOLICITUD DE PATENTE
PCT

ENTRADA EN FASE NACIONAL

1

SOLICITUD DE:

☒ Patente de Invención

☐ Patente de Modelo de Utilidad

☐ Capítulo I

☒ Capítulo II

2

SOLICITANTE
(71)

Nombre: FRITO - LAY NORTH AMERICA, INC.
RECOT, INC
Dirección: 7701 Legacy Drive Plano, TX 75268
United States
Nacionalidad o domicilio: Estados Unidos de América
Lugar de Constitución:

Teléfono: Fax:
E-mail:

IDENTIFICACIÓN

C.C. ☐ NIT ☐

C.E. ☐ Otro ☐

Cual: _____

Número:

3

REPRESENTANTE
O APODERADO

Nombre: JAIME EDUARDO DELGADO VILLEGAS
Dirección: Avda. 22 No. 37 - 31 of. 202, BOGOTA
Teléfono: 2444098 Fax: 2442498
E-mail:

IDENTIFICACIÓN

C.C. ☒ NIT ☐

C.E. ☐ Otro ☐

Cual

Número: 19.270.955 T.P. 43.308 C.S.J.

4

INVENTOR (ES)
(72)

Nombre: (Ver anexo)
Dirección:
Nacionalidad o Domicilio:

5

PCT (88)
Solicitud Internacional No. PCT/US2004/03375 Fecha 08.02.2004
Publicación Internacional No. WO 2004/078955 A2 Fecha 10-09-04

6

Título (84)
MÉTODO PARA REDUCIR LA FORMACIÓN DE ACRILAMIDA EN ALIMENTOS
PROCESADOS TÉRMICAMENTE

7

Clasificación Internacional (81) A23L 1/217

8

Prioridad

SI ☒ NO ☐

(33) País de Origen

US

(32) Fecha

21/02/2003

(31) Número de Solicitud

US10/372.738

9

Comprobante de pago No.

Fecha:

Instrucciones para el diligenciamiento del presente formulario, ver reverso de esta página.

10

ANEXOS

☒

Comprobante de pago de la tasa de presentación de la solicitud.

☐

Documento que acredite la existencia y representación legal cuando el solicitante sea persona jurídica.

☒

Poderes, si fuere el caso.

☒

Documento de cesión del inventor al solicitante o a su causante.

☐

Declaraciones

☒

Copia de la solicitud internacional (Resumen, descripción, reivindicaciones, dibujos)

☒

Traducción de la solicitud internacional al castellano. (Resumen, descripción, reivindicaciones, dibujos)

☒

Copia del examen preliminar internacional efectuado por la Autoridad Internacional de Examen Preliminar (IPEA).

☐

Traducción del examen preliminar internacional efectuado por la IPEA.

☐

De ser el caso, copia del contrato de acceso.

☐

De ser el caso, documento que acredite la licencia o autorización de uso de conocimientos tradicionales de las comunidades indígenas.

☐

De ser el caso, certificado de depósito del material biológico

☐

Arte final 12X12 cm.

☐

De ser el caso, información de otras solicitudes de patente o títulos obtenidos en el extranjero por el mismo titular o su causante, relacionadas total o parcialmente con la invención de esta solicitud.

☒

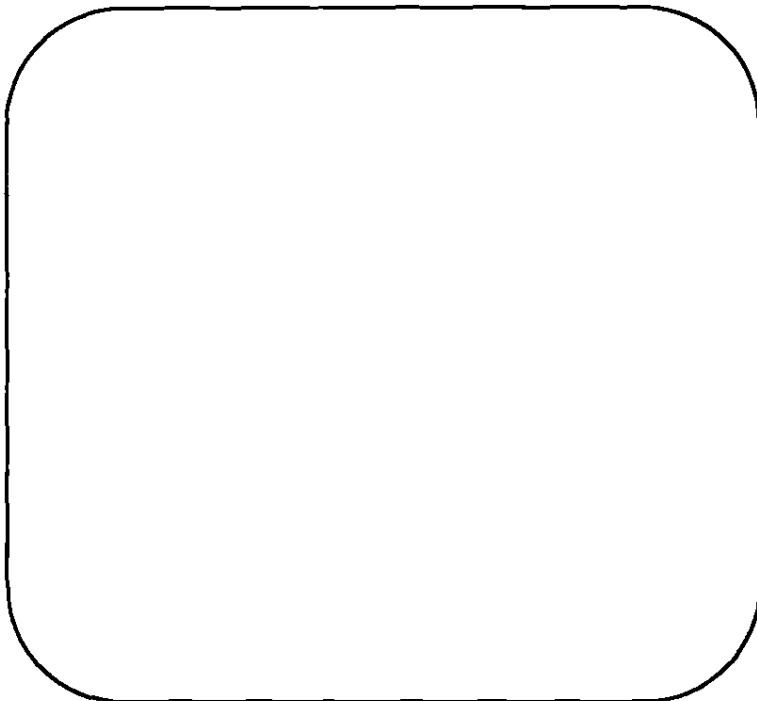
De ser el caso, modificaciones efectuadas a la solicitud internacional, Nuevas Reivindicaciones

☒

Otros: Informe de Búsqueda de Antecedentes Internacional

11

FIGURA CARACTERISTICA



12

Solicito la concesión de la patente,

NOMBRE: JAIME EDUARDO DELGADO VILLEGAS

FIRMA:

C.C. 19.270.955 Bogotá T.P. 43.308 C.S.J.

Instrucciones para el diligenciamiento del presente formulario, ver reverso de esta página

INVENTORES

**Vincent Allen Elder
2903 Panorama Drive
Carrollton, Dallas County, Texas 75007
Ciudadano Americano**

**John Gregory Fulcher
9930 Ontario Lane
Dallas, Dallas County, Texas 75220
Ciudadano Americano**

**Henry Kin-Hang Leung
3704 Ellington Drive
Plano, Collin County, Texas 75093
Ciudadano Americano**

**Michael Grant Topor
2312 Evergreen
Carrollton, Dallas County, Texas 75006
Ciudadano Americano**

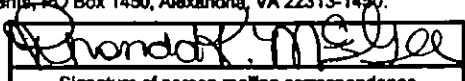
PCT/US2004/003375, documentos adjuntos al Petitorio:

1. Traducción de la solicitud PCT/US2004/003375 presentada el 6 de febrero de 2004 con descripción, reivindicaciones, figuras o dibujos y resumen. (44 folios)
2. Solicitud PCT/US2004/003375 en inglés, tal como fue presentada el 6 de febrero de 2004 con descripción, reivindicaciones, figuras o dibujos y resumen, con carta transmisión a la Oficina de los Estados Unidos del 6 de febrero de 2004. (41 folios).
3. Carta de Recordatorio de asignación documento de cesión de los inventores, de la Oficina de Patentes y Marcas de los Estados Unidos del 18 de Septiembre de 2003 (6 folios).
4. Formulario PCT/IB/301, notificación del recibo de copia registrada de la solicitud PCT con lista de países designados con fecha de envío PCT del 29 de abril de 2004 (3 folios).
5. Formulario PCT/IB/304, notificación del recibo del documento de prioridad No. US 10/372.738 del 21 de febrero de 2003, con fecha de envío del PCT del 29 de abril de 2004. (1 folio).
6. Formulario PCT/IB/311, notificación y copia de la Publicación Internacional en la Gaceta Oficial del PCT No. WO 2004/075.655 A2 del 10 de Septiembre de 2004. (32 folios).
7. Formulario PCT/IB/308 Primera notificación informando comunicación de la Oficina del PCT sobre la solicitud internacional a los países designados, lo cual no aplica de 30 meses tiempo límite bajo el Artículo 22(1), de 23 de Septiembre de 2004. (1 folio).
8. Formulario PCT/ISA/220 y 210, notificación envío del Reporte de la Búsqueda Internacional y Opinión Escrita del 24 de febrero de 2005, (6 folios) junto con documentos del arte anterior:
 - a) Patente US 5.620.727 del 15 de Abril de 1997. (10 folios).
 - b) Patente US 4.272.554 del 9 de Junio de 1981. (4 folios).
 - c) Patente US 5.045.335 del 3 de Septiembre de 1991. (3 folios).
 - d) Patente US 5.389.389 del 14 de Febrero de 1995. (13 folios).
9. Formulario PCT/IPEA/401, Solicitud de Examen Preliminar, junto con carta de recibo por parte de la Oficina de los Estados Unidos (6 folios), Respuesta a la Opinión Escrita junto con modificación de las reivindicaciones 1 a 49 (12 folios), Corrección al Poder y Cesión de los derechos de los Inventores (3 folios) en inglés, y Traducción Oficial al español de los anteriores documentos (28 folios).
10. Formulario PCT/IPEA/402, Notificación del Recibo de la Solicitud de Examen Preliminar por la Autoridad Competente encargada de dicho Examen, con fecha del 8 de junio de 2005 (1 folio).

11. **Formulario PCT/IB/308 Segunda y notificación suplementaria informando al solicitante la comunicación de la Oficina del PCT sobre la solicitud internacional a los países designados, aplicando los 30 meses como tiempo llmite bajo el Artículo 22(1), del 23 de junio de 2005. (1 folio).**
12. **Formulario PCT/IPEA/416, Notificación de Envío de Reporte de Patentabilidad del Examen Preliminar Internacional (4 folios) con fecha 1 de julio de 2005.**
13. **Formulario PCT/IB/332 Información concerniente a las oficinas elegidas y su notificación, del 14 de julio de 2005.**
14. **Tarjeta Archivo Temático y Tarjeta Propietarios.**

TRANSMITTAL LETTER TO THE UNITED STATES RECEIVING OFFICE

Date	
International Application No.	
Attorney Docket No.	CFLAY.00178P

I. Certification under 37 CFR 1.10 (if applicable)	
EV 333419120 US	February 6, 2004
Express Mail mailing number	Date of Deposit
I hereby certify that the application/correspondence attached hereto is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to Mail Stop PCT, Commissioner for Patents, PO Box 1450, Alexandria, VA 22313-1450.	
	Rhonda K. McGee
Signature of person mailing correspondence	Typed or printed name of person mailing correspondence

II. ☒ New International Application	
TITLE	Method for Reducing Acrylamide Formation in Thermally Processed Foods
	Earliest priority date (Day/Month/Year) 21 Feb 2003 (21.02.2003)
SCREENING DISCLOSURE INFORMATION: In order to assist in screening the accompanying international application for purposes of determining whether a license for foreign transmittal should and could be granted and for other purposes, the following information is supplied. (Note: check as many boxes as apply):	
A. ☐ The invention disclosed was not made in the United States.	
B. ☐ There is no prior U.S. application relating to this invention.	
C. ☒ The following prior U.S. application(s) contain subject matter which is related to the invention disclosed in the attached international application. (NOTE: priority to these applications may or may not be claimed on form PCT/RO/101 (Request) and this listing does not constitute a claim for priority.)	
application no.	10/372,738
application no.	
filed on	21 Feb 2003 (21.02.2003)
filed on	
D. ☐ The present international application contains additional subject matter not found in the prior U.S. application(s) identified in paragraph C. above. The additional subject matter is found on pages and ☐ DOES NOT ALTER ☐ MIGHT BE CONSIDERED TO ALTER the general nature of the invention in a manner which would require the U.S. application to have been made available for inspection by the appropriate defense agencies under 35 U.S.C. 181 and 37 CFR 5.1. See 37 CFR 5.15.	

III. ☐ A Response to an invitation from the RO/US. The following document(s) is (are) enclosed:	
A. ☐ A Request for An Extension of Time to File a Response	
B. ☐ A Power of Attorney (General or Regular)	
C. ☐ Replacement pages:	
pages	of the request (PCT/RO/101)
pages	of the description
pages	of the claims
D. ☐ Submission of Priority Documents	
Priority document	Priority document
E. ☐ Fees as specified on attached Fee Calculation sheet form PCT/RO/101 annex	

IV. ☐ A Request for Rectification under PCT 91	☐ A Petition	☐ A Sequence Listing Diskette
---	-------------------------------------	--

V. ☐ Other (please specify):

The person signing this form is the:	☐ Applicant	Colin P. Cahoon, Registration No. 38,836
	☒ Attorney/Agent (Reg. No.)	Typed name of signer
	☐ Common Representative	Signature

PCT

REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

International Application No.

International Filing Date

Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference (if desired) (12 characters maximum) CFLAY.00178P

Box No. I TITLE OF INVENTION

Method for Reducing Acrylamide Formation in Thermally Processed Foods

Box No. II APPLICANT

☐ This person is also inventor

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence (if no State of residence is indicated below.)

FRITO-LAY NORTH AMERICA, INC.
f/k/a RECOT, INC.
7701 Legacy Drive
Plano, TX 75266

Telephone No.

Facsimile No.

Teleprinter No.

Applicant's registration No. with the Office

State (that is, country) of nationality:

US

State (that is, country) of residence:

US

This person is applicant for the purposes of:

☐ all designated States

☒ all designated States except the United States of America

☐ the United States of America only

☐ the States indicated in the Supplemental Box

Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence (if no State of residence is indicated below.)

ELDER, Vincent Allen
2903 Panorama Drive
Carrollton, Texas 75007
US

This person is:

☐ applicant only

☒ applicant and inventor

☐ inventor only (If this check-box is marked, do not fill in below.)

Applicant's registration No. with the Office

State (that is, country) of nationality:

US

State (that is, country) of residence:

US

This person is applicant for the purposes of:

☐ all designated States

☐ all designated States except the United States of America

☒ the United States of America only

☐ the States indicated in the Supplemental Box

☒ Further applicants and/or (further) inventors are indicated on a continuation sheet.

Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:

☐ agent

☐ common representative

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

CAHOON, Colin P.
Carstens, Yee & Cahoon, L.L.P.
P.O. Box 802334
Dallas, TX 75380
US

Telephone No.

972-367-2001

Facsimile No.

972-367-2002

Teleprinter No.

Agent's registration No. with the Office

38,836

☐ Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

Continuation of Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S) <i>If none of the following sub-boxes is used, this sheet should not be included in the request.</i>	
Name and address: <i>(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)</i> FULCHER, John Gregory 9930 Ontario Lane Dallas, Texas 75220 US	This person is: ☐ applicant only ☒ applicant and inventor ☐ inventor only <i>(If this check-box is marked, do not fill in below.)</i> Applicant's registration No. with the Office
State (that is, country) of nationality: US	State (that is, country) of residence: US
This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box	
Name and address: <i>(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)</i> LEUNG, Henry Kin-Hang 3704 Ellington Drive Plano, Texas 75093 US	This person is: ☐ applicant only ☒ applicant and inventor ☐ inventor only <i>(If this check-box is marked, do not fill in below.)</i> Applicant's registration No. with the Office
State (that is, country) of nationality: US	State (that is, country) of residence: US
This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box	
Name and address: <i>(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)</i> TOPOR, Michael Grant 2312 Evergreen Carrollton, Texas 75006 US	This person is: ☐ applicant only ☒ applicant and inventor ☐ inventor only <i>(If this check-box is marked, do not fill in below.)</i> Applicant's registration No. with the Office
State (that is, country) of nationality: US	State (that is, country) of residence: US
This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box	
Name and address: <i>(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)</i> 	This person is: ☐ applicant only ☐ applicant and inventor ☐ inventor only <i>(If this check-box is marked, do not fill in below.)</i> Applicant's registration No. with the Office
State (that is, country) of nationality:	State (that is, country) of residence:
This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box	

☐ Further applicants and/or (further) inventors are indicated on another continuation sheet.

Box No. VIII (ii) DECLARATION: ENTITLEMENT TO APPLY FOR AND BE GRANTED A PATENT

The declaration must conform to the standardized wording provided for in Section 212; see Notes to Boxes Nos. VIII, VIII (i) to (v) (in general) and the specific Notes to Box No. VIII (ii). If this Box is not used, this sheet should not be included in the request.

Declaration as to the applicant's entitlement, as at the international filing date, to apply for and be granted a patent (Rules 4.17(ii) and 51bis.1(a)(ii)), in a case where the declaration under Rule 4.17(iv) is not appropriate:

FRITO-LAY NORTH AMERICA, INC. is entitled to apply for and be granted a patent by the virtue of the following:

an assignment from

RECOT, Inc., to FRITO-LAY NORTH AMERICA, INC., and recorded on February 2, 2004, at Reel/Frame 014296/0295,

and an assignment from

Vincent Allen Elder, John Gregory Fulcher, Henry Kin-Hang Leung, and Michael Grant Topor, to RECOT, INC., and recorded on May 19, 2003, at Reel/Frame 014085/0410.

This declaration is made for the purposes of all designations, except for the designation of the United States of America.

☐ This declaration is continued on the following sheet, "Continuation of Box No. VIII (ii)".

Box No. VIII (iv) DECLARATION: INVENTORSHIP (only for the purposes of the designation of the United States of America)
The declaration must conform to the following standardized wording provided for in Section 214: see Notes to Boxes Nos. VIII, VIII (i) to (iv) (in general) and the specific Notes to Box No. VIII (iv). If this Box is not used, this sheet should not be included in the request.

Declaration of Inventionship (Rules 4.17(iv) and 51bis.1(a)(iv))
for the purposes of the designation of the United States of America:

I hereby declare that I believe I am the original, first and sole (if only one inventor is listed below) or joint (if more than one inventor is listed below) inventor of the subject matter which is claimed and for which a patent is sought.

This declaration is directed to the international application of which it forms a part (if filing declaration with application).

This declaration is directed to international application No. PCT/..... (if furnishing declaration pursuant to Rule 26ter).

I hereby declare that my residence, mailing address, and citizenship are as stated next to my name.

I hereby state that I have reviewed and understand the contents of the above-identified international application, including the claims of said application. I have identified in the request of said application, in compliance with PCT Rule 4.10, any claim to foreign priority, and I have identified below, under the heading "Prior Applications," by application number, country or Member of the World Trade Organization, day, month and year of filing, any application for a patent or inventor's certificate filed in a country other than the United States of America, including any PCT international application designating at least one country other than the United States of America, having a filing date before that of the application on which foreign priority is claimed.

Prior Applications: U.S. Serial No. 10/372,738 filed on February 21, 2003

I hereby acknowledge the duty to disclose information that is known by me to be material to patentability as defined by 37 C.F.R. § 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the PCT international filing date of the continuation-in-part application.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Name: ELDER, Vincent Allen

Residence: Carrollton, TX, US

(city and either US state, if applicable, or country)

Mailing Address: 2903 Panorama Drive, Carrollton, TX 75007, US

Citizenship: US

Inventor's Signature: Vincent A. Elder
(if not contained in the request, or if declaration is corrected or added under Rule 26ter after the filing of the international application. The signature must be that of the inventor, not that of the agent)

Date: February 6, 2004

(of signature which is not contained in the request, or of the declaration that is corrected or added under Rule 26ter after the filing of the international application)

Name: FULCHER, John Gregory

Residence: Dallas, TX, US

(city and either US state, if applicable, or country)

Mailing Address: 9930 Ontario Lane, Dallas, TX 75220, US

Citizenship: US

Inventor's Signature: John H. Fulcher
(if not contained in the request, or if declaration is corrected or added under Rule 26ter after the filing of the international application. The signature must be that of the inventor, not that of the agent)

Date: February 7, 2004

(of signature which is not contained in the request, or of the declaration that is corrected or added under Rule 26ter after the filing of the international application)

☒ This declaration is continued on the following sheet, "Continuation of Box No. VIII (iv)".

Continuation of Box No. VIII (i) to (v) DECLARATION

If the space is insufficient in any of Boxes Nos. VIII (i) to (v) to furnish all the information, including in the case where more than two inventors are to be named in Box No. VIII (iv), in such case, write "Continuation of Box No. VIII ..." (indicate the item number of the Box) and furnish the information in the same manner as required for the purposes of the Box in which the space was insufficient. If additional space is needed in respect of two or more declarations, a separate continuation box must be used for each such declaration. If this Box is not used, this sheet should not be included in the request.

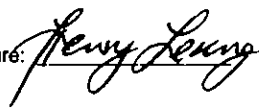
Continuation of Box No. VIII(iv), DECLARATION: INVENTORSHIP

Name: LEUNG, Henry Kin-Hang

Residence: Plano, TX, US

Mailing Address: 3704 Ellington Drive, Plano, TX 75093, US

Citizenship: US

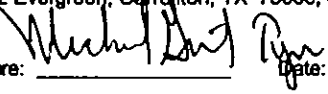
XX Inventor's Signature:  Date: February 2, 2004

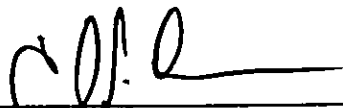
Name: TOPOR, Michael Grant

Residence: Carrollton, TX, US

Mailing Address: 2312 Evergreen, Carrollton, TX 75006, US

Citizenship: US

XX Inventor's Signature:  Date: February 5, 2004

Box No. IX CHECK LIST; LANGUAGE OF FILING		
This international application contains: (a) In paper form, the following number of sheets: request (including declaration sheets) : 7 description (excluding sequence listing and/or tables related thereto) : 21 claims : 7 abstract : 1 drawings : 2 Sub-total number of sheets : 38 sequence listing : tables related thereto : (for both, actual number of sheets if filed in paper form, whether or not also filed in computer readable form; see (c) below) Total number of sheets : 38 (b) ☐ only in computer readable form (Section 801(a)(i)) (i) ☐ sequence listing (ii) ☐ tables related thereto (c) ☐ also in computer readable form (Section 801(a)(ii)) (i) ☐ sequence listing (ii) ☐ tables related thereto Type and number of carriers (diskette, CD-ROM, CD-R or other) on which are contained the ☐ sequence listing: ☐ tables related thereto: (additional copies to be indicated under items 9(ii) and/or 10(ii), in right column)		This international application is accompanied by the following item(s) (mark the applicable check-boxes below and indicate in right column the number of each item): 1. ☒ fee calculation sheet : 1 2. ☒ original separate power of attorney : 1 3. ☐ original general power of attorney : 4. ☐ copy of general power of attorney; reference number, if any: : 5. ☐ statement explaining lack of signature : 6. ☐ priority document(s) identified in Box No. VI as item(s): : 7. ☐ translation of international application into (language): : 8. ☐ separate indications concerning deposited microorganism or other biological material : 9. ☐ sequence listing in computer readable form (indicate type and number of carriers) (i) ☐ copy submitted for the purposes of international search under Rule 13ter only (and not as part of the international application) : (ii) ☐ (only where check-box (b)(i) or (c)(i) is marked in left column) additional copies including, where applicable, the copy for the purposes of international search under Rule 13ter : (iii) ☐ together with relevant statement as to the identity of the copy or copies with the sequence listing mentioned in left column : 10. ☐ tables in computer readable form related to sequence listing (indicate type and number of carriers) (i) ☐ copy submitted for the purposes of international search under Section 802(b-quater) only (and not as part of the international application) : (ii) ☐ (only where check-box (b)(ii) or (c)(ii) is marked in left column) additional copies including, where applicable, the copy for the purposes of international search under Section 802(b-quater) : (iii) ☐ together with relevant statement as to the identity of the copy or copies with the tables mentioned in left column : 11. ☒ other (specify): Check in the Amount of \$1,743.00; and Postcard Receipt :
Figure of the drawings which should accompany the abstract:		Language of filing of the international application:
Box No. X SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).  Colin P. CAHOON Registration No. 38,836		

For receiving Office use only	
1. Date of actual receipt of the purported international application:	2. Drawings: ☐ received: ☐ not received:
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Annex to the Request

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Applicant's or agent's
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CFLAY.00178P

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Applicant

FRITO-LAY NORTH AMERICA, INC.

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1. TRANSMITTAL FEE

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2. SEARCH FEE

300.00 [S]

International search to be carried out by

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FRITO-LAY NORTH AMERICA, INC.
t/w/a RECOT, Inc.
7701 Legacy Drive
Plano, TX 75266
US

hereby appoints (appoint) the following person as:

☒

agent

☐

common representative

Name and address

(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

Colin P. Cahoon, Esq.
Carstens, Yee & Cahoon, L.L.P.
P.O. Box 802334
Dallas, TX 75380
972-367-2001
972-367-2002 Fax
Registration No. 38,836

to represent the undersigned before

☒

all the competent International Authorities

☐

the International Searching Authority only

☐

the International Preliminary Examining Authority only

in connection with the international application identified below:

Title of the invention: Method for Reducing Acrylamide Formation In Thermally Processed Foods

Applicant's or agent's file reference: CFLAY.00178P

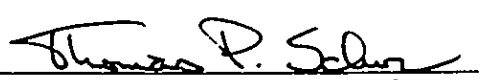
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Thomas P. Schur, Assistant Secretary of
Frito-Lay North America, Inc.
t/w/a RECOT, Inc.

Date: February 2, 2004

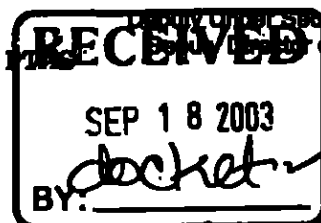


UNITED STATES
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SEPTEMBER 15, 2003

CARSTENS YEE & CAHOON, L.L.P.
COLIN P. CAHOON
P.O. BOX 802334
DALLAS, TEXAS 75380



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NUMBER OF PAGES: 2

BRIEF: ASSIGNMENT OF ASSIGNOR'S INTEREST (SEE DOCUMENT FOR DETAILS).

ASSIGNOR:
ELDER, VINCENT ALLEN

DOC DATE: 02/18/2003

ASSIGNOR:
FULCHER, JOHN GREGORY

DOC DATE: 02/18/2003

ASSIGNEE:
RECOT, INC.
5000 HOPYARD ROAD
PLEASANTON, CALIFORNIA 94588

SERIAL NUMBER: 10372738
PATENT NUMBER:

FILING DATE: 02/21/2003
ISSUE DATE:

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ASSIGNMENT DIVISION
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04-21-2003

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Rev. 03/01)
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4-1503

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Internal Address:

Street Address: 5000 Hopyard Road

City: Pleasanton State: CA Zip: 94588

Additional name(s) of conveying party(ies) attached? ☐ Yes ☒ No

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Execution Date: February 18, 2003

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B. Patent No.(s)

10/372,738

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5. Name and address of party to whom correspondence concerning document should be mailed:

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Internal Address: Carstens, Yee & Cahoon, L.L.P.

ISA#10811-00000004-1037E738

40.00 IP

Street Address: P.O. Box 802334

City: Dallas State: TX Zip: 75380

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ASSIGNMENT

WHEREAS, we, Vincent Allen Elder, a citizen of the United States, residing at 2903 Panorama Drive, Carrollton, Texas 75007, and John Gregory Fulcher, a citizen of the United States, residing at 9930 Ontario Lane, Dallas, Texas 75220, are the inventors of the invention Method for Reducing Acrylamide Formation in Thermally Processed Foods, for which we have executed an application for Letters Patent of the United States with attorney reference number CFLAY.00178; and

WHEREAS, RECOT, INC., incorporated in the state of Delaware, with a place of business at 5000 Hopyard Road, Suite 460, Pleasanton, California 94588 is desirous of obtaining the entire right, title and interest in, to and under the said invention and the said application;

NOW, THEREFORE, in consideration of the sum of One Dollar (\$1.00) to us in hand paid, and other good and valuable consideration, the receipt of which is hereby acknowledged, we the said Vincent Allen Elder and John Gregory Fulcher, have sold, assigned, transferred, and set over, and by these presents do hereby sell, assign, transfer, and set over, unto the said RECOT, INC., its successors, legal representatives, and assigns, the entire right, title, and interest in, to, and under the said invention, and the said application and all divisions, renewals, and continuations thereof, and all Letters Patent of the United States which may be granted thereon and all reissues and extensions thereof, and all applications for Letters Patent which may hereafter be filed for said invention in any country or countries foreign to the United States, and all Letters Patent which may be granted for said invention in any country or countries foreign to the United States and all extensions, renewals, and reissues thereof and all rights of priority in any such country or countries based upon the filing of the said application for Letters Patent of the United States which are created by any law, treaty, or international convention; and we hereby authorize and request the Commissioner of Patents of the United States, and any Official of any country or countries foreign to the United States, whose duty it is to issue patents on applications as aforesaid, to issue all Letters Patent for said invention to the said RECOT, INC., its successors, legal representatives, and assigns, in accordance with the terms of this instrument.

AND WE HEREBY covenant that we have full right to convey the entire interest herein assigned, and that we have not executed, and will not execute, any agreement in conflict herewith.

AND WE HEREBY further covenant and agree that we will communicate to said RECOT, INC., its successors, legal representatives, and assigns, any facts known to us respecting said invention, and testify in any legal proceeding, sign all lawful papers, execute all divisional, continuing, and reissue applications, make all rightful oaths, and generally do everything possible to aid the said RECOT, INC., its successors, legal representatives, and assigns, to obtain and enforce proper patent protection for said invention in all countries.

IN TESTIMONY WHEREOF, we hereunto set our hand and seal the day and year set opposite our signatures.

Date: February 18, 2003 Vincent A. Elder L.S.
Vincent Allen Elder

Date: February 18 2003 John G. Fulcher L.S.
John Gregory Fulcher



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MÉTODO PARA REDUCIR LA FORMACIÓN DE ACRILAMIDA EN ALIMENTOS PROCESADOS TÉRMICAMENTE

ANTECEDENTES DEL INVENTO

1. Área técnica

El presente invento se relaciona con un método para reducir la cantidad de acrilamida en alimentos procesados térmicamente. Este invento permite la producción de alimentos que tengan niveles significativamente reducidos de acrilamida. El método se basa en el uso de uno o más aminoácidos de un grupo selecto de ellos en la fabricación de un alimento tipo "pasabocas".

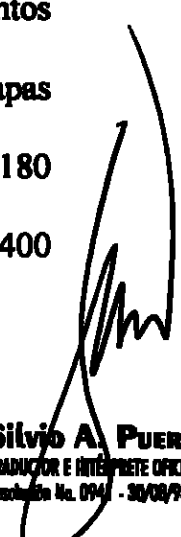
2. Descripción de la técnica relacionada

La acrilamida química se ha usado durante mucho tiempo en su forma de polímero en aplicaciones industriales para el tratamiento del agua, la recuperación de petróleo

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mejorado, hacer papel, agentes de floculación, espesantes, procesamiento de oro y textiles que no se arrugan. La acrilamida se precipita en forma de sólido cristalino blanco, inodoro y altamente soluble en agua (2155 g/L a 30°C). Los sinónimos de la acrilamida son 2-propenamida, etilencarboxamida, amida de ácido acrílico, amida de vinilo y amida de ácido propenóico. La acrilamida tiene una masa molecular de 71.08, un punto de fusión de 84.5°C y un punto de ebullición de 125°C a 25 mmHg. Recientemente, una gran variedad de alimentos ha resultado positiva al buscar la presencia de monómero de acrilamida. La acrilamida se ha encontrado básicamente en productos alimenticios de carbohidratos que han sido calentados o procesados a altas temperaturas. Entre los ejemplos de alimentos que han resultado positivos al buscar acrilamida se encuentran el café, los cereales, las galletas, las papas fritas, las galletas de sal, las papas a la francesa, los panes y panecillos y las carnes apanadas fritas. En general, se han encontrado contenidos relativamente bajos de acrilamida en alimentos ricos en proteínas calentados, mientras que se han encontrado niveles relativamente altos de acrilamida en alimentos ricos en carbohidratos, en comparación con niveles no detectables en alimentos hervidos o no calentados. Los niveles reportados de acrilamida que se han encontrado en diversos alimentos procesados de manera similar incluyen un rango de 330-2300 ($\mu\text{g/kg}$) en las papas fritas, un rango de 300-1100 ($\mu\text{g/kg}$) en las papas a la francesa, un rango 120-180 ($\mu\text{g/kg}$) en las hojuelas de maíz, y niveles que van desde lo no detectable hasta 1400 ($\mu\text{g/kg}$) en diversos cereales para el desayuno.

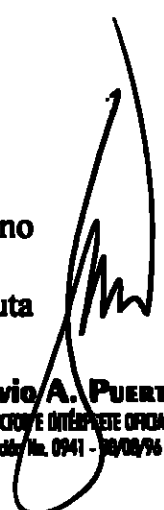


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Actualmente se cree que la acrilamida se forma a partir de la presencia de aminoácidos y azúcares reductores. Por ejemplo, se cree que una reacción entre la asparagina libre, un aminoácido que se encuentra comúnmente en los vegetales crudos, y los azúcares reductores libres, explica la mayoría de la acrilamida que se encuentra en los productos alimenticios fritos. La asparagina brinda aproximadamente el 40% de los aminoácidos libres totales encontrados en las papas crudas, aproximadamente el 18% de los aminoácidos libres totales encontrados en el centeno rico en proteínas y aproximadamente el 14% de los aminoácidos libres totales encontrados en el trigo.

Es posible que se forme acrilamida a partir de aminoácidos diferentes de la asparagina, pero todavía no se ha confirmado con certeza. Por ejemplo, se ha reportado cierta formación de acrilamida al probar como precursores la glutamina, la metionina, la cisteína y el ácido aspártico. Sin embargo, estos hallazgos son difíciles de confirmar debido a las posibles impurezas de asparagina presentes en los aminoácidos almacenados. No obstante, se ha identificado la asparagina como el aminoácido precursor más responsable de la formación de acrilamida.

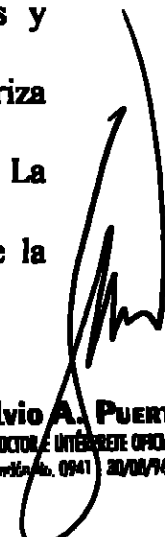
Como la acrilamida en los alimentos es un fenómeno descubierto recientemente, no se ha confirmado el mecanismo exacto de su formación. Ahora se cree que la ruta



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más probable para la formación de acrilamida incluye una reacción de Maillard. La reacción de Maillard ha sido identificada desde hace mucho tiempo en la química de los alimentos como una de las reacciones químicas más importantes en el procesamiento de alimentos y puede afectar el sabor, el color y el valor nutritivo de los alimentos. La reacción de Maillard necesita calor, humedad, azúcares reductores y aminoácidos.

La reacción de Maillard incluye una serie de reacciones complejas con numerosos productos intermedios, aunque por lo general se puede describir como una reacción de tres pasos. El primer paso de la reacción de Maillard incluye la combinación de un grupo amino libre (proveniente de aminoácidos libres y/o proteínas) con un azúcar reductor (como la glucosa) para formar productos de reagrupación de Amadori o Heyns. El segundo paso incluye la degradación de los productos de reagrupación de Amadori o Heyns a través de diferentes rutas alternativas que incluyen desoxiosonas, fisión o degradación de Strecker. Una serie compleja de reacciones que incluyen la deshidratación, eliminación, ciclización, fisión y fragmentación producen una mezcla de productos saborizantes intermedios y compuestos saborizantes. El tercer paso de la reacción de Maillard se caracteriza por la formación de polímeros y co-polímeros nitrogenados de color marrón. La Figura 1 ilustra una simplificación de las presuntas rutas de la formación de la



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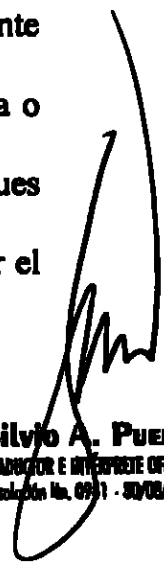
acrilamida a partir de asparagina y glucosa, usando la reacción de Maillard como la ruta probable para la formación.

No se ha determinado que la acrilamida sea nociva para los humanos, aunque su presencia en los productos alimenticios es indeseable, especialmente a niveles elevados. Como se señaló anteriormente, en los productos alimenticios que han sido calentados o procesados térmicamente, se encuentran concentraciones relativamente altas de acrilamida. La reducción de acrilamida en esos productos alimenticios podría lograrse reduciendo o eliminando los compuestos precursores que forman la acrilamida, inhibiendo la formación de acrilamida durante el procesamiento de los alimentos, desdoblado o haciendo reaccionar el monómero de acrilamida una vez se haya formado en los alimentos, o extrayendo la acrilamida del producto antes de su consumo. Cada producto alimenticio, obviamente, presenta retos únicos para llevar a cabo algunas de las opciones anteriores. Por ejemplo, es posible que los alimentos que se cortan y se cocinan en pedazos uniformes no se mezclen con facilidad con diversos aditivos sin destruir físicamente las estructuras celulares que le dan a los productos alimenticios sus características únicas al ser cocinados. Otros requisitos de procesamiento para los productos alimenticios específicos pueden, igualmente, hacer que las estrategias de reducción de acrilamida sean incompatibles o extremadamente difíciles.



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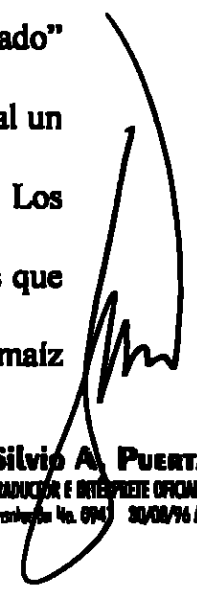
A manera de ejemplo, la Figura 2 ilustra los métodos de técnicas anteriores, bastante conocidas, para hacer papas fritas a partir de papas crudas almacenadas. Las papas crudas, que contiene alrededor de un 80% de agua en peso o más, primero se someten al paso 21 de pelado. Después de retirar la cáscara de las papas crudas, las papas se someten al paso 22 de tajado. El grosor de cada tajada de papa en el paso 22 de tajado depende del grosor deseado del producto final. Un ejemplo de la técnica anterior es tajar las papas con un grosor de 0.053 pulgadas aproximadamente. Luego se llevan estas tajadas a un paso 23 de lavado, en el que se retira con el agua el almidón de la superficie de cada tajada. Luego, las tajadas de papa enjuagadas se llevan al paso 24 de cocción. Este paso 24 de cocción incluye usualmente freír las tajadas en una freidora continua desde, por ejemplo, unos 177°C por aproximadamente 2.5 minutos. El paso de cocción, por lo general, reduce el nivel de humedad de la papa frita a menos del 2% en peso. Por ejemplo, una papa frita usualmente sale de la freidora con aproximadamente 1.4% de humedad en peso. Luego, las papas fritas cocinadas se llevan a un paso 25 de sazonado, donde se les echan condimentos en un tambor giratorio. Finalmente, las papas sazonadas se llevan al paso 26 de empackado. Este paso 26 de empackado incluye generalmente llevar las papas sazonadas a una o más pesas que luego dirigen las papas a una o más máquinas de forma vertical de llenado y sellado que las empackan en empaques flexibles. Una vez empackado, el producto pasa a distribución y es comprado por el consumidor.



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Los ajustes menores que se le hagan a ciertos pasos del procesamiento de las papas fritas anteriormente descritos pueden producir cambios significativos en las características del producto final. Por ejemplo, si las tajadas de papa permanecen en agua por más tiempo en el paso 23 de lavado pueden lixiviarse los compuestos de las tajadas que le dan al producto final su sabor, color y textura. Aumentar los tiempos de cocción o aumentar las temperaturas en el paso 24 de cocción puede ocasionar un aumento en los niveles de coloración de Maillard de la papa, al igual que una disminución mayor en el contenido de humedad. Si se desea agregarle ingredientes a las tajadas de papa antes de freírlas, puede ser necesario establecer mecanismos que garanticen la absorción de los ingredientes agregados a las porciones interiores de las tajadas sin alterar la estructura celular de la papa o los compuestos de lixiviación provechosos de las tajadas.

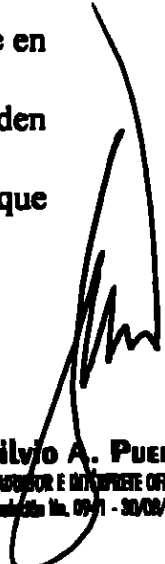
Otro ejemplo de los productos alimenticios calentados que representan retos únicos para reducir los niveles de acrilamida en el producto final son los pasabocas, que también se pueden fabricar a partir de una masa. El término "pasabocas fabricado" quiere decir un alimento de refrigerio para el que se usa como ingrediente inicial un ingrediente diferente al material inicial feculento original e inalterado. Los pasabocas fabricados incluyen, por ejemplo, las papas fritas fabricadas para las que se usa un producto de papa deshidratada como materia inicial y las hojuelas de maíz



Silvio A. PUERTAS P.
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para las que se usa harina de maíz como material inicial. Aquí se observa que el producto de papa deshidratada puede ser harina de papa, hojuelas de papa, gránulos de papa o cualquier otra forma en que exista la papa deshidratada. Cuando se use alguno de estos términos para esta aplicación, se entiende que se incluyen todas estas variaciones.

Haciendo referencia nuevamente a la Figura 2, una papa frita fabricada no necesita el paso 21 de pelado, el paso 22 de tajado ni el paso 23 de lavado. En cambio, la papa frita fabricada comienza con un producto de papa deshidratada como las hojuelas de papa, que se mezclan con agua y otros ingredientes menores para formar una masa. Luego se aplana la masa y se corta antes de proceder con el paso de cocción. El paso de cocción puede incluir freír u hornear. Luego las papas se someten a un paso de sazonado y un paso de empackado. La mezcla de la masa de papas generalmente hace fácil la adición de otros ingredientes. Por el contrario, la adición de dichos ingredientes a un producto crudo, como a las tajadas de papa, exige encontrar un mecanismo que permita la penetración de los ingredientes en la estructura celular del producto. Sin embargo, la adición de cualquier ingrediente en el paso de mezclado debe hacerse teniendo en cuenta que los ingredientes pueden afectar de manera desfavorable las características laminares de la masa al igual que las características de la papa frita final.



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Sería deseable desarrollar uno o más métodos para reducir el nivel de acrilamida en el producto final de los alimentos procesados térmicamente. En condiciones ideales, dicho proceso reduciría o eliminaría sustancialmente la acrilamida en el producto final sin afectar de manera adversa la calidad y las características del producto final. Además, el método sería fácil de implementar y, mejor aún, no aumentaría o aumentaría muy poco el costo del proceso general.

RESUMEN DEL INVENTO

En el proceso de invención, se añade uno o más aminoácidos seleccionados a los alimentos antes de la cocción para reducir la formación de acrilamida. Los aminoácidos se pueden añadir durante el proceso de molienda, mezclado seco, mezclado húmedo u otro mezclado adicional, de modo que el aminoácido se encuentre presente en todo el producto alimenticio. El aminoácido también puede incorporarse a los alimentos crudos exponiendo el ingrediente de alimento crudo al aminoácido, por empapado, por ejemplo. El aminoácido puede estar en forma de químico disponible comercialmente o como producto alimenticio en el que el aminoácido esté presente en forma libre. La adición de cisteína o lisina ha demostrado reducir la formación de acrilamida en dos configuraciones del invento. Otros aminoácidos seleccionados también han demostrado que reducen la formación de acrilamida.

Silvio A. PUERTAS P.
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La adición de uno o más aminoácidos seleccionados reduce de manera efectiva la cantidad de acrilamida presente en el producto final del alimento calentado o procesado térmicamente al tiempo que se afecta al mínimo la calidad y características del producto final. Además, dicho método de reducción de acrilamida normalmente es fácil de implementar y añade poco o ningún costo al proceso general.

BREVE DESCRIPCIÓN DE LOS DIBUJOS

Los rasgos novedosos que se creen característicos del invento se formulan más adelante en las afirmaciones anexas. Sin embargo, el invento mismo, así como un modo preferido de usarlo, los objetivos ulteriores y las ventajas del mismo, se entenderán mejor remitiéndose a la siguiente descripción detallada de las configuraciones ilustrativas, leída junto con los dibujos acompañantes, donde la:

Figura 1 es un diagrama de supuestas rutas químicas para la formación de acrilamida en alimentos;

Figura 2 es un diagrama de los pasos de procesamiento de las papas fritas según la técnica anterior;



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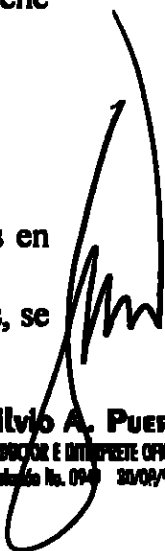
Figura 3 es un diagrama de un método para hacer papas fritas fabricadas a partir de hojuelas, gránulos o harina de papa según una configuración del invento presente; y Figura 3 es una representación gráfica de los efectos de la adición de cisteína y lisina a las papas fritas fabricadas.

DESCRIPCIÓN DETALLADA

Efectos de los aminoácidos en la formación de acrilamida

La formación de acrilamida en los alimentos procesados térmicamente requiere una fuente de carbono y una fuente de nitrógeno. Se ha formulado la hipótesis de que el carbono es suministrado por una fuente de carbohidratos y el nitrógeno es suministrado por una fuente proteínica o de aminoácidos. Muchos ingredientes alimenticios derivados vegetales como el arroz, el trigo, el maíz, la cebada, la soya, la papa y la avena contienen asparagina y son principalmente componentes de carbohidratos que tienen aminoácidos en menor cantidad. Normalmente, dichos ingredientes alimenticios tienen un contenido de aminoácidos pequeño, que contiene otros aminoácidos aparte de la asparagina.

Por “procesado térmicamente” se entiende alimento o ingredientes alimenticios en los que los componentes del alimento, como mezcla de ingredientes alimenticios, se



Silvio A. PUERTAS P.
TRABAJADOR E INTERPRETE OFICIAL - INGLÉS
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calienta a temperaturas de al menos 80°C. Preferiblemente el procesamiento térmico de los alimentos o los ingredientes alimenticios sucede a temperaturas entre 100°C y 205°C aproximadamente. El ingrediente alimenticio puede procesarse por separado a temperatura elevada antes de la formación del producto alimenticio final. Un ejemplo de un ingrediente alimenticio procesado térmicamente son las hojuelas de papa, que se hacen con papas crudas en un proceso que expone las papas a temperaturas de hasta 170°C (Los términos “hojuelas de papa”, “gránulos de papa” y “harina de papa” se usan indistintamente aquí, y sirven para denotar cualquier producto deshidratado a base de papa). Algunos ejemplos de otros ingredientes procesados térmicamente son la avena, el arroz semi-cocido y seco, los productos de soya cocinados, la masa de maíz, los granos de café tostados y los granos de cacao tostados. Alternativamente, los ingredientes alimenticios crudos se pueden usar en la preparación del producto alimenticio final, en donde la producción del producto alimenticio final incluye un paso de calentamiento térmico. Un ejemplo de procesamiento de materia prima en donde el producto alimenticio final es el resultado de un paso de calentamiento térmico es la fabricación de papas fritas a partir de tajadas de papa cruda en el paso de freidura a una temperatura de 100°C hasta 205°C aproximadamente o la producción de papas a la francesa fritas a temperaturas similares.



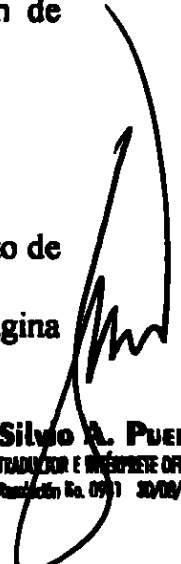
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Sin embargo, según el presente invento, se ha encontrado que una formación significativa de acrilamida sucede cuando el aminoácido asparagina se calienta en presencia de un azúcar reductor. El calentamiento de otros aminoácidos como la lisina y la alanina en presencia de un azúcar reductor como la glucosa no conlleva a formación de acrilamida. Sin embargo, la adición de otros aminoácidos a la mezcla de asparagina y azúcar puede aumentar o disminuir la cantidad de acrilamida formada.

Habiendo establecido la formación rápida de acrilamida cuando la asparagina se calienta en presencia de un azúcar reductor, se puede lograr una reducción de la acrilamida en los alimentos procesados térmicamente mediante la desactivación de la asparagina. Por “desactivación” se entiende la remoción de la asparagina del alimento o hacer que la asparagina se vuelva no reactiva a lo largo de la ruta de formación de acrilamida mediante la conversión o fijación a otro químico que interfiera con la formación de acrilamida a partir de la asparagina.

I: Efecto de la cisteína, la lisina, la glutamina y la glicina en la formación de acrilamida

Como la asparagina reacciona con la glucosa para formar acrilamida, el aumento de la concentración de otros aminoácidos puede afectar la reacción entre la asparagina



Silvio A. PUERTAS P.
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con la glucosa y así reducir la formación de acrilamida. Para este experimento se preparó una solución de asparagina (0.176%) y glucosa (0.4%) en un buffer de fosfato sódico de pH 7.0. Se añadieron otros aminoácidos, la glicina (GLY), la lisina (LYS), la glutamina (GLN) y la cisteína (CYS) a la misma concentración de la glucosa en base molar. El diseño experimental fue completamente factorial sin réplica de manera que se probaron todas las posibles combinaciones de aminoácidos añadidos. Las soluciones se calentaron a 120°C por 40 minutos antes de medir la acrilamida. La Tabla 1 siguiente muestra las concentraciones y los resultados.

	Glucosa	ASN	GLY	LYS	GLN	CYS	Acrilamida
Orden	%	%	%	%	%	%	%
1	0.4	0.176	0	0	0	0	1679
2	0.4	0.176	0	0	0	0.269	4
3	0.4	0.176	0	0	0.324	0	5378
4	0.4	0.176	0	0	0.324	0.269	7
5	0.4	0.176	0	0.325	0	0	170
6	0.4	0.176	0	0.325	0	0.269	7
7	0.4	0.176	0	0.325	0.324	0	1517
8	0.4	0.176	0	0.325	0.324	0.269	7
9	0.4	0.176	0.167	0	0	0	213

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10	0.4	0.176	0.167	0	0	0.269	6
11	0.4	0.176	0.167	0	0.324	0	2033
12	0.4	0.176	0.167	0	0.324	0.269	4
13	0.4	0.176	0.167	0.325	0	0	161
14	0.4	0.176	0.167	0.325	0	0.269	4
15	0.4	0.176	0.167	0.325	0.324	0	127
16	0.4	0.176	0.167	0.325	0.324	0.269	26

Tabla 1

Como se muestra en la tabla anterior, la glucosa y la asparagina sin ningún otro aminoácido formaron 1679 ppb de acrilamida. Los aminoácidos añadidos tuvieron tres tipos de efecto.

1) La cisteína prácticamente eliminó la formación de acrilamida. Todos los tratamientos con cisteína tuvieron menos de 25 ppb de acrilamida (una reducción de 98%).

2) La lisina y la glicina redujeron la formación de acrilamida pero no tanto como la cisteína. Todos los tratamientos con lisina y/o glicina pero sin glutamina ni cisteína tuvieron menos de 220 ppb de acrilamida (una reducción de 85%).

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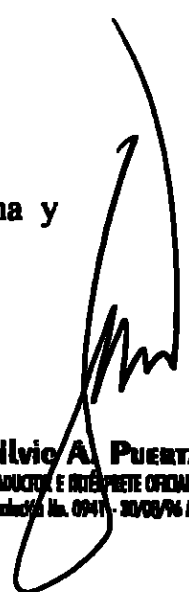
3) Sorprende que la glutamina aumentó la formación de acrilamida hasta 5378 ppb (aumento de 200%). La glutamina con cisteína no formaba acrilamida. La adición de glicina y lisina a la glutamina redujo la formación de acrilamida.

Estas pruebas demuestran la efectividad de la cisteína, la lisina y la glicina en la reducción de la formación de acrilamida. Sin embargo, los resultados de la glutamina demuestran que no todos los aminoácidos son efectivos para reducir la formación de acrilamida. La combinación de cisteína, lisina o glicina con un aminoácido que por sí sólo puede acelerar la formación de acrilamida (como la glutamina) puede reducir igualmente la formación de acrilamida.

II: Efecto de la cisteína, la lisina, la glutamina y la metionina en diferentes concentraciones y temperaturas

Como se reportó anteriormente, la cisteína y la lisina reducían la acrilamida cuando se añadían a la misma concentración que la glucosa. Se diseñó un experimento de seguimiento para responder a las siguientes preguntas:

1) ¿Cómo afectan las concentraciones menores de cisteína, lisina, glutamina y metionina la formación de acrilamida?



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2) ¿Son iguales los efectos de la adición de cisteína y lisina cuando la solución se calienta a 120°C y 150°C?

Se preparó una solución de asparagina (0.176%) y glucosa (0.4%) en un buffer de fosfato sódico de pH 7.0. Se añadieron dos concentraciones de aminoácido (cisteína (CYS), lisina (LYS), glutamina (GLN) o metionina (MET)). Las dos concentraciones eran de 0.2 y 1.0 moles de aminoácido por mol de glucosa. En la mitad de las pruebas, se calentaron 2 ml de las soluciones a 120°C por 40 minutos; en la segunda mitad, se calentaron 2 ml a 150°C por 15 minutos. Después del calentamiento se midió la acrilamida mediante GC-MS, con los resultados mostrados en la tabla 2. El control fue la solución de asparagina y glucosa sin adición de aminoácido.

Temperatura del aminoácido	Nivel de acrilamida				
	Control	Aminoácido	Porcentaje	Aminoácido	Porcentaje
		a una Conc. De 0.2	de control	a una Conc. De 1.0	de control
LYS-120°C	1332 ppb	1109 ppb	83%	280 ppb	21%
CYS-120°C	1332 ppb	316 ppb	24%	34 ppb	3%
LYS-150°C	3127 ppb	1683 ppb	54%	536 ppb	17%

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CYS-150°C	3127 ppb	1146 ppb	37%	351 ppb	11%
GLN-120°C	1953 ppb	4126 ppb	211%	6795 ppb	348%
MET-120°C	1953 ppb	1978 ppb	101%	1132 ppb	58%
GLN-150°C	3866 ppb	7223 ppb	187%	9516 ppb	246%
MET-150°C	3866 ppb	3885 ppb	100%	3024 ppb	78%

Tabla 2

En las pruebas con cisteína y lisina, un control formaba 1332 ppb de acrilamida después de 40 minutos a 120°C , y 3127 ppb de acrilamida después de 15 minutos a 150°C. La cisteína y la lisina redujeron la formación de acrilamida a 120°C y 150°C, con reducción de acrilamida aproximadamente proporcional a la concentración de la cantidad de cisteína o lisina añadida.

En las pruebas con glutamina y metionina, un control formaba 1953 ppb de acrilamida después de 40 minutos a 120°C y un control formaba 3866 ppb de acrilamida después de 15 minutos a 150°C. La glutamina aumentó la formación de acrilamida a 120°C y 150°C. La metionina a 0.2 mol/mol de glucosa no afectó la formación de acrilamida. La metionina a 1.0 mol/mol de glucosa reducía la formación de acrilamida en menos de un 50%.

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III: Efecto de diecinueve aminoácidos en la formación de acrilamida en la solución de glucosa y asparagina

Se describió anteriormente el efecto de cuatro aminoácidos (lisina, cisteína, metionina y glutamina) sobre la formación de acrilamida. Se probaron quince aminoácidos adicionales. Se preparó una solución de asparagina (0.176%) y glucosa (0.4%) en un buffer de fosfato sódico de pH 7.0. Se añadieron quince aminoácidos a la misma concentración que la de la glucosa en base molar. El control contenía solución de asparagina y glucosa sin otro aminoácido. Las soluciones se calentaron a 120°C por 40 minutos antes de medir la acrilamida mediante GC-MS. Los resultados se dan en la Tabla 3 siguiente.

Aminoácido	Acrilamida formada	
	Ppb	% de control
Control	959	100
Histidina	215	22
Alanina	478	50
Metionina	517	54
Ácido glutámico	517	54
Ácido aspártico	529	55

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Prolina	647	67
Fenilalanina	648	68
Valina	691	72
Arginina	752	78
Triptófano	1059	111
Treonina	1064	111
Tirosina	1091	114
Leucina	1256	131
Serina	1296	135
Isoleucina	1441	150

Tabla 3

Como se ve en la tabla anterior, ninguno de los quince aminoácidos adicionales fue tan efectivo como la cisteína, la lisina o la glicina en la reducción de la formación de acrilamida. Los nueve aminoácidos adicionales redujeron la acrilamida a un nivel entre 22-78% del control, mientras que seis aminoácidos aumentaron la acrilamida a un nivel entre 111-150% del control.

La Tabla 4 siguiente resume los resultados para todos los aminoácidos, enumerando los aminoácidos en su orden de efectividad. La cisteína, la lisina y la glicina fueron inhibidores efectivos, formando una cantidad de acrilamida menor al 15% de la

Silvio A. PUERTAS P.
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cantidad del control. Los siguientes nueve aminoácidos fueron inhibidores menos efectivos, con una formación total de acrilamida entre 22-78% de la cantidad de control. Los siguientes siete aminoácidos aumentaban la acrilamida. La glutamina causó el mayor aumento de acrilamida, exhibiendo 320% del control.

Aminoácido	Acrilamida producida como % del control
Control	100%
Cisteína	0%
Lisina	10%
Glicina	13%
Histidina	22%
Alanina	50%
Metionina	54%
Ácido glutámico	54%
Ácido aspártico	55%
Prolina	67%
Fenilalanina	68%
Valina	72%
Arginina	78%

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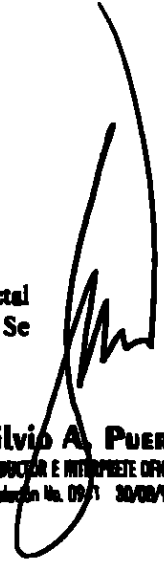
Triptófano	111%
Treonina	111%
Tirosina	114%
Leucina	131%
Serina	135%
Isoleucina	150%
Glutamina	320%

Tabla 4

IV: Hojuelas de papa con adición de 750 ppm de L-cisteína

Las hojuelas de papa de prueba se fabricaron con adición de 750 ppm (partes por millón) de L-cisteína. Las hojuelas de papa de control no contenían adición de L-cisteína. Se pesaron tres gramos de hojuelas de papa en un vial de vidrio. Después de tapar herméticamente, los viales se calentaron por 15 minutos o 40 minutos a 120°C. Se midió la acrilamida mediante GC-MS en partes por cada mil millones (ppb)*.

* Billion en inglés significa: billón (1×10^{12}) si el documento procede de un país con variante dialectal británica; mil millones (1×10^9) si el documento procede de un país con variante dialectal norteamericana. Se ha optado por esta última.



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Hojuelas de papa	Acrilamida (ppb) 15 min. a 120°C	Reducción de acrilamida 15 min.	Acrilamida (ppb) 40 min. a 120°C	Reducción de acrilamida 40 min.
Control	1662	-	9465	-
Cisteína 750 ppm	653	60%	7529	20%

Tabla 5

V: Papas fabricadas al horno

Dados los resultados anteriores, se han desarrollado configuraciones preferidas de la invención en las que se añadía cisteína o lisina a la fórmula para un alimento tipo pasabocas, en este caso, papas fabricadas al horno. El proceso para hacer este producto se muestra en la Figura 3. En un paso de preparación de masa 31, las hojuelas, el agua y los otros ingredientes se combinan para formar una masa. (Los términos “hojuelas de papa” y “harina de papa” se usan indistintamente aquí y cualquiera de ellas incluye toda hojuela seca o preparaciones en polvo, sin importar el tamaño de partícula). En un paso 32 de laminado, la masa se hace pasar por un laminador, que aplana la masa, y luego se corta en pedazos discretos. En un paso de cocción 33, las piezas cortadas se hornean hasta que alcanzan un color y un


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contenido de agua específicos. Las papas resultantes se sazonan luego en un paso de sazonado 34 y se ponen en paquetes en un paso de empaque 35.

Una primera configuración del invento está demostrada por el uso del proceso descrito anteriormente. Para ilustrar esta configuración se hace una comparación entre un lote de control y de prueba al que se añadieron alguna de las tres concentraciones de cisteína o una concentración de lisina. La Tabla 6 a continuación muestra los ingredientes usados en los distintos lotes.

Ingrediente	Control	Cisteína 1	Cisteína 2	Cisteína 3	Lisina
Hojuela de papa y almidón modificado	5496 g	5496 g	5496 g	5496 g	5496 g
Azúcar	300 g	300 g	300 g	300 g	300 g
Aceite	90 g	90 g	90 g	90 g	90 g
Agentes leudantes	54 g	54 g	54 g	54 g	54 g
Emulsificante	60 g	60 g	60 g	60 g	60 g
L-cisteína (disuelta en agua) ¹	0 g	1.8 g	4.2 g	8.4 g	0 g
Monohidrocloreuro de L-lisina	0 g	0 g	0 g	0 g	42 g
Seco total	6000 g	6001.8 g	6004.2 g	6008.4 g	6042 g

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Agua	3947 ml	3947 ml	3947 ml	3947 ml	3947 ml
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Tabla 6

En todos los lotes, los ingredientes secos se mezclaron juntos primero y luego se añadió aceite a cada mezcla seca y se mezclaron nuevamente. La cisteína o la lisina se disolvió en el agua antes de añadirla a la masa. El nivel de humedad de la masa antes del laminado era de 40% a 45% en peso. La masa se laminó para producir un espesor de entre 0.020 y 0.030 pulgadas, se cortó en pedazos del tamaño del pasabocas, y se horneó.

Después de la cocción se realizó prueba de humedad, aceite y color según la escala Hunter L-A-B. Se probaron las muestras para obtener los niveles de acrilamida del producto terminado. La Tabla 7 siguiente muestra los resultados de estos análisis.

Medición	Control	Cisteína 1	Cisteína 2	Cisteína 3	Lisina
Agua (H ₂ O)	2.21%	1.73%	2.28%	2.57%	2.68%
Aceite, %	1.99%	2.15%	2.05%	2.12%	1.94%
Acrilamida	1030 ppb	620 ppb	166 ppb	104 ppb	456 ppb
Color L	72.34	76.53	79.02	78.36	73.2
Color A	1.99	-1.14	-2.02	-2.14	1.94

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Color B	20.31	25.52	23.2	23.0	25.77
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Tabla 7

En los pasabocas de control, el nivel de acrilamida después de la cocción final fue de 1030 ppb. La adición de cisteína a los niveles probados, y de lisina redujo significativamente el nivel de acrilamida final. La Figura 4 muestra los niveles resultantes de acrilamida en forma gráfica.

Al añadir cisteína o lisina a la masa se baja significativamente el nivel de acrilamida presente en el producto terminado. Las muestras de cisteína muestran que el nivel de acrilamida se baja en proporción casi directa con la cantidad de cisteína añadida. Sin embargo, se deben tener en cuenta los efectos colaterales sobre las características (tales como color, sabor y textura) del producto final debido a la adición de un aminoácido al proceso de fabricación.

Se realizaron pruebas adicionales, usando adición de cisteína, lisina y combinación de cada uno de los dos aminoácidos con CaCl₂. Estas pruebas usaron el mismo procedimiento descrito en las pruebas anteriores, pero usaron hojuelas de papa con niveles variables de azúcares reductores y cantidades variables de aminoácidos y CaCl₂ añadido. En la Tabla 8 siguiente, el lote 1 de hojuelas de papa tenía 0.81% de azúcares reductores (esta porción de la tabla reproduce los resultados de la prueba

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mostrada anteriormente), el lote 2 tenía 1.0% y el lote 3 tenía 1.8% de azúcares reductores.

Nota 1: Se espera que el isómero D o una mezcla racémica de isómeros D y L de los aminoácidos sea igualmente efectiva, aunque es probable que el isómero L sea la fuente mejor y menos costosa.

Lote de hojuelas	CaCl ₂ % en peso de seco total	Cisteína ppm de seco total	Lisina % de seco total	H2O final % en peso	Valor de color final	Acrilamida ppb
1	0	0	0	2.21	72.34	1030
1	0	300	0	1.73	76.53	620
1	0	700	0	2.28	79.02	166
1	0	1398	0	2.57	78.36	104
1	0	0	0.685	2.68	73.20	456
2	0	0	0	1.71	72.68	599
2	0	0	0	1.63	74.44	1880
2	0	0	0	1.69	71.26	1640
2	0	0	0	1.99	71.37	1020
2	0	700	0	2.05	75.81	317

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2	0.646	0	0.685	1.74	73.99	179
3	0	0	0	1.80	73.35	464
3	0	0	0	1.61	72.12	1060
3	0	700	0	1.99	75.27	290
3	0	1398	0	1.96	75.87	188
3	0	0	0.685	1.90	76.17	105
3	0.646	0	0.685	2.14	75.87	47
3	0.646	700	0	1.83	77.23	148

Tabla 8

Como se muestra mediante los datos de esta tabla, la adición de cisteína o de lisina brinda una mejoría significativa en el nivel de acrilamida en cada nivel de azúcares reductores probado. La combinación de lisina con cloruro de calcio dio una eliminación casi total de la acrilamida producida, a pesar de que esta prueba se realizó con le mayor nivel de azúcares reductores.

VI: Pruebas en papas tajadas fritas

Un resultado similar se puede lograr con papas fritas hechas con rebanadas de papa. Sin embargo, el aminoácido deseado no se puede mezclar simplemente con las tajadas de papa, como en las configuraciones mostradas anteriormente, ya que esto

Silvio A. PUERTAS P.
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destruiría la integridad de las tajadas. En una configuración, las tajadas de papa se sumergen en una solución acuosa que contiene el aditivo de aminoácido deseado por un período de tiempo suficiente para permitir que el aminoácido migra al interior de la estructura celular de las rebanadas de papal. Esto se puede realizar, por ejemplo, durante el paso de lavado 23 mostrado en la Figura 2.

La Tabla 9 siguiente muestra el resultado de añadir un porcentaje en peso de cisteína al tratamiento de lavado que se describió en le paso 23 o Figura 2 anterior. Todos los lavados se realizaron a temperatura ambiente por el tiempo indiciado; en los tratamiento de control no se añadía nada al agua. Las papas se frieron en aceite de semilla de algodón a 178°C por el tiempo indicado.

	Tiempo de fritura (segundos)	Agua de terminado % en peso	Aceite de terminado % en peso	Acrilamida de terminado
Control – lavado de 2 a 3 min.	140	1.32%	42.75%	323 ppb
Cisteína al 1% - lavado de 15 minutos	140	0.86%	45.02%	239 ppb
Control – lavado de 2 a 3 min.	110	1.72%	40.87%	278 ppb
Control – lavado de 15 min.	110	1.68%	41.02%	231 ppb

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Cisteína al 1% - lavado de 15 min.	110	1.41%	44.02%	67 ppb
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Tabla 9

Como se muestra en esta tabla, la inmersión de las rebanadas de papa de 0.053 pulgadas de espesor por 15 minutos en una solución acuosa que contiene una concentración de 1% de cisteína es suficiente para reducir el nivel de acrilamida del producto final dentro del orden de 100-200 ppb.

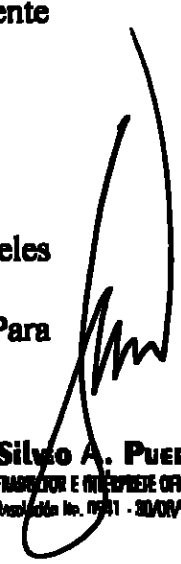
El invento también ha sido demostrado añadiendo cisteína a la masa de maíz para los pasabocas de maíz. Se añadió L-cisteína disuelta al maíz cocido durante el proceso de molido de manera que la cisteína se distribuyera uniformemente en la masa de maíz producida durante el molido. La adición de 600 ppm de L-cisteína redujo la acrilamida de 190 ppb en el producto de control a 75 ppb en el producto tratado con L-cisteína.

Cualquier número de aminoácidos se puede usar con el invento revelado aquí, siempre y cuando se hagan ajustes por los efectos colaterales de los ingredientes adicionales, como los cambios en color, sabor y textura del alimento. Aunque todos los ejemplos mostrados utilizan aminoácidos α (en los que el grupo NH_2 está unido al átomo de carbono α), los solicitantes prevén que se pueden usar otros isómeros,

Silvio A. PUERTAS P.
TRADUCTOR E INTERPRETE OFICIAL - INGLÉS
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como los aminoácidos β y γ , aunque los aminoácidos β y γ no se usan comúnmente como aditivos de alimentos. La configuración preferida de este invento utiliza cisteína, lisina y/o glicina. Sin embargo, se pueden usar otros aminoácidos como la histidina, la alanina, la metionina, el ácido glutámico, el ácido aspártico, la prolina, la fenilalanina, la valina y la arginina. Dichos aminoácidos, y en particular la cisteína, la lisina y la glicina, son relativamente económicos y se usan comúnmente como aditivos de los alimentos. Estos aminoácidos preferidos pueden usarse solos o en combinación con el fin de reducir la cantidad de acrilamida del producto alimenticio final. Además, el aminoácido puede añadirse a un producto alimenticio antes del calentamiento, ya sea añadiendo el aminoácido disponible comercialmente al material de inicio del producto alimenticio, o bien añadiendo otro ingrediente alimenticio que contiene un alto nivel de concentración del aminoácido libre. Por ejemplo, la caseína contiene lisina libre y la gelatina contiene glicina libre. Así, cuando los Solicitantes indican que un aminoácido se añade a una formulación alimenticia, se entenderá que el aminoácido puede añadirse como aminoácido disponible comercialmente o como alimento que tiene una concentración del aminoácido libre que es mayor al nivel de asparagina que se presenta naturalmente en los alimentos.

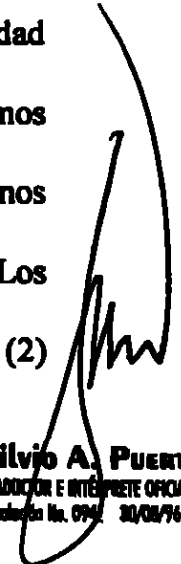
La cantidad de aminoácido que debería añadirse al alimento para reducir los niveles de acrilamida hasta un nivel aceptable puede expresarse de distintas formas. Para



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ser comercialmente aceptable, la cantidad de aminoácido añadido debe ser suficiente como para reducir el nivel final de producción de acrilamida en al menos un veinte por ciento (20%) en comparación con un producto no tratado. Mejor aún, el nivel de producción de acrilamida debería reducirse en cantidades en el rango de 35 a 95%. Incluso mejor, el nivel de producción de acrilamida debería reducirse en cantidades en el rango de 50 a 95%. En una configuración preferencial que usa cisteína, se ha determinado que la adición de al menos 100 ppm puede ser efectiva en la reducción de la acrilamida. Sin embargo, un rango preferencial de adición de cisteína es entre 100 ppm y 10000 ppm, siendo el rango más preferido aproximado a 1000 ppm. En las configuraciones preferenciales que usan otros aminoácidos efectivos, como la lisina y la glicina, se ha descubierto que una razón molar del aminoácido añadido al azúcar reductor presente en el producto, de al menos 0.1 mol de aminoácido frente a un mol de azúcares reductores (0.1:1), es efectiva en la reducción de la formación de acrilamida. Se prefiere mejor que la razón molar de aminoácido añadido al azúcar reductor esté entre 0.1:1 y 2:1, siendo la razón más preferible aproximadamente 1:1.

Los mecanismos por los cuales los aminoácidos seleccionados reducen la cantidad de acrilamida presente no se conocen hasta el momento. Los posibles mecanismos incluyen la competencia por reactivo y la disolución del precursor, que crea menos acrilamida, y un mecanismo de reacción con la acrilamida que la destruye. Los posibles mecanismos incluyen (1) inhibición de la reacción de Maillard, (2)



Silvio A. PUERTAS P.
TRADUCCION E INTERPRETE OFICIAL - INGLIS
Asociación No. 0794 30/08/96 (Instituto)

consumo de glucosa y otros azúcares reductores, y (3) reacción con la acrilamida. La cisteína, con un grupo tiol libre, actúa como inhibidor de la reacción de Maillard. Como se cree que la acrilamida se forma a partir de la asparagina a través de la reacción de Maillard, la cisteína debería reducir la tasa de reacción de Maillard y la formación de acrilamida. La lisina y la glicina reaccionan rápidamente con la glucosa y otros azúcares reductores. Si la glucosa es consumida por la lisina y la glicina, habrá menos glucosa para reaccionar con la asparagina para formar acrilamida. El grupo amino de los aminoácidos puede reaccionar con el enlace doble de acrilamida, una adición de Michael. El tiol libre de la cisteína también puede reaccionar con el enlace doble de acrilamida.

Debería entenderse que los cambios adversos en las características del producto final, como los cambios de color, sabor y textura, pueden ser causados por la adición de un aminoácido. Estos cambios en las características del producto según este invento pueden compensarse de diversas formas. Por ejemplo, las características de color en la papas fritas puede ajustarse controlando la cantidad de azúcares en el producto inicial. Algunas características de sabor pueden modificarse añadiendo diversos agentes saborizantes al producto final. La textura física del producto puede ajustarse, por ejemplo, añadiendo agentes leudantes o distintos emulsificantes.



Silvio A. PUERTAS P.
TRADUCCION E INTERPRETE OFICIAL - INGLÉS
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Mientras que el invento se ha mostrado y descrito particularmente con referencia a varias configuraciones, las personas expertas en la técnica entienden que los distintos enfoques en la reducción de la acrilamida en los alimentos procesados térmicamente mediante el uso de un aditivo de aminoácido pueden hacerse sin salirse del espíritu y alcance de esta invención. Por ejemplo, mientras el proceso se ha mostrado aquí con respecto a productos de papa y maíz, el proceso también se puede usar en el procesamiento de productos alimenticios hechos a partir de cebada, trigo, centeno, arroz, avena, mijo y otros granos con base de almidón, así como otros alimentos que contienen asparagina y un azúcar reductor, como las batatas, la cebolla y otros vegetales. Además, el proceso se ha demostrado en papas fritas y hojuelas de maíz, pero puede usarse en el procesamiento de muchos otros tipos de productos alimenticios, como otros tipos de pasabocas, cereales, galletas, galletas saladas, pretzels crocantes, panes y bizcochos, y apanado de carnes. En muchos de estos alimentos, el aminoácido puede añadirse durante la mezcla de la masa usada para hacer el producto, haciendo que el aminoácido esté disponible durante la cocción para brindar una reducción en el nivel de acrilamida. Además, la adición de un aminoácido puede combinarse con otras estrategias para la reducción de acrilamida para obtener un nivel de acrilamida aceptable sin afectar negativamente el sabor, color, olor u otra característica de un alimento particular.

AFIRMACIONES:



Silvio A. PUERTAS P.
TRADUCTOR E INTERPRETE OFICIAL - INGLES
Cualificación No. 094 30/04/96

Lo que se afirma es:

1. Un método para disminuir el nivel de acrilamida en un alimento procesado térmicamente que contenga asparagina libre y azúcares simples, incluyendo dicho método los pasos de:

a) agregar un ingrediente que contiene un aminoácido libre a un producto alimenticio, agregándose dicho ingrediente en una cantidad suficiente para reducir el nivel final de acrilamida en ese alimento procesado térmicamente hasta un nivel aceptable;

b) procesar térmicamente dicho producto alimenticio.

2. El método de la Afirmación 1, donde en el paso de adición a) se agrega una cantidad del ingrediente mencionado que sea suficiente para reducir dicho nivel final de acrilamida al menos en un 20% en dicho alimento procesado térmicamente.

3. El método de la Afirmación 1, donde en el paso de adición a) se agrega una cantidad del ingrediente mencionado que sea suficiente para reducir dicho nivel final de acrilamida al menos en un 35% en dicho alimento procesado térmicamente.

4. El método de la Afirmación 1, donde en el paso de adición a) se agrega una cantidad del ingrediente mencionado que sea suficiente para reducir dicho nivel final de acrilamida al menos en un 50% en dicho alimento procesado térmicamente.

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5. El método de la Afirmación 1, donde en el paso de adición a) se agrega una cantidad del ingrediente mencionado que sea suficiente para reducir dicho nivel final de acrilamida al menos en un 65% en dicho alimento procesado térmicamente.
6. El método de la Afirmación 1, donde en el paso de adición a) se agregan al menos 100 partes por millón, de cisteína.
7. El método de la Afirmación 1, donde en el paso de adición a) se agregan al menos 1.000 partes por millón, de cisteína.
8. El método de la Afirmación 1, donde en el paso de adición a) se agregan al menos 10.000 partes por millón, de cisteína.
9. El método de la Afirmación 1, donde en el paso de adición a) se agregan al menos 0.1 moles de un aminoácido por cada mol de azúcar reductor en dicho producto.
10. El método de la Afirmación 1, donde en el paso de adición a) se agregan al menos 1.0 moles de un aminoácido por cada mol de azúcar reductor en dicho producto.
11. El método de la Afirmación 1, donde en el paso de adición a) se agregan al menos 2.0 moles de un aminoácido por cada mol de azúcar reductor en dicho producto.
12. El método de la Afirmación 1, donde dicho aminoácido libre se escoge entre el grupo que consta de cisteína, lisina, glicina, histidina, alanina, metionina, ácido glutámico, ácido aspártico, prolina, fenilalanina, valina y arginina.



Silvio A. PUERTAS P.
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13. El método de la Afirmación 1, donde en el paso de adición a) se le agrega a dicho producto alimenticio un aminoácido disponible comercialmente.
14. El método de la Afirmación 1, donde en el paso de adición a) se le agrega a dicho producto alimenticio un alimento que contiene dicho aminoácido libre.
15. El método de la Afirmación 1, donde en el paso de adición a), dicho producto alimenticio se remoja en una solución que contiene dicho ingrediente.
16. El método de la Afirmación 1, donde dicho ingrediente se mezcla con otros ingredientes para formar una masa.
17. El método de la Afirmación 1, donde dicho paso de cocción b) comprende freír dicho producto alimenticio.
18. El método de la Afirmación 1, donde dicho paso de cocción b) comprende hornear dicho producto alimenticio.
19. El método de la Afirmación 1, donde el paso de adición a) comprende, además, agregarle a dicho producto alimenticio un ingrediente que contiene calcio.
20. El método de la Afirmación 19, donde dicho ingrediente que contiene calcio incluye cloruro de calcio.
21. El alimento procesado térmicamente producido mediante el método de la Afirmación 1.
22. Un método para reducir la producción de acrilamida en un producto alimenticio fabricado, comprendiendo dicho método los pasos de:

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a) agregar un ingrediente que contiene un aminoácido libre a una mezcla para hacer un producto fabricado, donde dicho ingrediente se agrega en una cantidad suficiente para reducir el nivel final de acrilamida en dicho producto alimenticio fabricado hasta un nivel predeterminado;

b) procesar térmicamente dicha mezcla.

23. El método de la Afirmación 22, donde dicho aminoácido libre se escoge entre el grupo que consta de cisteína, lisina, glicina, histidina, alanina, metionina, ácido glutámico, ácido aspártico, prolina, fenilalanina, valina y arginina.

24. El método de la Afirmación 22, donde en el paso de adición a) a dicha mezcla se le agrega un aminoácido disponible comercialmente.

25. El método de la Afirmación 22, donde en el paso de adición a) a dicha mezcla se le agrega un alimento que contiene dicho aminoácido libre.

26. El método de la Afirmación 22, donde el paso de cocción b) comprende freír dicho producto alimenticio.

27. El método de la Afirmación 22, donde el paso de cocción b) comprende hornear dicho producto alimenticio.

28. El producto alimenticio fabricado producido mediante el método de la Afirmación 22.

29. Un método para preparar papas fritas fabricadas, comprendiendo dicho método los pasos de:



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a) preparar una masa que incluye hojuelas de papa, agua y un ingrediente que contiene un aminoácido libre, agregándose dicho ingrediente en una cantidad suficiente para reducir el nivel final de acrilamida en esas papas fritas fabricadas hasta un nivel determinado;

b) aplanar y cortar dicha mezcla para formar piezas cortadas;

c) procesar térmicamente dichas piezas cortadas para formar papas fritas.

30. El método de la Afirmación 29, donde dicho aminoácido libre se escoge entre el grupo que consta de cisteína, lisina, glicina, histidina, alanina, metionina, ácido glutámico, ácido aspártico, prolina, fenilalanina, valina y arginina.

31. El método de la Afirmación 29, donde el paso de procesar térmicamente a) comprende hornear.

32. El método de la Afirmación 29, donde el paso de procesar térmicamente c) comprende freír.

33. El método de la Afirmación 29, incluyendo además el paso de:

d) sazonar dichas papas fritas fabricadas.

34. El método de la Afirmación 29, incluyendo además el paso de:

d) empacar dichas papas fritas fabricadas.

35. Las papas fritas fabricadas producidas mediante el método de la Afirmación 29.

36. Un método de preparar papas fritas, comprendiendo dicho método los pasos de:

a) rebanar papas crudas para formar tajadas de papa;



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b) remojar dicha tajadas de papa en una solución que contiene una cantidad de aminoácido suficiente para reducir el nivel de acrilamida en dichas papas fritas hasta un nivel aceptable;

c) procesar térmicamente dichas tajadas de papa para formar papas fritas.

37. El método de la Afirmación 36, donde dicho aminoácido se escoge entre el grupo que consta de cisteína, lisina, glicina, histidina, alanina, metionina, ácido glutámico, ácido aspártico, prolina, fenilalanina, valina y arginina.

38. El método de la Afirmación 36, donde dicho paso de procesar térmicamente a) comprende hornear.

39. El método de la Afirmación 36, donde dicho paso de procesar térmicamente c) comprende freír.

40. El método de la Afirmación 36, donde dicho paso de remojo b) reduce dicho nivel final de acrilamida al menos en un 20%.

41. El método de la Afirmación 36, donde dicho paso de remojo b) reduce dicho nivel final de acrilamida al menos en un 50%.

42. Las papas fritas producidas mediante el método de la Afirmación 36.

43. Un método de preparar tajaditas de maíz, comprendiendo dicho método los pasos de:

a) preparar una mezcla que contiene maíz molido, agua y un ingrediente que contiene un aminoácido libre en una cantidad suficiente para reducir la formación de acrilamida en dichas tajaditas de maíz hasta un nivel predeterminado;

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b) aplanar y cortar dicha mezcla para formar las tajaditas; y

c) procesar térmicamente dichas tajaditas.

44. El método de la Afirmación 43; donde dicho aminoácido libre se escoge entre el grupo que consta de cisteína, lisina, glicina, histidina, alanina, metionina, ácido glutámico, ácido aspártico, prolina, fenilalanina, valina y arginina.

45. El método de la Afirmación 43; donde dicho paso de procesar térmicamente c) comprende hornear.

46. El método de la Afirmación 43; donde dicho paso de procesar térmicamente c) comprende freír.

47. El método de la Afirmación 43; incluyendo además el paso de:

d) sazonar dichas tajaditas de maíz.

48. El método de la Afirmación 43; incluyendo además el paso de:

d) empacar dichas tajaditas de maíz.

49. Una tajadita de maíz producida mediante el método de la Afirmación 43.

MÉTODO PARA REDUCCIÓN DE LA FORMACIÓN DE ACRILAMIDA EN ALIMENTOS PROCESADOS TÉRMICAMENTE

RESUMEN DEL DESCUBRIMIENTO

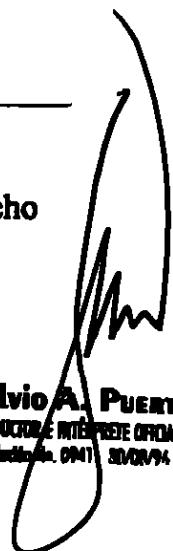
Silvio A. PUERTAS P
TRADUCTOR E INTÉRPRETE OFICIAL 19661
Resolución No. 0941 2004/MIN. Justicia

En alimentos tipo pasabocas procesados térmicamente, fabricados, la adición de un aminoácido de un grupo selecto de ellos a la receta del alimento inhibe la formación de acrilamida durante el procesamiento térmico. El aminoácido puede provenir del grupo de la cisteína, lisina, glicina, histidina, alanina, metionina, ácido glutámico, ácido aspártico, prolina, fenilalanina, valina y arginina y puede ser un aminoácido disponible comercialmente o en forma libre en un ingrediente que se añade al alimento. Los aminoácidos pueden añadirse a los alimentos fabricados en la etapa de mezclado de ingredientes o exponiendo el lote de alimento crudo a una solución que contiene una concentración del aditivo de aminoácido.

(Hay 2 anexos)

Traductor: SILVIO ALEJANDRO PUERTAS PINO

Resolución 0941 del 30 de agosto de 1996 del Ministerio de Justicia y del Derecho



Silvio A. Puertas P.
TRADUCTOR E INTERPRETE OFICIAL - INGLES
Traducción No. 0941 30/08/96 Ministerio

FIG. 3

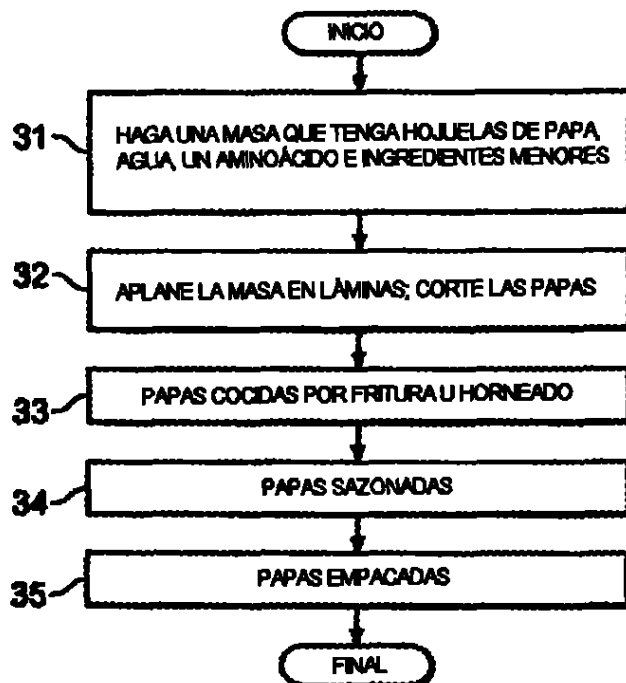
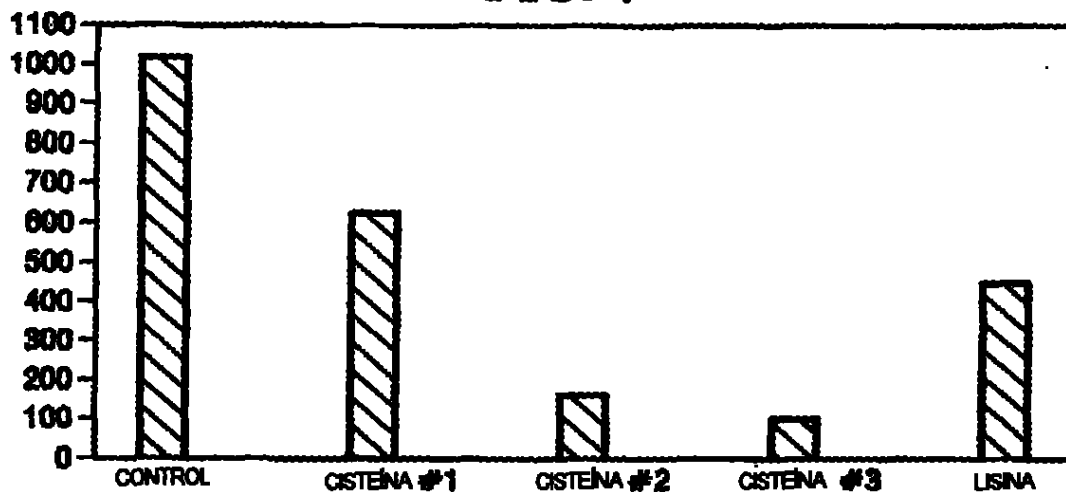


FIG. 4



Silvio A. PUERTAS P.
 TRADUCTOR INTERPRETE OFICIAL - INGLES
 Inscripción No. 0941 30/08/96 México

**METHOD FOR REDUCING ACRYLAMIDE FORMATION
IN THERMALLY PROCESSED FOODS**

BACKGROUND OF THE INVENTION

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1. Technical Field

The present invention relates to a method for reducing the amount of acrylamide in thermally processed foods. This invention permits the production of foods having significantly reduced levels of acrylamide. The method relies on the use of one or more of a select group of amino acids in the
10 manufacture of a snack food.

2. Description of Related Art

The chemical acrylamide has long been used in its polymer form in industrial applications for water treatment, enhanced oil recovery, papermaking, flocculants, thickeners, ore processing and
15 permanent press fabrics. Acrylamide participates as a white crystalline solid, is odorless, and is highly soluble in water (2155 g/L at 30°C). Synonyms for acrylamide include 2-propenamide, ethylene carboxamide, acrylic acid amide, vinyl amide, and propenoic acid amide. Acrylamide has a molecular mass of 71.08, a melting point of 84.5°C, and a boiling point of 125°C at 25 mmHg.

In very recent times, a wide variety of foods have tested positive for the presence of
20 acrylamide monomer. Acrylamide has especially been found primarily in carbohydrate food products that have been heated or processed at high temperatures. Examples of foods that have tested positive for acrylamide include coffee, cereals, cookies, potato chips, crackers, french-fried potatoes, breads and rolls, and fried breaded meats. In general, relatively low contents of acrylamide have been found in heated protein-rich foods, while relatively high contents of acrylamide have been
25 found in carbohydrate-rich foods, compared to non-detectable levels in unheated and boiled foods. Reported levels of acrylamide found in various similarly processed foods include a range of 330 -

2,300 (µg/kg) in potato chips, a range of 300 - 1100 (µg/kg) in french fries, a range 120 - 180 (µg/kg) in corn chips, and levels ranging from not detectable up to 1400 (µg/kg) in various breakfast cereals.

It is presently believed that acrylamide is formed from the presence of amino acids and reducing sugars. For example, it is believed that a reaction between free asparagine, an amino acid commonly found in raw vegetables, and free reducing sugars accounts for the majority of acrylamide found in fried food products. Asparagine accounts for approximately 40% of the total free amino acids found in raw potatoes, approximately 18% of the total free amino acids found in high protein rye, and approximately 14% of the total free amino acids found in wheat.

The formation of acrylamide from amino acids other than asparagine is possible, but it has not yet been confirmed to any degree of certainty. For example, some acrylamide formation has been reported from testing glutamine, methionine, cysteine, and aspartic acid as precursors. These findings are difficult to confirm, however, due to potential asparagine impurities in stock amino acids. Nonetheless, asparagine has been identified as the amino acid precursor most responsible for the formation of acrylamide.

Since acrylamide in foods is a recently discovered phenomenon, its exact mechanism of formation has not been confirmed. However, it is now believed that the most likely route for acrylamide formation involves a Maillard reaction. The Maillard reaction has long been recognized in food chemistry as one of the most important chemical reactions in food processing and can affect flavor, color, and the nutritional value of the food. The Maillard reaction requires heat, moisture, reducing sugars, and amino acids.

The Maillard reaction involves a series of complex reactions with numerous intermediates, but can be generally described as involving three steps. The first step of the Maillard reaction involves the combination of a free amino group (from free amino acids and/or proteins) with a reducing sugar (such as glucose) to form Amadori or Heyns rearrangement products. The second

step involves degradation of the Amadori or Heyns rearrangement products via different alternative routes involving deoxyosones, fission, or Strecker degradation. A complex series of reactions - including dehydration, elimination, cyclization, fission, and fragmentation - results in a pool of flavor intermediates and flavor compounds. The third step of the Maillard reaction is characterized by the formation of brown nitrogenous polymers and co-polymers. Using the Maillard reaction as the likely route for the formation of acrylamide, Figure 1 illustrates a simplification of suspected pathways for the formation of acrylamide starting with asparagine and glucose.

Acrylamide has not been determined to be detrimental to humans, but its presence in food products, especially at elevated levels, is undesirable. As noted previously, relatively higher concentrations of acrylamide are found in food products that have been heated or thermally processed. The reduction of acrylamide in such food products could be accomplished by reducing or eliminating the precursor compounds that form acrylamide, inhibiting the formation of acrylamide during the processing of the food, breaking down or reacting the acrylamide monomer once formed in the food, or removing acrylamide from the product prior to consumption. Understandably, each food product presents unique challenges for accomplishing any of the above options. For example, foods that are sliced and cooked as coherent pieces may not be readily mixed with various additives without physically destroying the cell structures that give the food products their unique characteristics upon cooking. Other processing requirements for specific food products may likewise make acrylamide reduction strategies incompatible or extremely difficult.

By way of example, Figure 2 illustrates well-known prior art methods for making fried potato chips from raw potato stock. The raw potatoes, which contain about 80% or more water by weight, first proceed to a peeling step 21. After the skins are peeled from the raw potatoes, the potatoes are then transported to a slicing step 22. The thickness of each potato slice at the slicing step 22 is dependent on the desired thickness of the final product. An example in the prior art involves slicing the potatoes to about 0.053 inches in thickness. These slices are then transported to

a washing step 23, wherein the surface starch on each slice is removed with water. The washed potato slices are then transported to a cooking step 24. This cooking step 24 typically involves frying the slices in a continuous fryer at, for example, 177°C for approximately 2.5 minutes. The cooking step generally reduces the moisture level of the chip to less than 2% by weight. For example, a typical fried potato chip exits the fryer at approximately 1.4% moisture by weight. The cooked potato chips are then transported to a seasoning step 25, where seasonings are applied in a rotation drum. Finally, the seasoned chips proceed to a packaging step 26. This packaging step 26 usually involves feeding the seasoned chips to one or more weighers that then direct chips to one or more vertical form, fill, and seal machines for packaging in a flexible package. Once packaged, the product goes into distribution and is purchased by a consumer.

Minor adjustments in a number of the potato chip processing steps described above can result in significant changes in the characteristics of the final product. For example, an extended residence time of the slices in water at the washing step 23 can result in leaching compounds from the slices that provide the end product with its potato flavor, color and texture. Increased residence times or heating temperatures at the cooking step 24 can result in an increase in the Maillard browning levels in the chip, as well as a lower moisture content. If it is desirable to incorporate ingredients into the potato slices prior to frying, it may be necessary to establish mechanisms that provide for the absorption of the added ingredients into the interior portions of the slices without disrupting the cellular structure of the chip or leaching beneficial compounds from the slice.

By way of another example of heated food products that represent unique challenges to reducing acrylamide levels in the final products, snacks can also be made from a dough. The term “fabricated snack” means a snack food that uses as its starting ingredient something other than the original and unaltered starchy starting material. For example, fabricated snacks include fabricated potato chips that use a dehydrated potato product as a starting material and corn chips that use a masa flour as its starting material. It is noted here that the dehydrated potato product can be potato flour,

potato flakes, potato granules, or any other form in which dehydrated potatoes exist. When any of these terms are used in this application, it is understood that all of these variations are included.

Referring back to Figure 2, a fabricated potato chip does not require the peeling step 21, the slicing step 22, or the washing step 23. Instead, fabricated potato chips start with, for example,

5 potato flakes, which are mixed with water and other minor ingredients to form a dough. This dough is then sheeted and cut before proceeding to a cooking step. The cooking step may involve frying or baking. The chips then proceed to a seasoning step and a packaging step. The mixing of the potato dough generally lends itself to the easy addition of other ingredients. Conversely, the addition of such ingredients to a raw food product, such as potato slices, requires that a mechanism be found to
10 allow for the penetration of ingredients into the cellular structure of the product. However, the addition of any ingredients in the mixing step must be done with the consideration that the ingredients may adversely affect the sheeting characteristics of the dough as well as the final chip characteristics.

It would be desirable to develop one or more methods of reducing the level of acrylamide in
15 the end product of heated or thermally processed foods. Ideally, such a process should substantially reduce or eliminate the acrylamide in the end product without adversely affecting the quality and characteristics of the end product. Further, the method should be easy to implement and, preferably, add little or no cost to the overall process.

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SUMMARY OF THE INVENTION

In the inventive process, one or more selected amino acids are added to foods prior to cooking to reduce the formation of acrylamide. The amino acid(s) can be added during milling, dry mix, wet mix, or other admix, so that the amino acid is present throughout the food product. The amino acid can also be incorporated into raw foods by exposing the raw food ingredient to the amino acid, such as by soaking. The amino acid can be in the form of either a commercially available chemical or a food product in which the amino acid is present in a free form. The addition of cysteine or lysine has been shown to reduce acrylamide formation in two embodiments of the invention. Selected other amino acids have also been shown to reduce acrylamide formation.

10 The addition of one or more selected amino acids effectively reduces the amount of acrylamide found in the end product of the heated or thermally processed food while minimally affecting the quality and characteristics of the end product. Further, such a method of acrylamide reduction is generally easy to implement and adds little or no cost to the overall process.

BRIEF DESCRIPTION OF THE DRAWINGS

The novel features believed characteristic of the invention are set forth in the appended claims. The invention itself, however, as well as a preferred mode of use, further objectives and advantages thereof, will be best understood by reference to the following detailed description of illustrative embodiments when read in conjunction with the accompanying drawings, wherein:

Figure 1 is a schematic of suspected chemical pathways for acrylamide formation in foods;

Figure 2 is a schematic of prior art potato chip processing steps;

Figure 3 is a schematic of a method for making fabricated potato chips from potato flakes, granules or flour according to an embodiment of the present invention; and

Figure 4 is a graph representation of the effects of the addition of cysteine and lysine to fabricated potato chips.

DETAILED DESCRIPTION

Effect of Amino Acids on Acrylamide Formation

The formation of acrylamide in thermally processed foods requires a source of carbon and a source of nitrogen. It is hypothesized that carbon is provided by a carbohydrate source and nitrogen is provided by a protein source or amino acid source. Many plant-derived food ingredients such as rice, wheat, corn, barley, soy, potato and oats contain asparagine and are primarily carbohydrates having minor amino acid components. Typically, such food ingredients have a small amino acid pool, which contains other amino acids in addition to asparagine.

By "thermally processed" is meant food or food ingredients wherein components of the food, such as a mixture of food ingredients, are heated at temperatures of at least 80°C. Preferably the thermal processing of the food or food ingredients takes place at temperatures between about 100°C and 205°C. The food ingredient may be separately processed at elevated temperature prior to the formation of the final food product. An example of a thermally processed food ingredient is potato flakes, which is formed from raw potatoes in a process that exposes the potato to temperatures as high as 170°C. (The terms "potato flakes", "potato granules", and "potato flour" are used interchangeably herein, and are meant to denote any potato based, dehydrated product.) Examples of other thermally processed food ingredients include processed oats, par-boiled and dried rice, cooked soy products, corn masa, roasted coffee beans and roasted cacao beans. Alternatively, raw food ingredients can be used in the preparation of the final food product wherein the production of the final food product includes a thermal heating step. One example of raw material processing wherein the final food product results from a thermal heating step is the manufacture of potato chips from raw potato slices by the step of frying at a temperature of from about 100°C to about 205°C or the production of french fries fried at similar temperatures.

In accordance with the present invention, however, a significant formation of acrylamide has been found to occur when the amino acid asparagine is heated in the presence of a reducing sugar.

Heating other amino acids such as lysine and alanine in the presence of a reducing sugar such as glucose does not lead to the formation of acrylamide. But, surprisingly, the addition of other amino acids to the asparagine-sugar mixture can increase or decrease the amount of acrylamide formed.

Having established the rapid formation of acrylamide when asparagine is heated in the presence of a reducing sugar, a reduction of acrylamide in thermally processed foods can be achieved by inactivating the asparagine. By "inactivating" is meant removing asparagine from the food or rendering asparagine non-reactive along the acrylamide formation route by means of conversion or binding to another chemical that interferes with the formation of acrylamide from asparagine.

I: Effect of Cysteine, Lysine, Glutamine and Glycine on Acrylamide Formation

Since asparagine reacts with glucose to form acrylamide, increasing the concentration of other free amino acids may affect the reaction between asparagine with glucose and reduce acrylamide formation. For this experiment, a solution of asparagine (0.176 %) and glucose (0.4%) was prepared in pH 7.0 sodium phosphate buffer. Four other amino acids, glycine (GLY), lysine (LYS), glutamine (GLN), and cysteine (CYS) were added at the same concentration as glucose on a molar basis. The experimental design was full factorial without replication so all possible combinations of added amino acids were tested. The solutions were heated at 120°C for 40 minutes before measuring acrylamide. Table 1 below shows the concentrations and the results.

	Glucose	ASN	GLY	LYS	GLN	CYS	acrylamide
Order	%	%	%	%	%	%	ppb
1	0.4	0.176	0	0	0	0	1679
2	0.4	0.176	0	0	0	0.269	4
3	0.4	0.176	0	0	0.324	0	5378
4	0.4	0.176	0	0	0.324	0.269	7
5	0.4	0.176	0	0.325	0	0	170
6	0.4	0.176	0	0.325	0	0.269	7
7	0.4	0.176	0	0.325	0.324	0	1517
8	0.4	0.176	0	0.325	0.324	0.269	7
9	0.4	0.176	0.167	0	0	0	213
10	0.4	0.176	0.167	0	0	0.269	6

PATENT COOPERATION TREATY

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NOTIFICATION OF RECEIPT OF RECORD COPY

(PCT Rule 24.2(a))

From the INTERNATIONAL BUREAU

To:

CAHOON, Colln, P.
Carstens, Yee & Cahoon, L.L.P.
P.O. Box 802334
Dallas, TX 75380
United States of America

RECEIVED

MAY 07 2004

BY: *Choket*

Date of mailing (day/month/year) 29 April 2004 (29.04.2004)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference CFLAY.00178P	International application No. PCT/US2004/003375

The applicant is hereby notified that the International Bureau has received the record copy of the international application as detailed below.

Name(s) of the applicant(s) and State(s) for which they are applicants:

FRITO-LAY NORTH AMERICA, INC. formerly known as RECOT, INC. (for all designated States except US)

ELDER, Vincent, Allen et al (for US)

International filing date : 08 February 2004 (08.02.2004)

Priority date(s) claimed : 21 February 2003 (21.02.2003)

Date of receipt of the record copy by the International Bureau : 05 April 2004 (05.04.2004)

List of designated Offices :

AP : BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW

EA : AM, AZ, BY, KG, KZ, MD, RU, TJ, TM

EP : AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR

OA : BF, BJ, CF, CG, CI, CM, GA, GN, GO, GW, ML, MR, NE, SN, TD, TG

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The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No. (41-22) 338.89.75

Form PCT/IB/301 (January 2004)

Authorized officer:

Jocelyne REY-MILLET (Fax : 338 89 75)

Telephone No. (41-22) 338 8943

008228381

Continuation of Form PCT/IB/301
NOTIFICATION OF RECEIPT OF RECORD COPY

Date of mailing (day/month/year) 29 April 2004 (29.04.2004)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference CFLAY.00178P	International application No. PCT/US2004/003375

ATTENTION

The applicant should carefully check the data appearing in this Notification. In case of any discrepancy between these data and the indications in the international application, the applicant should immediately inform the International Bureau.

In addition, the applicant's attention is drawn to the information contained in the Annex, relating to:

- ☒ time limits for entry into the national phase - see updated important information (as of April 2002)
- ☐ requirements regarding priority documents (if applicable)

A copy of this Notification is being sent to the receiving Office and to the International Searching Authority.

INFORMATION ON TIME LIMITS FOR ENTERING THE NATIONAL PHASE

The applicant is reminded that the "national phase" must be entered before each of the designated Offices indicated on the cover sheet of this Notification by paying national fees and furnishing translations, as prescribed by Articles 22 and 39 and the applicable national laws. In addition, the applicant may also have to comply with other special requirements applicable in certain Offices. It is the applicant's responsibility to ensure the necessary steps to enter the national phase are taken in a timely fashion. Most Offices do not issue reminders to applicants in connection with the entry into the national phase.

The applicable time limit for entering the national phase will, subject to what is said in the following paragraph, be 30 MONTHS from the priority date, not only in respect of any elected Office if a demand for international preliminary examination is filed before the expiration of 18 months from the priority date (see Article 39(1)), but also in respect of any designated Office, in the absence of filing of such demand, where Article 22(1) as modified with effect from 1 April 2002 applies in respect of that designated Office. For further details, see PCT Gazette No. 44/2001 of 1 November 2001, pages 18826, 18832 and 18834, as well as the PCT Newsletter, October and November 2001 and February 2002 issues.

In practice, time limits other than the 30-month time limit will continue to apply, for various periods of time, in respect of certain designated or elected Offices. For regular updates on the applicable time limits (20, 21, 30 or 31 months, or other time limit), Offices by Office, refer to the PCT Gazette ("Section IV" part published on a weekly basis), to the PCT Newsletter (on a monthly basis) and to the relevant National Chapters in Volume II of the PCT Applicant's Guide (the paper version of which is updated usually twice a year and the Internet version of which is updated usually on a weekly basis). Finally, a cumulative table of all applicable time limits for entering the national phase is available from WIPO's Internet site, via links from various pages the site including those of the Gazette, Newsletter and Guide, at <http://www.wipo.int/pct/en/index.html>.

Information about the requirements for filing a demand for international preliminary examination is set out in the PCT Applicant's Guide, Volume I/A, Chapter IX. Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination (at present, all PCT Contracting States are bound by Chapter II).

REQUIREMENTS REGARDING PRIORITY DOCUMENTS

For applicants who have not yet complied with the requirements regarding priority documents, the following is recalled.

Where the priority of an earlier national, regional or international application is claimed, the applicant must submit a copy of the said earlier application, certified by the authority with which it was filed ("the priority document") to the receiving Office (which will transmit it to the International Bureau) or directly to the International Bureau, before the expiration of 18 months from the priority date, provided that any such priority document may still be submitted to the International Bureau before that date of international publication of the international application, in which case that document will be considered to have been received by the International Bureau on the last day of the 18-month time limit (Rule 17.1(a)).

Where the priority document is issued by the receiving Office, the applicant may, instead of submitting the priority document, request the receiving Office to prepare and transmit the priority document to the International Bureau. Such request must be made before the expiration of the 18-month time limit and may be subjected by the receiving Office to the payment of a fee (Rule 17.1(b)).

If the priority document concerned is not submitted to the International Bureau or if the request to the receiving Office to prepare and transmit the priority document has not been made (and the corresponding fee, if any, paid) within the applicable time limit indicated under the preceding paragraphs, any designated State may disregard the priority claim, provided that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within the time limit which is reasonable under the circumstances (Rule 17.1(c)).

Where several priorities are claimed, the priority date to be considered for the purposes of computing the 18-month time limit (and all other PCT time limits) is the filing date of the earliest application whose priority is claimed (Article 2(x)(b)).

PATENT COOPERATION TREATY

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From the INTERNATIONAL BUREAU

NOTIFICATION CONCERNING
SUBMISSION OR TRANSMITTAL
OF PRIORITY DOCUMENT

(PCT Administrative Instructions, Section 411)

To:

CAHOON, Collin, P.
Carstens, Yee & Cahoon, L.L.P.
P.O. Box 802334
Dallas, TX 75380
United States of America

Date of mailing (day/month/year) 29 April 2004 (29.04.2004)	
Applicant's or agent's file reference CFLAY.00178P	IMPORTANT NOTIFICATION
International application No. PCT/US2004/003375	International filing date (day/month/year) 06 February 2004 (06.02.2004)
International publication date (day/month/year) Not yet published	Priority date (day/month/year) 21 February 2003 (21.02.2003)
Applicant FRITO-LAY NORTH AMERICA, INC. formerly known as RECOT, INC. et al	

1. By means of this Form, which replaces any previously issued notification concerning submission or transmittal of priority documents, the applicant is hereby notified of the date of receipt by the International Bureau of the priority document(s) relating to all earlier application(s) whose priority is claimed. Unless otherwise indicated by the letters "NR", in the right-hand column or by an asterisk appearing next to a date of receipt, the priority document concerned was submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b).
2. (If applicable) The letters "NR" appearing in the right-hand column denote a priority document which, on the date of mailing of this Form, had not yet been received by the International Bureau under Rule 17.1(a) or (b). Where, under Rule 17.1(a), the priority document must be submitted by the applicant to the receiving Office or the International Bureau, but the applicant fails to submit the priority document within the applicable time limit under that Rule, the attention of the applicant is directed to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.
3. (If applicable) An asterisk(*) appearing next to a date of receipt, in the right-hand column, denotes a priority document submitted or transmitted to the International Bureau but not in compliance with Rule 17.1(a) or (b) (the priority document was received after the time limit prescribed in Rule 17.1(a) or the request to prepare and transmit the priority document was submitted to the receiving Office after the applicable time limit under Rule 17.1(b)). Even though the priority document was not furnished in compliance with Rule 17.1(a) or (b), the International Bureau will nevertheless transmit a copy of the document to the designated Offices, for their consideration. In case such a copy is not accepted by the designated Office as priority document, Rule 17.1(c) provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

Priority date	Priority application No.	Country or regional Office or PCT receiving Office	Date of receipt of priority document
21 Febr 2003 (21.02.2003)	10/372,738	US	22 April 2004 (22.04.2004)

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. (41-22) 338.88.75	Authorized officer Jocelyne REY-MILLET (Fax : 338 89 71 Telephone No. (41-22) 338 8943
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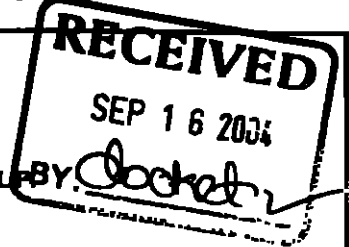
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NOTIFICATION CONCERNING
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To:

CAHOON, Colin, P.
Carstens, Yee & Cahoon, L.L.
P.O. Box 802334
Dallas, TX 75380
ETATS-UNIS D'AMERIQUE



Date of mailing (day/month/year) 10 September 2004 (10.09.2004)		
Applicant's or agent's file reference CFLAY.00178P		IMPORTANT NOTICE
International application No. PCT/US2004/003375	International filing date (day/month/year) 06 February 2004 (06.02.2004)	Priority date (day/month/year) 21 February 2003 (21.02.2003)
Applicant FRITO-LAY NORTH AMERICA, INC. formerly known as RECOT, INC. et al		

The International Bureau transmits herewith the following documents:

- ☒ copy of the international application as published by the International Bureau on 10 September 2004 (10.09.2004) under No. WO 2004/075655
- ☐ copy of international application as republished by the International Bureau on under No. WO
For an explanation as to the reason for this republication of the international application, reference is made to INID codes (15), (48) or (88) (as the case may be) on the front page of the attached document.

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Organization
International Bureau



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10 September 2004 (10.09.2004)

PCT

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WO 2004/075655 A2

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TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM,
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(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),
Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), Euro-
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GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK,
TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,
ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— as to applicant's entitlement to apply for and be granted
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(71) Applicant (for all designated States except US):
FRITO-LAY NORTH AMERICA, INC. formerly
known as RECOT, INC. [US/US]; 7701 Legacy Drive,
Plano, TX 75266 (US).

(72) Inventors; and

(73) Inventors/Applicants (for US only): ELDER, Vincent,
Allen [US/US]; 2903 Pimocana Drive, Carrollton, TX
75007 (US). FULCHER, John, Gregory [US/US]; 9930
Ontario Lane, Dallas, TX 75220 (US). LEUNG, Henry,
Kin-Hang [US/US]; 3704 Ellington Drive, Plano, TX
75093 (US). TOPOR, Michael, Grant [US/US]; 2312
Evergreen, Carrollton, TX 75006 (US).

(74) Agent: CAHOON, Colla, P.; Cantons, Yee & Cahoon,
L.L.P., P.O. Box 802334, Dallas, TX 75380 (US).

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(57) Abstract: In fabricated, thermally processed snack foods, the addition of one of a select group of amino acids to the recipe for the food inhibits the formation of acrylamide during the thermal processing. The amino acid can come from the group of cysteine, lysine, glycine, histidine, alanine, methionine, glutamic acid, aspartic acid, proline, phenylalanine, valine, and arginine and can be a commercially available amino acid or in a free form in an ingredient added to the food. Amino acids can be added to fabricated foods at the admix stage or by exposing raw food stock to a solution containing a concentration of the amino acid additive.

WO 2004/075655 A2

METHOD FOR REDUCING ACRYLAMIDE FORMATION IN THERMALLY PROCESSED FOODS

BACKGROUND OF THE INVENTION

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1. Technical Field

The present invention relates to a method for reducing the amount of acrylamide in thermally processed foods. This invention permits the production of foods having significantly reduced levels of acrylamide. The method relies on the use of one or more of a select group of amino acids in the manufacture of a snack food.

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2. Description of Related Art

The chemical acrylamide has long been used in its polymer form in industrial applications for water treatment, enhanced oil recovery, papermaking, flocculants, thickeners, ore processing and permanent press fabrics. Acrylamide participates as a white crystalline solid, is odorless, and is highly soluble in water (2155 g/L at 30°C). Synonyms for acrylamide include 2-propenamide, ethylene carboxamide, acrylic acid amide, vinyl amide, and propenoic acid amide. Acrylamide has a molecular mass of 71.08, a melting point of 84.5°C, and a boiling point of 125°C at 25 mmHg.

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In very recent times, a wide variety of foods have tested positive for the presence of acrylamide monomer. Acrylamide has especially been found primarily in carbohydrate food products that have been heated or processed at high temperatures. Examples of foods that have tested positive for acrylamide include coffee, cereals, cookies, potato chips, crackers, french-fried potatoes, breads and rolls, and fried breaded meats. In general, relatively low contents of acrylamide have been found in heated protein-rich foods, while relatively high contents of acrylamide have been found in carbohydrate-rich foods, compared to non-detectable levels in unheated and boiled foods. Reported levels of acrylamide found in various similarly processed foods include a range of 330 -

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2,300 (µg/kg) in potato chips, a range of 300 - 1100 (µg/kg) in french fries, a range 120 - 180 (µg/kg) in corn chips, and levels ranging from not detectable up to 1400 (µg/kg) in various breakfast cereals.

It is presently believed that acrylamide is formed from the presence of amino acids and reducing sugars. For example, it is believed that a reaction between free asparagine, an amino acid commonly found in raw vegetables, and free reducing sugars accounts for the majority of acrylamide found in fried food products. Asparagine accounts for approximately 40% of the total free amino acids found in raw potatoes, approximately 18% of the total free amino acids found in high protein rye, and approximately 14% of the total free amino acids found in wheat.

The formation of acrylamide from amino acids other than asparagine is possible, but it has not yet been confirmed to any degree of certainty. For example, some acrylamide formation has been reported from testing glutamine, methionine, cysteine, and aspartic acid as precursors. These findings are difficult to confirm, however, due to potential asparagine impurities in stock amino acids. Nonetheless, asparagine has been identified as the amino acid precursor most responsible for the formation of acrylamide.

Since acrylamide in foods is a recently discovered phenomenon, its exact mechanism of formation has not been confirmed. However, it is now believed that the most likely route for acrylamide formation involves a Maillard reaction. The Maillard reaction has long been recognized in food chemistry as one of the most important chemical reactions in food processing and can affect flavor, color, and the nutritional value of the food. The Maillard reaction requires heat, moisture, reducing sugars, and amino acids.

The Maillard reaction involves a series of complex reactions with numerous intermediates, but can be generally described as involving three steps. The first step of the Maillard reaction involves the combination of a free amino group (from free amino acids and/or proteins) with a reducing sugar (such as glucose) to form Amadori or Heyns rearrangement products. The second

step involves degradation of the Amadori or Heyns rearrangement products via different alternative routes involving deoxyosones, fission, or Strecker degradation. A complex series of reactions - including dehydration, elimination, cyclization, fission, and fragmentation - results in a pool of flavor intermediates and flavor compounds. The third step of the Maillard reaction is characterized by the formation of brown nitrogenous polymers and co-polymers. Using the Maillard reaction as the likely route for the formation of acrylamide, Figure 1 illustrates a simplification of suspected pathways for the formation of acrylamide starting with asparagine and glucose.

Acrylamide has not been determined to be detrimental to humans, but its presence in food products, especially at elevated levels, is undesirable. As noted previously, relatively higher concentrations of acrylamide are found in food products that have been heated or thermally processed. The reduction of acrylamide in such food products could be accomplished by reducing or eliminating the precursor compounds that form acrylamide, inhibiting the formation of acrylamide during the processing of the food, breaking down or reacting the acrylamide monomer once formed in the food, or removing acrylamide from the product prior to consumption. Understandably, each food product presents unique challenges for accomplishing any of the above options. For example, foods that are sliced and cooked as coherent pieces may not be readily mixed with various additives without physically destroying the cell structures that give the food products their unique characteristics upon cooking. Other processing requirements for specific food products may likewise make acrylamide reduction strategies incompatible or extremely difficult.

By way of example, Figure 2 illustrates well-known prior art methods for making fried potato chips from raw potato stock. The raw potatoes, which contain about 80% or more water by weight, first proceed to a peeling step 21. After the skins are peeled from the raw potatoes, the potatoes are then transported to a slicing step 22. The thickness of each potato slice at the slicing step 22 is dependent on the desired thickness of the final product. An example in the prior art involves slicing the potatoes to about 0.053 inches in thickness. These slices are then transported to

a washing step 23, wherein the surface starch on each slice is removed with water. The washed potato slices are then transported to a cooking step 24. This cooking step 24 typically involves frying the slices in a continuous fryer at, for example, 177°C for approximately 2.5 minutes. The cooking step generally reduces the moisture level of the chip to less than 2% by weight. For example, a typical fried potato chip exits the fryer at approximately 1.4% moisture by weight. The cooked potato chips are then transported to a seasoning step 25, where seasonings are applied in a rotation drum. Finally, the seasoned chips proceed to a packaging step 26. This packaging step 26 usually involves feeding the seasoned chips to one or more weighers that then direct chips to one or more vertical form, fill, and seal machines for packaging in a flexible package. Once packaged, the product goes into distribution and is purchased by a consumer.

Minor adjustments in a number of the potato chip processing steps described above can result in significant changes in the characteristics of the final product. For example, an extended residence time of the slices in water at the washing step 23 can result in leaching compounds from the slices that provide the end product with its potato flavor, color and texture. Increased residence times or heating temperatures at the cooking step 24 can result in an increase in the Maillard browning levels in the chip, as well as a lower moisture content. If it is desirable to incorporate ingredients into the potato slices prior to frying, it may be necessary to establish mechanisms that provide for the absorption of the added ingredients into the interior portions of the slices without disrupting the cellular structure of the chip or leaching beneficial compounds from the slice.

By way of another example of heated food products that represent unique challenges to reducing acrylamide levels in the final products, snacks can also be made from a dough. The term "fabricated snack" means a snack food that uses as its starting ingredient something other than the original and unaltered starchy starting material. For example, fabricated snacks include fabricated potato chips that use a dehydrated potato product as a starting material and corn chips that use a masa flour as its starting material. It is noted here that the dehydrated potato product can be potato flour,

potato flakes, potato granules, or any other form in which dehydrated potatoes exist. When any of these terms are used in this application, it is understood that all of these variations are included.

Referring back to Figure 2, a fabricated potato chip does not require the peeling step 21, the slicing step 22, or the washing step 23. Instead, fabricated potato chips start with, for example, potato flakes, which are mixed with water and other minor ingredients to form a dough. This dough is then sheeted and cut before proceeding to a cooking step. The cooking step may involve frying or baking. The chips then proceed to a seasoning step and a packaging step. The mixing of the potato dough generally lends itself to the easy addition of other ingredients. Conversely, the addition of such ingredients to a raw food product, such as potato slices, requires that a mechanism be found to allow for the penetration of ingredients into the cellular structure of the product. However, the addition of any ingredients in the mixing step must be done with the consideration that the ingredients may adversely affect the sheeting characteristics of the dough as well as the final chip characteristics.

It would be desirable to develop one or more methods of reducing the level of acrylamide in the end product of heated or thermally processed foods. Ideally, such a process should substantially reduce or eliminate the acrylamide in the end product without adversely affecting the quality and characteristics of the end product. Further, the method should be easy to implement and, preferably, add little or no cost to the overall process.

SUMMARY OF THE INVENTION

In the inventive process, one or more selected amino acids are added to foods prior to cooking to reduce the formation of acrylamide. The amino acid(s) can be added during milling, dry mix, wet mix, or other admix, so that the amino acid is present throughout the food product. The amino acid can also be incorporated into raw foods by exposing the raw food ingredient to the amino acid, such as by soaking. The amino acid can be in the form of either a commercially available chemical or a food product in which the amino acid is present in a free form. The addition of cysteine or lysine has been shown to reduce acrylamide formation in two embodiments of the invention. Selected other amino acids have also been shown to reduce acrylamide formation.

10 The addition of one or more selected amino acids effectively reduces the amount of acrylamide found in the end product of the heated or thermally processed food while minimally affecting the quality and characteristics of the end product. Further, such a method of acrylamide reduction is generally easy to implement and adds little or no cost to the overall process.

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85**BRIEF DESCRIPTION OF THE DRAWINGS**

The novel features believed characteristic of the invention are set forth in the appended claims. The invention itself, however, as well as a preferred mode of use, further objectives and advantages thereof, will be best understood by reference to the following detailed description of
5 illustrative embodiments when read in conjunction with the accompanying drawings, wherein:

Figure 1 is a schematic of suspected chemical pathways for acrylamide formation in foods;

Figure 2 is a schematic of prior art potato chip processing steps;

Figure 3 is a schematic of a method for making fabricated potato chips from potato flakes, granules or flour according to an embodiment of the present invention; and

10 Figure 4 is a graph representation of the effects of the addition of cysteine and lysine to fabricated potato chips.

DETAILED DESCRIPTION**Effect of Amino Acids on Acrylamide Formation**

The formation of acrylamide in thermally processed foods requires a source of carbon and a source of nitrogen. It is hypothesized that carbon is provided by a carbohydrate source and nitrogen is provided by a protein source or amino acid source. Many plant-derived food ingredients such as rice, wheat, corn, barley, soy, potato and oats contain asparagine and are primarily carbohydrates having minor amino acid components. Typically, such food ingredients have a small amino acid pool, which contains other amino acids in addition to asparagine.

By "thermally processed" is meant food or food ingredients wherein components of the food, such as a mixture of food ingredients, are heated at temperatures of at least 80°C. Preferably the thermal processing of the food or food ingredients takes place at temperatures between about 100°C and 205°C. The food ingredient may be separately processed at elevated temperature prior to the formation of the final food product. An example of a thermally processed food ingredient is potato flakes, which is formed from raw potatoes in a process that exposes the potato to temperatures as high as 170°C. (The terms "potato flakes", "potato granules", and "potato flour" are used interchangeably herein, and are meant to denote any potato based, dehydrated product.) Examples of other thermally processed food ingredients include processed oats, par-boiled and dried rice, cooked soy products, corn masa, roasted coffee beans and roasted cacao beans. Alternatively, raw food ingredients can be used in the preparation of the final food product wherein the production of the final food product includes a thermal heating step. One example of raw material processing wherein the final food product results from a thermal heating step is the manufacture of potato chips from raw potato slices by the step of frying at a temperature of from about 100°C to about 205°C or the production of french fries fried at similar temperatures.

In accordance with the present invention, however, a significant formation of acrylamide has been found to occur when the amino acid asparagine is heated in the presence of a reducing sugar.

Heating other amino acids such as lysine and alanine in the presence of a reducing sugar such as glucose does not lead to the formation of acrylamide. But, surprisingly, the addition of other amino acids to the asparagine-sugar mixture can increase or decrease the amount of acrylamide formed.

Having established the rapid formation of acrylamide when asparagine is heated in the presence of a reducing sugar, a reduction of acrylamide in thermally processed foods can be achieved by inactivating the asparagine. By "inactivating" is meant removing asparagine from the food or rendering asparagine non-reactive along the acrylamide formation route by means of conversion or binding to another chemical that interferes with the formation of acrylamide from asparagine.

10 I: Effect of Cysteine, Lysine, Glutamine and Glycine on Acrylamide Formation

Since asparagine reacts with glucose to form acrylamide, increasing the concentration of other free amino acids may affect the reaction between asparagine with glucose and reduce acrylamide formation. For this experiment, a solution of asparagine (0.176 %) and glucose (0.4%) was prepared in pH 7.0 sodium phosphate buffer. Four other amino acids, glycine (GLY), lysine (LYS), glutamine (GLN), and cysteine (CYS) were added at the same concentration as glucose on a molar basis. The experimental design was full factorial without replication so all possible combinations of added amino acids were tested. The solutions were heated at 120°C for 40 minutes before measuring acrylamide. Table 1 below shows the concentrations and the results.

	Glucose	ASN	GLY	LYS	GLN	CYS	acrylamide
Order	%	%	%	%	%	%	ppb
1	0.4	0.176	0	0	0	0	1679
2	0.4	0.176	0	0	0	0.269	4
3	0.4	0.176	0	0	0.324	0	5378
4	0.4	0.176	0	0	0.324	0.269	7
5	0.4	0.176	0	0.325	0	0	170
6	0.4	0.176	0	0.325	0	0.269	7
7	0.4	0.176	0	0.325	0.324	0	1517
8	0.4	0.176	0	0.325	0.324	0.269	7
9	0.4	0.176	0.167	0	0	0	213
10	0.4	0.176	0.167	0	0	0.269	6

11	0.4	0.176	0.167	0	0.324	0	2033
12	0.4	0.176	0.167	0	0.324	0.269	4
13	0.4	0.176	0.167	0.325	0	0	161
14	0.4	0.176	0.167	0.325	0	0.269	4
15	0.4	0.176	0.167	0.325	0.324	0	127
16	0.4	0.176	0.167	0.325	0.324	0.269	26

Table 1

As shown in the table above, glucose and asparagine without any other amino acid formed 1679 ppb acrylamide. The added amino acids had three types of effects.

1) Cysteine almost eliminated acrylamide formation. All treatments with cysteine had less than 25 ppb acrylamide (a 98% reduction).

2) Lysine and glycine reduced acrylamide formation but not as much as cysteine. All treatments with lysine and/or glycine but without glutamine and cysteine had less than 220 ppb acrylamide (a 85% reduction).

3) Surprisingly, glutamine increased acrylamide formation to 5378 ppb (200% increase). Glutamine plus cysteine did not form acrylamide. Addition of glycine and lysine to glutamine reduced acrylamide formation.

These tests demonstrate the effectiveness of cysteine, lysine, and glycine in reducing acrylamide formation. However, the glutamine results demonstrate that not all amino acids are effective at reducing acrylamide formation. The combination of cysteine, lysine, or glycine with an amino acid that alone can accelerate the formation of acrylamide (such as glutamine) can likewise reduce the acrylamide formation.

II. Effect of Cysteine, Lysine, Glutamine, and Methionine at Different Concentrations and Temperatures

As reported above, cysteine and lysine reduced acrylamide when added at the same concentration as glucose. A follow up experiment was designed to answer the following questions:

1) How do lower concentrations of cysteine, lysine, glutamine, and methionine effect acrylamide formation?

2) Are the effects of added cysteine and lysine the same when the solution is heated at 120°C and 150°C?

A solution of asparagine (0.176 %) and glucose (0.4%) was prepared in pH 7.0 sodium phosphate buffer. Two concentrations of amino acid (cysteine (CYS), lysine (LYS), glutamine (GLN), or methionine (MET)) were added. The two concentrations were 0.2 and 1.0 moles of amino acid per mole of glucose. In half of the tests, two ml of the solutions were heated at 120°C for 40 minutes; in the other half, two ml were heated at 150°C for 15 minutes. After heating, acrylamide was measured by GC-MS, with the results shown in Table 2. The control was asparagine and glucose solution without an added amino acid.

Amino acid/ Temperature	Acrylamide level				
	Control	Amino Acid @ Conc. 0.2	Percentage Of Control	Amino Acid @ Conc. 1.0	Percentage Of Control
LYS-120°C	1332 ppb	1109 ppb	83%	280 ppb	21%
CYS-120°C	1332 ppb	316 ppb	24%	34 ppb	3%
LYS-150°C	3127 ppb	1683 ppb	54%	536 ppb	17%
CYS-150°C	3127 ppb	1146 ppb	37%	351 ppb	11%
GLN-120°C	1953 ppb	4126 ppb	211%	6795 ppb	348%
MET-120°C	1953 ppb	1978 ppb	101%	1132 ppb	58%
GLN-150°C	3866 ppb	7223 ppb	187%	9516 ppb	246%
MET-150°C	3866 ppb	3885 ppb	100%	3024 ppb	78%

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Table 2

In the tests with cysteine and lysine, a control formed 1332 ppb of acrylamide after 40 minutes at 120°C, and 3127 ppb of acrylamide after 15 minutes at 150°C. Cysteine and lysine reduced acrylamide formation at 120°C and 150°C, with the acrylamide reduction being roughly proportional to the concentration of added cysteine or lysine.

In the tests with glutamine and methionine, a control formed 1953 ppb of acrylamide after 40 minutes at 120°C and a control formed 3866 ppb of acrylamide after 15 minutes at 150°C. Glutamine increased acrylamide formation at 120°C and 150°C. Methionine at 0.2 mole/mole of glucose did not affect acrylamide formation. Methionine at 1.0 mole/mole of glucose reduced acrylamide formation by less than fifty percent.

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III. Effect of Nineteen Amino Acids on Acrylamide Formation in Glucose and Asparagine Solution

The effect of four amino acids (lysine, cysteine, methionine, and glutamine) on acrylamide formation was described above. Fifteen additional amino acids were tested. A solution of asparagine (0.176 %) and glucose (0.4%) was prepared in pH 7.0 sodium phosphate buffer. The fifteen amino acids were added at the same concentration as glucose on a molar basis. The control contained asparagine and glucose solution without any other amino acid. The solutions were heated at 120°C for 40 minutes before measuring acrylamide by GC-MS. The results are given in Table 3 below.

Amino Acid	Acrylamide Formed	
	ppb	% of Control
Control	959	100
Histidine	215	22
Alanine	478	50
Methionine	517	54
Glutamic Acid	517	54
Aspartic Acid	529	55
Proline	647	67
Phenylalanine	648	68
Valine	691	72
Arginine	752	78
Tryptophan	1059	111
Threonine	1064	111
Tyrosine	1091	114
Leucine	1256	131
Serine	1296	135
Isoleucine	1441	150

Table 3

As seen in the table above, none of the fifteen additional amino acids were as effective as cysteine, lysine, or glycine in reducing acrylamide formation. Nine of the additional amino acids reduced acrylamide to a level between 22-78% of control, while six amino acids increased acrylamide to a level between 111-150 % of control.

Table 4 below summarizes the results for all amino acids, listing the amino acids in the order of their effectiveness. Cysteine, lysine, and glycine were effective inhibitors, with the amount of

acrylamide formed less than 15% of that formed in the control. The next nine amino acids were less effective inhibitors, having a total acrylamide formation between 22-78% of that formed in the control. The next seven amino acids increased acrylamide. Glutamine caused the largest increase of acrylamide, showing 320% of control.

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Amino Acid	Acrylamide produced as % of Control
Control	100 %
Cysteine	0 %
Lysine	10 %
Glycine	13 %
Histidine	22 %
Alanine	50 %
Methionine	54 %
Glutamic Acid	54 %
Aspartic Acid	55 %
Proline	67 %
Phenylalanine	68 %
Valine	72 %
Arginine	78 %
Tryptophan	111 %
Threonine	111 %
Tyrosine	114 %
Leucine	131 %
Serine	135 %
Isoleucine	150 %
Glutamine	320 %

Table 4

IV: Potato Flakes with 750 ppm of Added L-Cysteine

Test potato flakes were manufactured with 750 ppm (parts per million) of added L-cysteine.

- 10 The control potato flakes did not contain added L-cysteine. Three grams of potato flakes were weighed into a glass vial. After tightly capping, the vials were heated for 15 minutes or 40 minutes at 120°C. Acrylamide was measured by GC-MS in parts per billion (ppb).

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Potato Flakes	Acrylamide (ppb) 15 Min at 120°C	Acrylamide Reduction 15 Min	Acrylamide (ppb) 40 Min at 120°C	Acrylamide Reduction 40 Min
Control	1662	--	9465	--
750 ppm Cysteine	653	60%	7529	20%

Table 5

V. Baked Fabricated Potato Chips

Given the above results, preferred embodiments of the invention have been developed in which cysteine or lysine was added to the formula for a fabricated snack food, in this case baked, fabricated potato chips. The process for making this product is shown in Figure 3. In a dough preparation step 31, potato flakes, water, and other ingredients are combined to form a dough. (The terms "potato flakes" and "potato flour" are used interchangeably herein and either are intended to encompass all dried flake or powder preparations, regardless of particle size.) In a sheeting step 32, the dough is run through a sheeter, which flattens the dough, and is then cut into discrete pieces. In a cooking step 33, the cut pieces are baked until they reach a specified color and water content. The resulting chips are then seasoned in a seasoning step 34 and placed in packages in a packaging step 35.

A first embodiment of the invention is demonstrated by use of the process described above. To illustrate this embodiment, a comparison is made between a control and test batches to which were added either one of three concentrations of cysteine or one concentration of lysine. Table 6 below shows the ingredients used in the various batches.

Ingredient	Control	Cysteine #1	Cysteine #2	Cysteine #3	Lysine
Potato flakes and modified starch	5496 g	5496 g	5496 g	5496 g	5496 g
Sugar	300 g	300 g	300 g	300 g	300 g
Oil	90 g	90 g	90 g	90 g	90 g
Leavening agents	54 g	54 g	54 g	54 g	54 g
Emulsifier	60 g	60 g	60 g	60 g	60 g
L-Cysteine (dissolved in water) ¹	0 g	1.8 g	4.2 g	8.4 g	0 g
L-Lysine monohydrochloride	0 g	0 g	0 g	0 g	42 g
Total Dry	6000 g	6001.8 g	6004.2 g	6008.4 g	6042 g
Water	3947ml	3947ml	3947ml	3947ml	3947ml

Table 6

In all batches, the dry ingredients were first mixed together, then oil was added to each dry blend and mixed. The cysteine or lysine was dissolved in the water prior to adding to the dough. The moisture level of the dough prior to sheeting was 40% to 45% by weight. The dough was sheeted to produce a thickness of between 0.020 and 0.030 inches, cut into chip-sized pieces, and baked.

After cooking, testing was performed for moisture, oil, and color according to the Hunter L-A-B scale. Samples were tested to obtain acrylamide levels in the finished product. Table 7 below shows the results of these analyses.

Measurement	Control	Cysteine #1	Cysteine #2	Cysteine #3	Lysine
H ₂ O	2.21 %	1.73 %	2.28 %	2.57 %	2.68 %
Oil, %	1.99 %	2.15 %	2.05 %	2.12 %	1.94 %
Acrylamide	1030 ppb	620 ppb	166 ppb	104 ppb	456 ppb
Color	L	72.34	76.53	79.02	78.36
	A	1.99	-1.14	-2.02	-2.14
	B	20.31	25.52	23.2	23.0

Table 7

In the control chips, the acrylamide level after final cooking was 1030 ppb. Both the addition of cysteine, at all the levels tested, and lysine reduced the final acrylamide level significantly. Figure 4 shows the resulting acrylamide levels in graphical form.

Adding cysteines or lysine to the dough significantly lowers the level of acrylamide present in the finished product. The cysteine samples show that the level of acrylamide is lowered in roughly a

direct proportion to the amount of cysteine added. Consideration must be made, however, for the collateral effects on the characteristics (such as color, taste, and texture) of the final product from the addition of an amino acid to the manufacturing process.

Additional tests were also run, using added cysteine, lysine, and combinations of each of the
5 two amino acids with CaCl_2 . These tests used the same procedure as described in the tests above, but used potato flakes having varying levels of reducing sugars and varying amounts of amino acids and CaCl_2 added. In Table 8 below, lot 1 of potato flakes had 0.81% reducing sugars (this portion of the table reproduces the results from the test shown above), lot 2 had 1.0% and lot 3 had 1.8% reducing sugars.

1 It is expected that the D- isomer or a racemic mixture of both the D- and L- isomers of the amino acids would be equally effective, although the L- isomer is likely to be the best and least expensive source.

Flake Lot #	CaCl2 Wt % of total dry	Cysteine ppm of total dry	Lysine % of total dry	Finish H2O wt %	Finish color value	Acrylamide ppb
1	0	0	0	2.21	72.34	1030
1	0	300	0	1.73	76.53	620
1	0	700	0	2.28	79.02	166
1	0	1398	0	2.57	78.36	104
1	0	0	0.685	2.68	73.20	456
2	0	0	0	1.71	72.68	599
2	0	0	0	1.63	74.44	1880
2	0	0	0	1.69	71.26	1640
2	0	0	0	1.99	71.37	1020
2	0	700	0	2.05	75.81	317
2	0.646	0	0.685	1.74	73.99	179
3	0	0	0	1.80	73.35	464
3	0	0	0	1.61	72.12	1060
3	0	700	0	1.99	75.27	290
3	0	1398	0	1.96	75.87	188
3	0	0	0.685	1.90	76.17	105
3	0.646	0	0.685	2.14	75.87	47
3	0.646	700	0	1.83	77.23	148

Table 8

As shown by the data in this table, the addition of either cysteine or lysine provides significant improvement in the level of acrylamide at each level of reducing sugars tested. The combination of lysine with calcium chloride provided an almost total elimination of acrylamide produced, despite the fact that this test was run with the highest level of reducing sugars.

VL Tests in Sliced, Fried Potato Chips

A similar result can be achieved with potato chips made from potato slices. However, the desired amino acid cannot be simply mixed with the potato slices, as with the embodiments illustrated above, since this would destroy the integrity of the slices. In one embodiment, the potato slices are immersed in an aqueous solution containing the desired amino acid additive for a period of time sufficient to allow the amino acid to migrate into the cellular structure of the potato slices. This can be done, for example, during the washing step 23 illustrated in Figure 2.

46
96

Table 9 below shows the result of adding one weight percent of cysteine to the wash treatment that was described in step 23 of Figure 2 above. All washes were at room temperature for the time indicated; the control treatments had nothing added to the water. The chips were fried in cottonseed oil at 178°C for the indicated time.

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	Fry Time (seconds)	Finished H ₂ O wt %	Finished oil wt %	Finished Acrylamide
Control - 2-3 min wash	140	1.32 %	42.75 %	323 ppb
1 % cysteine - 15 min wash	140	.86 %	45.02 %	239 ppb
Control - 2-3 min wash	110	1.72 %	40.87 %	278 ppb
Control - 15 min wash	110	1.68 %	41.02 %	231 ppb
1% Cysteine - 15 min wash	110	1.41 %	44.02 %	67 ppb

Table 9

As shown in this table, immersing potato slices of .053 inch thickness for 15 minutes in an aqueous solution containing a concentration of one weight percent of cysteine is sufficient to reduce the acrylamide level of the final product on the order of 100-200 ppb.

10 The invention has also been demonstrated by adding cysteine to the corn dough (or masa) for tortilla chips. Dissolved L-cysteine was added to cooked corn during the milling process so that cysteine was uniformly distributed in the masa produced during milling. The addition of 600 ppm of L-cysteine reduced acrylamide from 190 ppb in the control product to 75 ppb in the L-cysteine treated product.

15 Any number of amino acids can be used with the invention disclosed herein, as long as adjustments are made for the collateral effects of the additional ingredient(s), such as changes to the color, taste, and texture of the food. Although all examples shown utilize α -amino acids (where the -NH₂ group is attached to the alpha carbon atom), the applicants anticipate that other isomers, such as β - or γ -amino acids can also be used, although β - and γ -amino acids are not commonly used as food
20 additives. The preferred embodiment of this invention uses cysteine, lysine, and/or glycine. However, other amino acids, such as histidine, alanine, methionine, glutamic acid, aspartic acid, proline, phenylalanine, valine, and arginine may also be used. Such amino acids, and in particular

cysteine, lysine, and glycine, are relatively inexpensive and commonly used as food additives. These preferred amino acids can be used alone or in combination in order to reduce the amount of acrylamide in the final food product. Further, the amino acid can be added to a food product prior to heating by way of either adding the commercially available amino acid to the starting material of the food product or adding another food ingredient that contains a high concentration level of the free amino acid. For example, casein contains free lysine and gelatin contains free glycine. Thus, when Applicants indicate that an amino acid is added to a food formulation, it will be understood that the amino acid may be added as a commercially available amino acid or as a food having a concentration of the free amino acid(s) that is greater than the naturally occurring level of asparagine in the food.

10 The amount of amino acid that should be added to the food in order to reduce the acrylamide levels to an acceptable level can be expressed in several ways. In order to be commercially acceptable, the amount of amino acid added should be enough to reduce the final level of acrylamide production by at least twenty percent (20%) as compared to a product that is not so treated. More preferably, the level of acrylamide production should be reduced by an amount in the range of thirty-
15 five to ninety-five percent (35-95%). Even more preferably, the level of acrylamide production should be reduced by an amount in the range of fifty to ninety-five percent (50-95%). In a preferred embodiment using cysteine, it has been determined that the addition of at least 100 ppm can be effective in reducing acrylamide. However, a preferred range of cysteine addition is between 100 ppm and 10,000 ppm, with the most preferred range in the amount of about 1,000 ppm. In preferred
20 embodiments using other effective amino acids, such as lysine and glycine, a mole ratio of the added amino acid to the reducing sugar present in the product of at least 0.1 mole of amino acid to one mole of reducing sugars (0.1:1) has been found to be effective in reducing acrylamide formation. More preferably the molar ratio of added amino acid to reducing sugars should be between 0.1:1 and 2:1, with a most preferable ratio of about 1:1.

25 The mechanisms by which the select amino acids reduce the amount of acrylamide found are

not presently known. Possible mechanisms include competition for reactant and dilution of the precursor, which will create less acrylamide, and a reaction mechanism with acrylamide to break it down." Possible mechanisms include (1) inhibition of Maillard reaction, (2) consumption of glucose and other reducing sugars, and (3) reaction with acrylamide. Cysteine, with a free thiol group, acts as an inhibitor of the Maillard reaction. Since acrylamide is believed to be formed from asparagine by the Maillard reaction, cysteine should reduce the rate of the Maillard reaction and acrylamide formation. Lysine and glycine react rapidly with glucose and other reducing sugars. If glucose is consumed by lysine and glycine, there will be less glucose to react with asparagine to form acrylamide. The amino group of amino acids can react with the double bond of acrylamide, a Michael addition. The free thiol of cysteine can also react with the double bond of acrylamide.

It should be understood that adverse changes in the characteristics of the final product, such as changes in color, taste, and texture, could be caused by the addition of an amino acid. These changes in the characteristics of the product in accordance with this invention can be compensated by various other means. For example, color characteristics in potato chips can be adjusted by controlling the amount of sugars in the starting product. Some flavor characteristics can be changed by the addition of various flavoring agents to the end product. The physical texture of the product can be adjusted by, for example, the addition of leavening agents or various emulsifiers.

While the invention has been particularly shown and described with reference to several embodiments, it will be understood by those skilled in the art that various other approaches to the reduction of acrylamide in thermally processed foods by use of an amino acid additive may be made without departing from the spirit and scope of this invention. For example, while the process has been disclosed with regard to potato and corn products, the process can also be used in processing of food products made from barley, wheat, rye, rice, oats, millet, and other starch-based grains, as well as other foods containing asparagine and a reducing sugar, such as sweet potatoes, onion, and other vegetables. Further, the process has been demonstrated in potato chips and corn chips, but can be

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used in the processing of many other food products, such as other types of snack chips, cereals, cookies, crackers, hard pretzels, breads and rolls, and the breading for breaded meats. In many of these foods, the amino acid can be added during the mixing of the dough used to make the product, making the amino acid available during cooking to provide a reduction in the level of acrylamide.

- 5 Further, the addition of an amino acid can be combined with other strategies for the reduction of acrylamide to produce an acceptable acrylamide level without adversely affecting the taste, color, odor, or other characteristics of an individual food.

CLAIMS:

What is claimed is:

1. A method of lowering the level of acrylamide in a thermally processed food containing free asparagine and simple sugars, said method comprising the steps of:
 - a) adding an ingredient containing a free amino acid to a food product, wherein said ingredient is added in an amount sufficient to reduce the final level of acrylamide in said thermally processed food to an acceptable level;
 - b) thermally processing said food product.
2. The method of Claim 1, wherein said adding step a) adds an amount of said ingredient that is sufficient to reduce said final level of acrylamide in said thermally processed food by at least 20 percent.
3. The method of Claim 1, wherein said adding step a) adds an amount of said ingredient that is sufficient to reduce said final level of acrylamide in said thermally processed food by at least 35 percent.
4. The method of Claim 1, wherein said adding step a) adds an amount of said ingredient that is sufficient to reduce said final level of acrylamide in said thermally processed food by at least 50 percent.
5. The method of Claim 1, wherein said adding step a) adds an amount of said ingredient that is sufficient to reduce said final level of acrylamide in said thermally processed food by at least 65 percent.
6. The method of Claim 1, wherein said adding step a) adds at least 100 parts per million of cysteine.
7. The method of Claim 1, wherein said adding step a) adds about 1,000 parts per million of cysteine.
8. The method of Claim 1, wherein said adding step a) adds up to 10,000 parts per million of cysteine.

9. The method of Claim 1, wherein said adding step a) adds at least 0.1 moles of an amino acid for each mole of reducing sugar in said food product.
10. The method of Claim 1, wherein said adding step a) adds about 1.0 moles of an amino acid for each mole of reducing sugar in said food product.
11. The method of Claim 1, wherein said adding step a) adds up to 2.0 moles of an amino acid for each mole of reducing sugar in said food product.
12. The method of Claim 1, wherein said free amino acid is chosen from the group consisting of cysteine, lysine, glycine, histidine, alanine, methionine, glutamic acid, aspartic acid, proline, phenylalanine, valine, and arginine.
13. The method of Claim 1, wherein said adding step a) adds a commercially available amino acid to said food product.
14. The method of Claim 1, wherein said adding step a) adds a food containing said free amino acid to said food product.
15. The method of Claim 1, wherein, in said adding step a), said food product is soaked in a solution containing said ingredient.
16. The method of Claim 1, wherein said ingredient is mixed with other ingredients to form dough.
17. The method of Claim 1, wherein said cooking step b) comprises frying said food product.
18. The method of Claim 1, wherein said cooking step b) comprises baking said food product.
19. The method of Claim 1, wherein the adding step a) further comprises adding an ingredient containing calcium to said food product.

20. The method of Claim 19, wherein said ingredient containing calcium comprises calcium chloride.
21. The thermally processed food produced by the method of Claim 1.

22. A method of reducing the production of acrylamide in a fabricated food product, said method comprising the steps of:
- 5 a) adding an ingredient containing a free amino acid to a mixture for a fabricated food product, wherein said ingredient is added in an amount sufficient to reduce the final level of acrylamide in said fabricated food product to a predetermined level;
- b) thermally processing said mixture.
23. The method of Claim 22, wherein said free amino acid is chosen from the group consisting of cysteine, lysine, glycine, histidine, alanine, methionine, glutamic acid, aspartic acid, proline, phenylalanine, valine, and arginine.
24. The method of Claim 22, wherein said adding step a) adds a commercially available amino acid to said mixture.
25. The method of Claim 22, wherein said adding step a) adds a food containing said free amino acid to said mixture.
26. The method of Claim 22, wherein said cooking step b) comprises frying said food product.
27. The method of Claim 22, wherein said cooking step b) comprises baking said food product.
28. The fabricated food product produced by the method of Claim 22.

29. A method of preparing fabricated potato chips, said method comprising the steps of:
- a) preparing a dough comprising potato flakes, water, and an ingredient containing a free amino acid, wherein said ingredient is added in an amount sufficient to reduce the final level of acrylamide in said fabricated potato chips to a predetermined level;
 - 5 b) sheeting and cutting said mixture to form cut pieces;
 - c) thermally processing said cut pieces to form chips.
30. The method of Claim 29, wherein said free amino acid is chosen from the group consisting of cysteine, lysine, glycine, histidine, alanine, methionine, glutamic acid, aspartic acid, proline, phenylalanine, valine, and arginine.
31. The method of Claim 29, wherein said thermally processing step a) comprises baking.
32. The method of Claim 29, wherein said thermally processing step c) comprises frying.
33. The method of Claim 29, further comprising the step of:
- d) seasoning said fabricated potato chips.
34. The method of Claim 29, further comprising the step of:
- d) packaging said fabricated potato chips.
35. The fabricated potato chips produced by the method of Claim 29.

36. A method of preparing potato chips, said method comprising the steps of:
- a) slicing raw potatoes to form potato slices;
 - b) soaking said potato slices in a solution containing a quantity of an amino acid sufficient to reduce the level of acrylamide in said potato chips to an acceptable level;
 - 5 c) thermally processing said potato slices to form potato chips.
37. The method of claim 36, wherein said amino acid is chosen from the group consisting of cysteine, lysine, glycine, histidine, alanine, methionine, glutamic acid, aspartic acid, proline, phenylalanine, valine, and arginine.
38. The method of Claim 36, wherein said thermally processing step a) comprises baking.
39. The method of Claim 36, wherein said thermally processing step c) comprises frying.
40. The method of Claim 36, wherein said soaking step b) reduces said final level of acrylamide by at least 20 percent.
41. The method of Claim 36, wherein said soaking step b) reduces said final level of acrylamide by at least 50 percent.
42. The potato chips produced by the method of Claim 36.

43. A method of preparing corn chips, said method comprising the steps of:
- a) preparing a mixture containing ground corn, water, and an ingredient containing a free amino acid in a quantity sufficient to reduce the formation of acrylamide in said corn chips to a predetermined level;
 - 5 b) sheeting and cutting said mixture to form chips; and
 - c) thermally processing said chips.
44. The method of Claim 43, wherein said free amino acid is chosen from the group consisting of cysteine, lysine, glycine, histidine, alanine, methionine, glutamic acid, aspartic acid, proline, phenylalanine, valine, and arginine.
45. The method of Claim 43, wherein said thermally processing step c) comprises baking.
46. The method of Claim 43, wherein said thermally processing step c) comprises frying.
47. The method of Claim 43, further comprising the step of:
- d) seasoning said corn chips.
48. The method of Claim 43, further comprising the step of:
- d) packaging said corn chips.
49. A corn chip produced by the method of Claim 43.

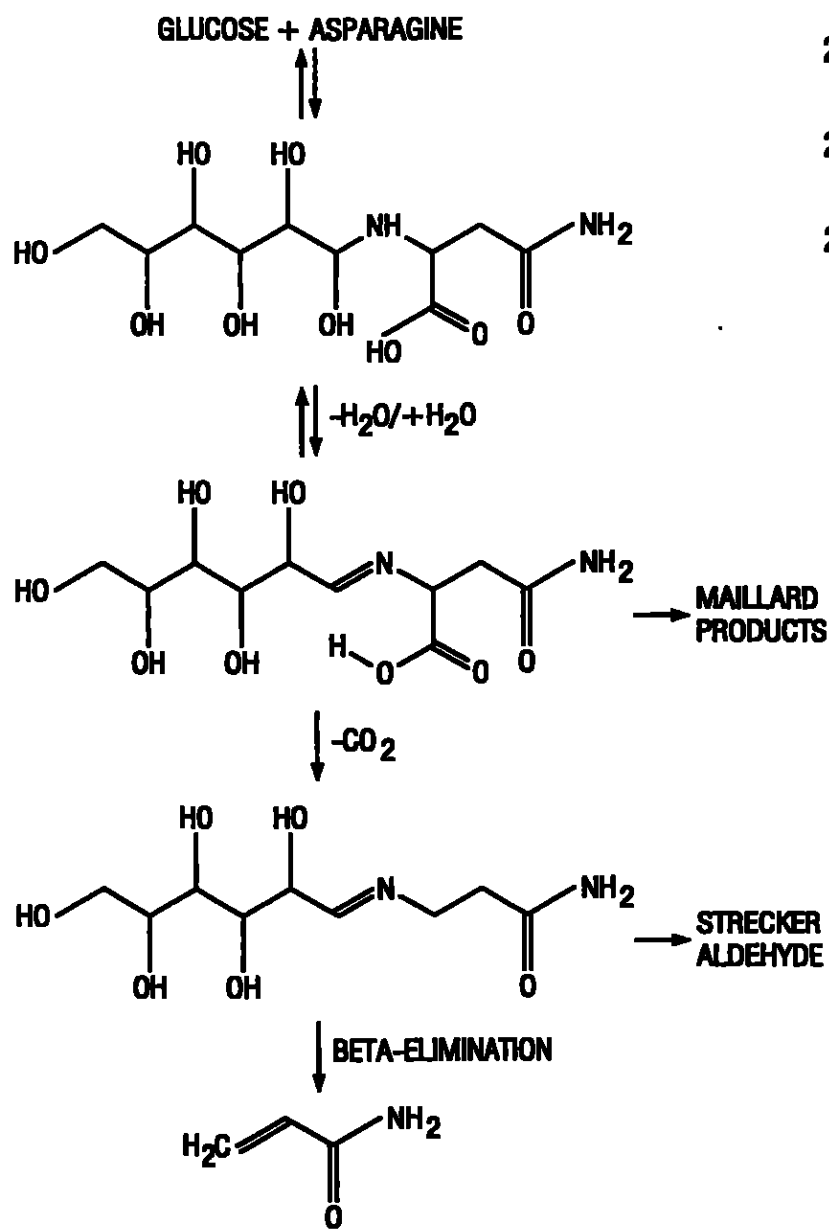


FIG. 1

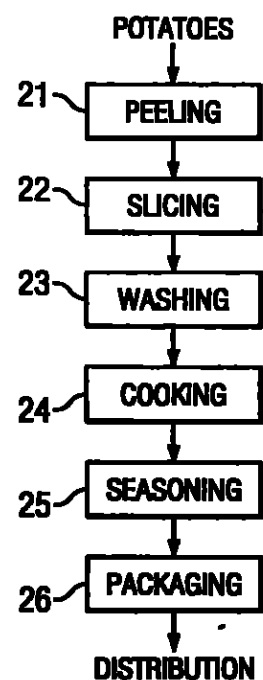


FIG. 2
(PRIOR ART)

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FIG. 3

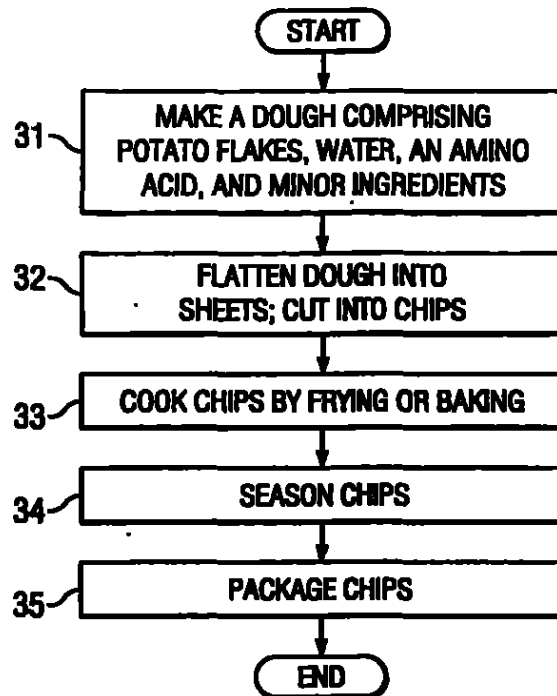
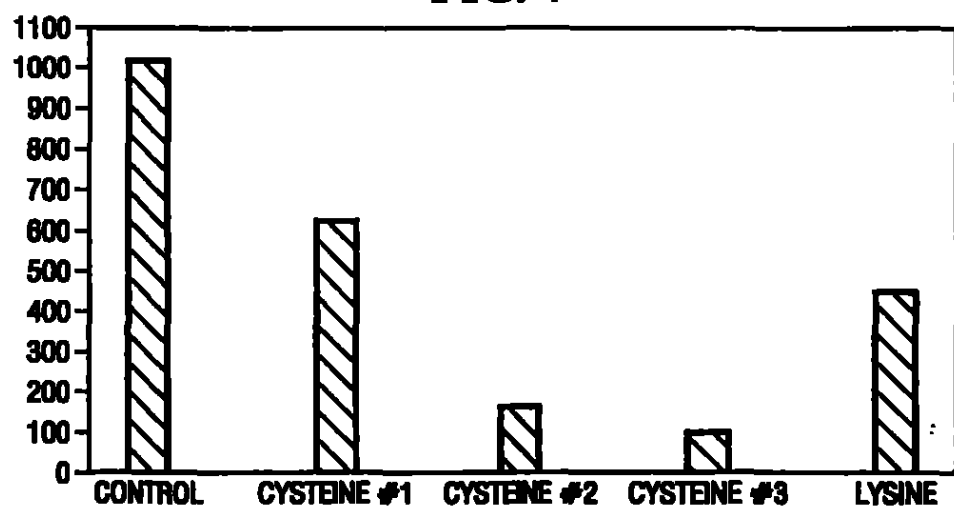


FIG. 4



From the INTERNATIONAL BUREAU

PCT

FIRST NOTICE INFORMING THE APPLICANT OF
THE COMMUNICATION OF THE INTERNATIONAL
APPLICATION (TO DESIGNATED OFFICES WHICH
DO NOT APPLY THE 30 MONTH TIME LIMIT
UNDER ARTICLE 22(1))

(PCT Rule 47.1(c))

Date of mailing (day/month/year) 23 September 2004 (23.09.2004)		RECEIVED OCT 04 2004 BY: <i>Booker</i>	
Applicant's or agent's file reference CFLAY.00178P			
International application No. PCT/US2004/003975		International filing date (day/month/year) 06 February 2004 (06.02.2004)	Priority date (day/month/year) 21 February 2003 (21.02.2003)
Applicant FRITO-LAY NORTH AMERICA, INC. formerly known as RECOT, INC. et al			

1. **ATTENTION:** For any designated Office(s), for which the time limit under Article 22(1), as in force from 1 April 2002 (30 months from the priority date), does apply, please see Form PCT/IB/308(Second and Supplementary Notice) (to be issued promptly after the expiration of 28 months from the priority date).

2. Notice is hereby given that the following designated Office(s), for which the time limit under Article 22(1), as in force from 1 April 2002, does not apply, has/have requested that the communication of the international application, as provided for in Article 30, be effected under Rule 93bis.1. The International Bureau has effected that communication on the date indicated below:
10 September 2004 (10.09.2004)

CH

In accordance with Rule 47.1(c-bis)(i), those Offices will accept the present notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

3. The following designated Offices, for which the time limit under Article 22(1), as in force from 1 April 2002, does not apply, have not requested, as at the time of mailing of the present notice, that the communication of the international application be effected under Rule 93bis.1:

FI, LU, SE, TZ, UG, ZM

In accordance with Rule 47.1(c-bis)(ii), those Offices accept the present notice as conclusive evidence that the Contracting State for which that Office acts as a designated Office does not require the furnishing, under Article 22, by the applicant of a copy of the international application.

4. **TIME LIMITS** for entry into the national phase

For the designated Office(s) listed above, and unless a demand for international preliminary examination has been filed before the expiration of 19 months from the priority date (see Article 39(1)), the applicable time limit for entering the national phase will, subject to what is said in the following paragraph, be 20 MONTHS from the priority date.

In practice, time limits other than the 20-month time limit will continue to apply, for various periods of time, in respect of certain of the designated Offices listed above. For regular updates on the applicable time limits (20 or 21 months, or other time limit), Office by Office, refer to the *PCT Gazette*, the *PCT Newsletter* and the *PCT Applicant's Guide*, Volume II, National Chapters, all available from WIPO's Internet site, at <http://www.wipo.int/pct/en/index.html>.

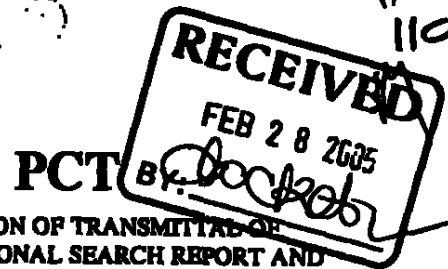
It is the applicant's sole responsibility to monitor all these time limits.

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. +41 22 740 14 35	Authorized officer Ellen Moyse Facsimile No. +41 22 338 89 75
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PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

To:
COLIN P. CAHOON
CARSTENS, YEB & CAHOON, L.L.P.
PO BOX 802334
DALLAS, TEXAS 75380



NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL SEARCH REPORT AND
THE WRITTEN OPINION OF THE INTERNATIONAL
SEARCHING AUTHORITY, OR THE DECLARATION

(PCT Rule 44.1)

Applicant's or agent's file reference CFLAY.00178P	Date of mailing (day/month/year) 24 FEB 2005
International application No. PCT/US04/03375	International filing date (day/month/year) 06 February 2004 (06.02.2004)
Applicant FRITO-LAY NORTH AMERICA, INC.	

1. ☒ The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.
 Filing of amendments and statement under Article 19:
 The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46):
 When? The time limit for filing such amendments is normally two months from the date of transmittal of the international search report.
 Where? Directly to the International Bureau of WIPO, 34 chemin des Colombettes
 1211 Geneva 20, Switzerland, Facsimile No.: +41 22 740 14 35
 For more detailed instructions, see the notes on the accompanying sheet.
2. ☐ The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.
3. ☐ With regard to the protest against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:
 - ☐ the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.
 - ☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.
4. **Reminders**
 Shortly after the expiration of 18 months from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90bis.1 and 90bis.3, respectively, before the completion of the technical preparations for international publication.
 The applicant may submit comments on an informal basis on the written opinion of the International Searching Authority to the International Bureau. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established. These comments would also be made available to the public but not before the expiration of 30 months from the priority date.
 Within 19 months from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later); otherwise, the applicant must, within 20 months from the priority date, perform the prescribed acts for entry into the national phase before those designated Offices.
 In respect of other designated Offices, the time limit of 30 months (or later) will apply even if no demand is filed within 19 months.
 See the Annex to Form PCT/IB/301 and, for details about the applicable time limits, Office by Office, see the PCT Applicant's Guide, Volume II, National Chapters and the WIPO Internet site.

Name and mailing address of the ISA/ US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1430 Alexandria, Virginia 22313-1430 Facsimile No. (703) 305-3230	Authorized officer Arthur L. Corbin Telephone No. (571) 272-1399
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Form PCT/ISA/220 (January 2004)

(See notes on accompanying sheet)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference CFLAY.00178P	FOR FURTHER ACTION see Form PCT/ISA/220 as well as, where applicable, item 5 below.	
International application No. PCT/US04/03375	International filing date (day/month/year) 06 February 2004 (06.02.2004)	(Earliest) Priority Date (day/month/year) 21 February 2003 (21.02.2003)
Applicant FRITO-LAY NORTH AMERICA, INC.		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 2 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the Report

a. With regard to the language, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ The international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. ☐ With regard to any nucleotide and/or amino acid sequence disclosed in the international application, see Box No. I.

2. ☐ Certain claims were found unsearchable (See Box No. II)

3. ☐ Unity of invention is lacking (See Box No. III)

4. With regard to the title,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the abstract,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the drawings,

a. the figure of the drawings to be published with the abstract is Figure No. _____

☐ as suggested by the applicant.

☐ as selected by this Authority, because the applicant failed to suggest a figure.

☐ as selected by this Authority, because this figure better characterizes the invention.

b. ☒ none of the figures is to be published with the abstract.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/03375

A. CLASSIFICATION OF SUBJECT MATTER IPC(7) : A 23 L 1/217 US CL : 426/321, 618, 637 According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) U.S. : 426/321, 618, 637 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched NONE Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) NONE		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,389,389 A (BECK) 14 February 1995 (14.02.95), see entire document. ✓	1-49
A	US 5,045,335 A (DEROUX et al) 03 September 1991 (03.09.91). ✓	
A	US 4,272,554 A (SCHROEDER et al) 09 June 1981 (09.06.81). ✓	
A	US 5,620,727 A (GERRISH et al) 15 April 1997 (15.04.97).	
☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "d" document member of the same patent family		
Date of the actual completion of the international search 26 January 2004 (26.01.2004)		Date of mailing of the international search report 24 FEB 2005
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1430 Alexandria, Virginia 22313-1430 Facsimile No. (703) 305-3230		Authorized officer Arthur L. Corbin Telephone No. (571) 272-1399 <i>J. Wetfield</i> For

Form PCT/ISA/210 (second sheet) (January 2004)

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PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:
COLIN P. CAHOON
CARSTENS, YEE & CAHOON, L.L.P.
PO BOX 802334
DALLAS, TEXAS 75380

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

Date of mailing
(day/month/year) **24 FEB 2005**

Applicant's or agent's file reference

FOR FURTHER ACTION

See paragraph 2 below

CFLAY.00178P

International application No.

International filing date (day/month/year)

Priority date (day/month/year)

PCT/US04/03375

06 February 2004 (06.02.2004)

21 February 2003 (21.02.2003)

International Patent Classification (IPC) or both national classification and IPC

IPC(7): A 23 L 1/217 and US Cl.: 426/321, 618, 637

Applicant

FRITO-LAY NORTH AMERICA, INC.

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/ US

Mail Stop PCT, Attn: ISA/US
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

Facsimile No. (703) 305-3230

Authorized officer

Arthur L. Corbin

Telephone No. (571) 272-1399

J. Whitehead
For

Form PCT/ISA/237 (cover sheet) (January 2004)

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/US04/03375

Box No. I Basis of this opinion

1. With regard to the language, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ This opinion has been established on the basis of a translation from the original language into the following language _____, which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).

2. With regard to any nucleotide and/or amino acid sequence disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:

a. type of material

☐ a sequence listing

☐ table(s) related to the sequence listing

b. format of material

☐ in written format

☐ in computer readable form

c. time of filing/furnishing

☐ contained in international application as filed.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

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PCT/US04/03375

Box No. V Reasoned statement under Rule 43 bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims <u>1-49</u>	YES
	Claims <u>NONE</u>	NO
Inventive step (IS)	Claims <u>NONE</u>	YES
	Claims <u>1-49</u>	NO
Industrial applicability (IA)	Claims <u>1-49</u>	YES
	Claims <u>NONE</u>	NO

2. Citations and explanations:

Claim 1-49 lack an inventive step under PCT Article 33(3) as being obvious over Beck. BECK discloses adding an amino acid, e.g. upto 0.5% cysteine, and calcium chloride to a potato or corn product before cooking thereof. It would have been obvious that the addition of amino acid will reduce the acrylamide level in the cooked food product since the amount of the amino acid used in BECK is within applicant's claimed range.

Claims 1-49 meet the criteria of PCT Article 33(4) since the claimed process is used to make an edible food product.



US005620727A

United States Patent [19]
Gerrish et al.

[11] **Patent Number:** **5,620,727**
[45] **Date of Patent:** **Apr. 15, 1997**

[54] **METHOD FOR PREPARING A FRIED POTATO FOOD**

[75] **Inventor:** **Timothy C. Gerrish; Lawrence E. Caronias**, both of **Wilmington, Del.**

[73] **Assignee:** **Hercules Incorporated**, **Wilmington, Del.**

[21] **Appl. No.:** **3,769**

[22] **Filed:** **Jan. 13, 1993**

Related U.S. Application Data

[65] **Continuation of Ser. No. 616,474, Nov. 21, 1990, abandoned.**

[51] **Int. Cl.⁶** **A23B 7/00; A23L 1/00**

[52] **U.S. Cl.** **426/382; 426/89; 426/102; 426/303; 426/637**

[58] **Field of Search** **426/89, 92, 102, 426/272, 273, 573, 271, 302, 303, 304, 438, 506, 509, 574, 575, 576, 577, 578, 637, 804**

[56] **References Cited**

U.S. PATENT DOCUMENTS

2,517,595	8/1950	Owens et al.	426/102
2,611,708	12/1952	Owens et al.	426/102
3,397,993	8/1968	Strong	426/464
3,434,591	1/1969	Gold	426/102
4,511,583	4/1983	Olson et al.	426/89
4,764,386	8/1988	Bernaschi et al.	426/89
4,877,628	10/1989	Stypula	426/302
4,897,275	1/1990	Nagai et al.	426/289
4,900,573	2/1990	Meyers et al.	426/302

4,900,576	2/1990	Bouzek et al.	426/438
4,917,908	4/1990	Funk	426/102
4,917,909	4/1990	Funk	426/102

FOREIGN PATENT DOCUMENTS

0048123	8/1991	European Pat. Off.
1079828	8/1987	United Kingdom

OTHER PUBLICATIONS

Thom, D. et al. "Interchain Associations of Alginates and Pectins" in *Gums and Stabilizers for the Food Industry—Interactions of Hydrocolloids*, 1982, pp. 97-108, Pergamon Press, Oxford.
Research Disclosure 18237, Jun. 19, 1979, "The Setting of Batter by Poaching Instead of Frying", disclosed by Alginates Industries Ltd., London.

Primary Examiner—**Leslie A. Wong**
Attorney, Agent, or Firm—**David Edwards**

[57] **ABSTRACT**

A food composition, product and method of making thereof uses flams, such as vegetable, meat, fish or poultry. The flams is coated with at least one coating, dried and fried. Initially the coating is a gel including water, hydrocolloid gel forming compounds and a cross-linking agent such as poly-valent cations. The coating at least partially encloses the outer surface of the flams. The coating is dried prior to frying. The coating (initial, dried and fried) includes at least ten percent equivalent weight of cross-linking agent based on the neutralization equivalent weight of the hydrocolloid. The dried coating is adapted to substantially impede the penetration of oil therethrough. The coated fried products have a low concentration of cooking oil.

11 Claims, 2 Drawing Sheets

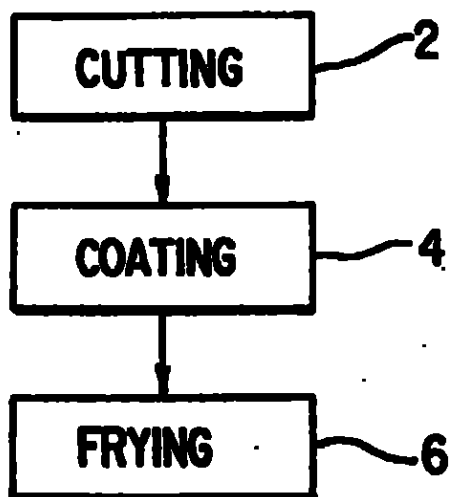


FIG. 1

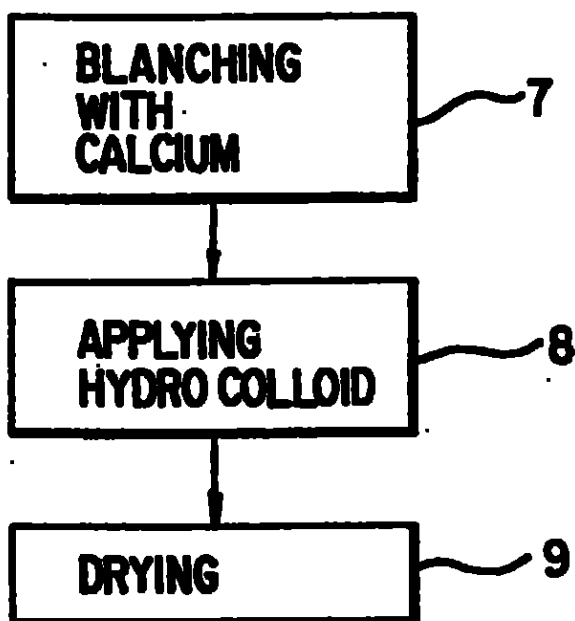
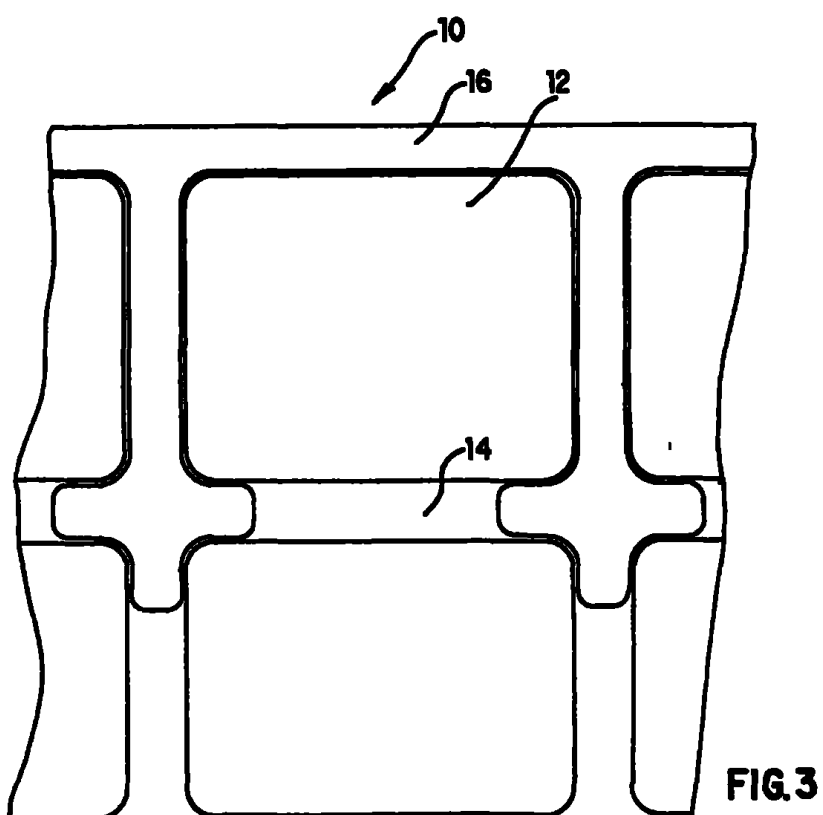


FIG. 2



METHOD FOR PREPARING A FRIED POTATO FOOD

This application is a continuation, of application Ser. No. 07/616,474, filed Nov. 21, 1990 now abandoned.

The invention relates to a food composition and method for the reduction of oil in fried products. The reduction in oil retention, both absorbed and adsorbed, is accomplished by forming a dry coating including hydrocolloid and polyvalent cations on food prior to frying.

Strong, in U.S. Pat. No. 3,397,993, discloses a process for preparing frozen french fry potato segments. Strong does not coat the potato segments as is provided by the present invention.

In W. L. Gold, U.S. Pat. No. 3,424,591 and M. A. Meyers, U.S. Pat. No. 4,900,573, potato strips are dipped in polymer solutions, drained and fat fried with the polymer layer still wet (hydrated). The coating used in the present invention is dried prior to frying.

In S. Olson, U.S. Pat. No. 4,511,583, potato strips are disclosed as being dipped in polymer solutions, drained, dried and fat fried. Olson does not disclose a potato having a salt bridged gel coating as used in the present invention. Protsiae in U.S. Pat. No. 4,917,908 discloses reduced oil french fried potato products and process for preparing by coating potato pieces with polyvinylpyrrolidone. Protsiae does not disclose a potato having a salt bridged gel coating as used in the present invention.

A gel is a form of matter intermediate between a solid and a liquid. It consists of polymers, or long-chain molecules, cross-linked to create a tangled network and immersed in a liquid medium. The properties of the gel depend strongly on the interaction of these two components.

The liquid prevents the polymer network from collapsing into a compact mass; the network prevents the liquid from flowing away. Depending on chemical composition and other factors, gels vary in consistency from viscous fluids to fairly rigid solids, but typically they are soft and resilient or jellylike.

The equivalent weight of a substance is the weight thereof that combines, neutralizes or reacts with another substance.

Matrix foods are finely cut and then shaped. They may be cooked and/or contain additives such as flavors, binders and fillers.

There is a need in the food industry for food with less fat, cholesterol and calories. The health consciousness of consumers demands low-fat food having the gustatory attributes (flavor, texture, unguency, etc.) of high-fat food. The invention disclosed herein includes food compositions having reduced fat content while retaining the flavor, texture and color of the afore mentioned fried food products.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic diagram of the general process steps used in the invention.

FIG. 2 is a schematic diagram of coating process steps used in accordance with the invention.

FIG. 3 is a schematic cross-section side view of a coated 60 tissue composition in accordance with the invention.

BRIEF SUMMARY OF THE INVENTION

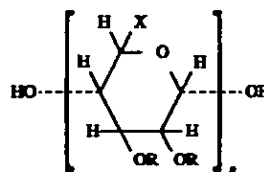
A food composition, product and method of making 65 thereof uses tissue, such as vegetable, meat, fish or poultry. The tissue is coated with at least one coating, dried and fried.

Initially the coating is a gel including water, hydrocolloid gel forming compounds and a cross-linking agent such as polyvalent cations. The coating at least partially encloses the outer surface of the tissue. The coating is dried prior to frying. The coating (initial, dried and fried) includes, at least ten percent equivalent weight of cross-linking agent based on the neutralization equivalent weight of the hydrocolloid. The dried coating is adapted to substantially impede the penetration of oil therethrough. The coated fried products have a low concentration of cooking oil.

DETAILED DESCRIPTION OF THE INVENTION

In accordance with the invention, tissue such as vegetable, meat, fish or poultry is coated and fried to form low fat food. The tissue is coated with hydrocolloid, dried and fried to produce a low oil product. Frying is carried out in cooking oil. As used here oil refers to oil and/or fat. The coating may be applied as a powder, or as a solution. The solvent of the solution may include water or a more volatile liquid to increase the rate of drying.

The coating includes cross-linking agents, such as polyvalent cations, for example metal ions, and at least one low molecular weight hydrocolloid gel forming compound, which forms a gel by complexing with the polyvalent ions. Examples of hydrocolloid gel forming compounds which may be used in coatings in accordance with the invention as low molecular weight, high molecular weight compounds or mixtures thereof include low methoxyl pectin, amidated low methoxyl pectin, polygalacturonic acid, polygalacturonate salts, pectic acid, pectate salts, alginate acid and carrageenan. Preferred low molecular weight hydrocolloid gel forming compounds useful in accordance with the invention are within the general formulas:

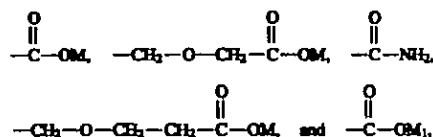


wherein

— is an alpha (α) or a beta (β) glycosidic bond.

n is an integer from 10 to 10,000.

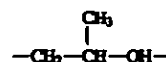
X is independently selected n times from



M is H or a cation.

M₁ is H or methyl.

R is H, CH₃, C₂H₅—, —(CH₂—CH₂—O)_n—H, or



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y is 1 or 2.

In addition to hydrocolloid gel forming compounds, the coating may include a film forming compound such as a high

molecular weight hydrocolloid either mixed with the hydrocolloid gel forming compound or as a separate outer layer applied to the coating.

The general process steps used in the invention are shown in FIG. 1. Tissue is processed by cutting 2 into desired shapes. By coating 4 the cut tissue is prepared for frying 6. In a preferred embodiment of the invention, coating includes blanching 7 with an aqueous solution containing calcium ions, applying hydrocolloid 8, and drying 9 as shown in FIG. 2.

Coated tissue 10 includes cells 12 adhered together by interstitial material 14. Coating 16 includes multivalent cations and low and high molecular weight hydrocolloids which cover cells 12 as shown in FIG. 3. During frying in cooking oil, water moves out of cells 12, but oil substantially prevented from entering cells 12 by coating 16.

The extent of penetration of the coating into the interstitial materials 14 is directly related to the blanch time, pressure and temperature. Vacuum (pressures below atmospheric) and pressures above atmospheric may be used to increase penetration of the coating. Blanching at higher temperatures and/or under a pressure gradient for longer times (but commensurate with tissue integrity) increases the extent of penetration by the coating between the cells 12.

Hydrocolloids for the coatings may be applied as a dry powder or solution of hydrocolloid. In dry powder form, the hydrocolloid hydrates with moisture on the surface of the tissue to form the gel. The solution includes water. The solution may include alcohol. During drying a continuous coating is formed, and the coated tissue is ready to be fried, par fried and frozen or frozen for later frying.

In a preferred embodiment of the invention, potato strips treated with a solution containing calcium ions to form a film are coated by soaking in a solution of low molecular weight ionic hydrocolloids. These potato strips are then coated by dipping or spraying with a solution of medium to high molecular weight synthetic or chemically modified natural hydrocolloid or other film forming material. In a preferred embodiment of the invention coatings are dried prior to deep fat frying. The invention provides for the production of french fried potatoes having up to 70% reduction in retained oil as compared to untreated potatoes.

Partial drying may be used before coating and after coating with hydrocolloid materials. Drying rates are increased by use of volatile solvents in the hydrocolloid solution. Drying of the outer tissue layer may be carried out before coating. This reduces the amount of water to be removed after a coating solution is applied. Other treatments which may be used before coating to make compositions in accordance with the present invention include: sugar dips, salt dips, pH adjustments, dehydration, heating, cooling, and agitation.

The blanch with cations is carried out using an aqueous solution having at least about 0.2 percent by weight of the cation, such as calcium. Preferably the aqueous blanch solution has from about 0.3 to 0.8 percent by weight of the cation.

Low molecular weight ionic hydrocolloid compositions provide improved processability by reducing the tendency of coated food pieces such as french fries to stick together. Use of low molecular weight ionic hydrocolloid compositions also improve processability due to increased drying rates and improve the organoleptic properties of the product such as its texture, mouth feel, bite, color and reduced shine or gloss.

Coated compositions in accordance with a preferred embodiment of the invention are formed by cutting, blanch-

ing, coating and drying. The blanch water typically includes calcium ions. Multiple coatings may be used. These coated compositions are then fried to form coated products. The frying may be short in duration (par frying) such as from about 1 to about 60 seconds, or of long duration (to fully cook the tissue), such as from about 60 seconds to about one hour. Frying of coated compositions in accordance with the invention may be carried out from about 3 seconds to about one hour at a temperature from about 100° to 200° C.

Frying is preferably carried out under substantially isothermal conditions at temperatures between 100° and 180° C. for from 5 seconds to about 30 minutes. More preferably, the frying is carried out at temperatures between 100° and 170° C. for from about 10 seconds to about 15 minutes.

The dry coatings of the composition in accordance with the invention may be from 0.0254 mm to 1.3 mm. Preferably, these coatings are from 0.0254 mm to 0.254 mm.

Low molecular weight hydrocolloids used in coatings in accordance with the invention have preferably have a molecular weight of greater than about 200; for example from about 200 to 80,000, and more preferably from about 2000 to 50,000 but most preferably from 2000 to 30,000. Within the most preferred range low molecular weight hydrocolloids used in coatings in accordance with the invention have a molecular weight of less than about 20,000 and more preferably less than 15,000.

High molecular weight hydrocolloids used in coatings in accordance with the invention preferably have a molecular weight of more than 80,000, for example from 80,000 to about 10,000,000 and more preferably from 80,000 to 1,000,000 and most preferably from 80,000 to 200,000.

Preferably, the dried coating of the coated raw tissue composition of the invention includes less than 20 percent by weight water. More preferably, the dried coating of the coated raw tissue composition of the invention includes less than 15 percent by weight water. Most preferably the dried coating of the coated raw tissue composition of the invention includes less than 10 percent by weight water.

Preferably, the outer cell tissue layer of raw cut tissue is at least partially dried prior to coating to form a dried outer tissue layer. Preferably the concentration of water in the outer layer of dried cut tissue is from 0.1 to 80 percent of the concentration of water in raw tissue. More preferably, the concentration of water in the outer layer of dried cut tissue is from 0.1 to 50 percent of the concentration of water in raw tissue. Most preferably, the concentration of water in the outer layer of dried cut tissue is from 0.1 to 30 percent of the concentration of water in raw tissue.

Preferably, the par fried coated product in accordance with an embodiment of the invention is frozen by reducing the temperature thereof to less than 0° C. to form a dried frozen food. Preferably, the frozen food, is heated to at least 100° C. for at least 5 seconds to form a cooked product.

Prior to drying the amount of polyvalent metal ions is at least 0.05 percent by weight in the gel coating on the raw tissue. The amount of polyvalent metal ions is at least 1.0 percent by weight in the coating of the par fried and fully fried tissue. Preferably, the concentration of polyvalent metal ions in the gel coating is more than 0.1 percent by weight. More preferably, the concentration of polyvalent metal ions in the gel coating is more than 0.2 percent by weight.

The polyvalent metal ions are present in the dry or the raw as well as the fried tissue coating in an amount of at least ten percent equivalent weight based on the neutralization equivalent weight of the hydrocolloid compounds. Thus, at least ten percent of the amount of polyvalent metal ions is required to neutralize the hydrocolloid compounds.

Preferably, the metal ions are present in the dry coating on the raw as well as the fried tissue in an amount of at least thirty percent equivalent weight based on the neutralization equivalent weight of the hydrocolloid compounds in the coating. Most preferably, the metal ions are present in the dry coating on the raw as well as the fried tissue in an amount of at least fifty percent equivalent weight of the neutralization equivalent weight based on the hydrocolloid compounds in the coating.

The cooked product preferably includes at least 40 percent by weight less cooking oil than said cooked control tissue. The cell tissue of the composition of the invention may include fruit, such as apples, bananas and plantain, vegetables such as potato, onion, carrots, zucchini, poultry, fish, meat or processed foods such as matrix potatoes and matrix meats.

Low molecular weight hydrocolloids may be readily prepared by either acid, alkaline or enzymatic degradation and hydrolysis of suitable precursors. In a preferred embodiment of this invention the low molecular weight hydrocolloid is derived from pectins which are a group of complex, high molecular weight polysaccharides found in plants and composed chiefly of partially methylated polygalacturonic acid units. Portions of the carboxyl group occur as methyl esters, and the remaining carboxyl groups exist in the form of the free acid or as its ammonium, potassium, or sodium salts, and in some types as the acid amide.

Pectin is produced commercially by extracting citrus peel, apple pomace, or sugar beet pulp with a hot dilute acid (pH 1.0 to 3.5, 70° to 90°). The extract is filtered, and pectin is then precipitated from the clear extract with ethanol or isopropanol, or as the copper or aluminum salt. The acid extract is sometimes spray- or roller-dried or it is concentrated.

Hydrocolloid gel forming compounds of the above general formula are used above in accordance with the invention as coatings to reduce the fat absorbed/adsorbed by cellular tissue fried in deep fat. Optional treatments before coating include: sugar dips, salt dips, pH adjustments, dehydration, heating, cooling, and agitation.

Coatings are applied for example to potato cell surfaces to form compositions in accordance with the invention by dipping, spraying, extrusion, sequential multiple or dry coating such as by dusting with powdered coating compounds. Coatings may be applied at atmospheric, high or low pressure. Coating compositions may be dried on all tissue using forced air (hot or cold), by using flash or vacuum drying to form coated compositions in accordance with the invention.

Additives which may be included in the coating compositions of the invention include: salts (mono- and polyvalent), sugars, plasticizers (propylene glycol, glycerol, sorbitol, propylene glycol monostearate, glycerol monostearate, polyethylene glycol), inert materials (celite, cellulose, silicas); solvents such as water, ethanol, isopropanol, ethyl acetate, binary mixtures, ternary mixtures.

One other advantage of this treatment method is that the oil resistant coating allows easy removal of the adsorbed oil present on the strips after removal from the hot frying oil. Conventional shaking, hot air and/or steam stripping of this adsorbed oil results in further oil reductions.

For use in the examples below low molecular weight pectin hydrocolloid is formed from pectin by providing a 10% high methoxyl pectin precursor slurry in 60:40 isopropanol (IPA) water. Sodium hydroxide is added to the slurry at a level of 3 equivalents/equivalent anhydrogalacturonide. After 5 days at 25° C. or 2 days at 40° C., sufficient

depolymerization and deesterification has occurred. The product is filtered and the filter cake resulting is washed with IPA water (60:40) to remove excess adhering alkali. The pH of the pectin cake is then adjusted with mineral acid to between 4 and 6 and is then dried. The degree of esterification of this product is less than 10%. The molecular weight, measured by the viscosity procedure of Smit and Bryant [J. Food Science, 32, 197 (1967)], ranges from 2000-20,000.

The fried products from the Control and Examples 1-32 are analyzed for oil content by extracting the fried potato strips with hexane using a Soxhlet extraction apparatus. The potato strips are diced into 3.18 mm (0.125 inch) segments, loaded into an extraction thimble and extracted with rapidly refluxing hexane for 2 hours. The oil-hexane mixture is then evaporated to a small volume using a rotary evaporator. The remaining small volume is transferred quantitatively to preweighed evaporation dishes to allow the remaining hexane to evaporate leading to a constant weight.

Control I below follows the blanching, drying and frying of U.S. Pat. No. 3,397,993 (McDonald's), column 2, lines 15-55. Control I is compared to Examples 1-28. Example 29 freezes a par fried coated potato, Example 30 fully fries frozen par fried potato and Examples 31 and 32 apply polyvalent cross-linking ions and hydrocolloid gel forming compound in a single coating step.

CONTROL I

Prefried

Fresh Idaho russet potatoes referred to by size as Idaho 100's (100 potatoes per 50 pound box) are sliced with a manual potato slicing device which produces consistent 7.95 mm by 7.95 mm (0.313 by 0.313 inch) strips. Twenty-five grams of strips are then washed in a large volume of cold water to remove surface starch and sugars. The washed strips are trimmed to 2.5 to 3.0 inches in length to form prefried strips. The strips are blanched by heating at 85° C. for 8 minutes in water. The strips are then dried in a mechanical convection oven at 150° C. for 10 minutes.

Fried

Strips are then fried in two (2) gallons of oil at 170° C. for three (3) minutes. At the completion of frying, the frying basket is removed from the oil and shaken by hand 5 seconds over the hot oil. The strips are then removed to paper towels to drain until cool. The product has 9.1 g of oil per 100 g product.

EXAMPLE 1

Prefried

The potato strips are treated as in Control I but with the use of 0.5% aqueous solution of calcium chloride as blanch water. The strips are then are soaked in a 5% aqueous solution of low molecular weight pectin for 5 minutes at 37° C. The strips are then dried in a convection oven at 150° C. for 10 minutes.

Fried

Strips are then fried in two (2) gallons of oil at 170° C. for three (3) minutes. At the completion of frying, the frying basket is removed from the oil and shaken by hand 5 seconds over the hot oil. The strips are then removed to paper towels

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to drain until cool. These product strips have an oil content of 6.1 g oil per 100 g of product.

EXAMPLE 2

Prefried

The potato strips treated as in Example 1 (Prefried Section) and then dipped for 8 seconds in a 1.0% aqueous solution of methylcellulose. The strips are allowed to drain for 2 minutes. The strips are then dried in a convection oven at 150° C. for 10 minutes.

Fried

Strips treated are fried in two (2) gallons of oil at 170° C. for three (3) minutes. At the completion of frying, the frying basket is removed from the oil and shaken by hand 5 seconds over the hot oil. The strips are then removed to paper towels to drain until cool. These product strips have an oil content of 4.3 g oil per 100 g of product.

EXAMPLE 3

Prefried

The potato strips treated as Example 1 (Prefried Section). The strips are then dipped for 8 seconds in a 1.0% aqueous solution of methylcellulose. The strips are allowed to drain for 2 minutes. The strips are then dried in a convection oven at 150° C. for 6 minutes. A second coating is applied by dipping the strips for 8 second in a 1.0% aqueous solution of methylcellulose, and then drying for an additional 10 minutes.

Fried

Strips are then fried in two (2) gallons of oil at 170° C. for three (3) minutes. At the completion of frying, the frying basket is removed from the oil and shaken by hand 5 seconds over the hot oil. The strips are then removed to paper towels to drain until cool. These product strips have an oil content of 3.8 g oil per 100 g of product.

EXAMPLE 4

Prefried

Fresh Idaho russet potatoes referred to by size as Idaho 100's (100 potatoes per 50 pound box) are sliced with a manual potato slicing device which produces consistent 0.313x0.313 inch strips. Twenty-five grams of strips are then washed in a large volume of cold water to remove surface starch and sugars. The washed strips are trimmed to 2.5 to 3.0 inches in length to form prefried strips. The strips are blanched by heating at 85° C. for 8 minutes in a 0.5% aqueous solution of calcium chloride. The prefried potato strips are soaked in a 5% aqueous solution of pectin prepared as described above for 5 minutes at 37° C. The coated strips are next dried with air at sufficient velocity and temperature to convert the aqueous pectin solution to a dried film. The strips are then dipped for 8 seconds in a 1.0% aqueous solution of methylcellulose. The strips are allowed to drain for 2 minutes. The strips are then dried in a convection oven at 150° C. for 10 minutes.

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Fried

Strips treated are fried in two (2) gallons of oil at 170° C. for three (3) minutes. At the completion of frying, the frying basket is removed from the oil and shaken by hand 5 seconds over the hot oil. The strips are then removed to paper towels to drain until cool. The product strips have an oil content of about 4 g of oil per 100 g of product.

EXAMPLE 5

The procedure of Example 4 (Prefried Section) is followed except that a 3% aqueous solution of high molecular weight (100,000), high methoxyl (50-75%, Degree of esterification) pectin is substituted for methylcellulose. Strips treated are fried in two (2) gallons of oil at 170° C. for three (3) minutes. At the completion of frying, the frying basket is removed from the oil and shaken by hand 5 seconds over the hot oil. The strips are then removed to paper towels to drain until cool. The product strips have an oil content of about 4 g of oil per 100 g of product.

EXAMPLE 6

The procedure of Example 4 (Prefried Section) is followed except that a 3% aqueous solution of low molecular weight (20,000), high methoxyl (50-75%, Degree of esterification) pectin is substituted for methylcellulose. Strips treated are fried in two (2) gallons of oil at 170° C. for three (3) minutes. At the completion of frying, the frying basket is removed from the oil and shaken by hand 5 seconds over the hot oil. The strips are then removed to paper towels to drain until cool. The product strips have an oil content of about 4 g of oil per 100 g of product.

EXAMPLE 7

The procedure of Example 4 (Prefried Section) is followed except that a 3% aqueous solution of high molecular weight (100,000), low methoxyl (15-50%, Degree of esterification) pectin is substituted for methylcellulose. Strips treated are fried in two (2) gallons of oil at 170° C. for three (3) minutes. At the completion of frying, the frying basket is removed from the oil and shaken by hand 5 seconds over the hot oil. The strips are then removed to paper towels to drain until cool. The product strips have an oil content of about 4 g of oil per 100 g of product.

EXAMPLE 8

The procedure of Example 4 (Prefried Section) is followed except that a 3% aqueous solution of low molecular weight (20,000), low methoxyl (15-50%, Degree of esterification) pectin is substituted for methylcellulose. Strips treated are fried in two (2) gallons of oil at 170° C. for three (3) minutes. At the completion of frying, the frying basket is removed from the oil and shaken by hand 5 seconds over the hot oil. The strips are then removed to paper towels to drain until cool. The product strips have an oil content of about 4 g of oil per 100 g of product.

EXAMPLE 9

The procedure of Example 4 (Prefried Section) followed except that a 3% aqueous solution of amidated pectin (Degree of amidation, 15-40%; Degree of esterification 20-40%) is substituted for methylcellulose. Strips treated are fried in two (2) gallons of oil at 170° C. for three (3) minutes. At the completion of frying, the frying basket is

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removed from the oil and shaken by hand 5 seconds over the hot oil. The strips are then removed to paper towels to drain until cool. The product strips have an oil content of about 4 g of oil per 100 g of product.

EXAMPLE 10

Prefried

The potato strips treated as in Example 1 (Prefried Section) except that drying is provided by partially dehydrating using air at sufficient velocity and temperature to result in about 10% by weight moisture loss. The partially dehydrated strips are soaked in a 5% aqueous solution of low molecular weight pectin for 5 minutes at 37° C. The coated strips are next dried with air at sufficient velocity and temperature to convert the aqueous low molecular weight solution to a dried film. The strips are then dipped for 8 seconds in a 1% aqueous solution of methylcellulose. The strips are allowed to drain for 2 minutes. The strips are then dried in a convection oven at 150° C. for sufficient time to result in about 25% moisture weight loss.

Fried

Strips treated are fried in two (2) gallons of oil at 170° C. for three (3) minutes. At the completion of frying, the frying basket is removed from the oil and shaken by hand 5 seconds over the hot oil. The strips are then removed to paper towels to drain until cool. The product strips have an oil content of about 3.5 g oil per 100 g of product.

EXAMPLE 11

The procedure of Example 10 (Prefried Section) is followed except that alginate having a molecular weight of about 100,000 is substituted for methylcellulose. Strips treated are fried in two (2) gallons of oil at 170° C. for three (3) minutes. At the completion of frying, the frying basket is removed from the oil and shaken by hand 5 seconds over the hot oil. The strips are then removed to paper towels to drain until cool. The product strips have an oil content of about 3.5 g oil per 100 g of product.

EXAMPLE 12

The procedure of Example 10 (Prefried Section) is followed except that alginate having a molecular weight of about 5,000 is substituted for low molecular weight pectin. Strips treated are fried in two (2) gallons of oil at 170° C. for three (3) minutes. At the completion of frying, the frying basket is removed from the oil and shaken by hand 5 seconds over the hot oil. The strips are then removed to paper towels to drain until cool. The product strips have an oil content of about 3.5 g oil per 100 g of product.

EXAMPLE 13

Prefried

The potato strips treated as in Control I but with the use of 0.5% aqueous solution of calcium chloride for the blanch water. The strips are then soaked in an aqueous solution mixture of low molecular weight pectin as described above (5%) and methylcellulose (1%) for 5 minutes at 37° C. The strips are then dried in a convection oven at 150° C. for 10 minutes.

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Fried

Strips treated are fried in two (2) gallons of oil at 170° C. for three (3) minutes. At the completion of frying, the frying basket is removed from the oil and shaken by hand 5 seconds over the hot oil. The strips are then removed to paper towels to drain until cool. The product strips have an oil content of about 4 g of oil per 100 g of product.

EXAMPLE 14

The procedure of Example 13 (Prefried Section) is followed except that carrageenan having a molecular weight of about 100,000 is substituted for methylcellulose. Strips treated are fried in two (2) gallons of oil at 170° C. for three (3) minutes. At the completion of frying, the frying basket is removed from the oil and shaken by hand 5 seconds over the hot oil. The strips are then removed to paper towels to drain until cool. The product strips have an oil content of about 4 g of oil per 100 g of product.

EXAMPLE 15

The procedure of Example 13 (Prefried Section) is followed except that the strips are fried for one (1) minute (rather than three (3) minutes) at 170° C. At the completion of frying, the frying basket is removed from the oil and shaken by hand 5 seconds over the hot oil. The strips are then removed to paper towels to drain until cool. The product strips have an oil content of about 2.5 g oil per 100 g of product.

EXAMPLE 16

The procedure of Example 13 (Prefried Section) is followed except that carrageenan having a molecular weight of about 5,000 is substituted for low molecular weight pectin. Strips treated are fried in two (2) gallons of oil at 170° C. for three (3) minutes. At the completion of frying, the frying basket is removed from the oil and shaken by hand 5 seconds over the hot oil. The strips are then removed to paper towels to drain until cool. The product strips have an oil content of about 4 g of oil per 100 g of product.

EXAMPLE 17

Prefried

The potato strips are treated as in Control I (prefried section) but with the use of 0.5% aqueous solution of calcium chloride for the blanch water. The strips are then soaked in an aqueous solution mixture of low molecular weight pectin as described above for 5 minutes at 37° C. The coated strips are next dried with air at sufficient velocity and temperature to convert the aqueous low molecular weight solution to a dried film. The strips are then recoated with the low molecular weight pectin by soaking in a 5% aqueous solution for 5 minutes at 37° C. The strips are then dried in a convection oven at 150° C. for sufficient time to result in a 10-35% moisture weight loss.

Fried

Strips are then fried in two (2) gallons of oil at 170° C. for three (3) minutes. At the completion of frying, the frying basket is removed from the oil and shaken by hand 5 seconds over the hot oil. The strips are then removed to paper towels to drain until cool. The product strips have an oil content of about 4 g of oil per 100 g of product.

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EXAMPLE 18

The procedure of Example 17 (Prefried Section) is followed except that arabic acid having a molecular weight of about 10,000 is substituted for low molecular weight pectin. Strips treated are fried in two (2) gallons of oil at 170° C. for three (3) minutes. At the completion of frying, the frying basket is removed from the oil and shaken by hand 5 seconds over the hot oil. The strips are then removed to paper towels to drain until cool. The product strips have an oil content of about 4 g of oil per 100 g of product.

EXAMPLE 19

The procedure of Example 17 (Prefried Section) is followed except that arabic acid having a molecular weight of about 100,000 is substituted for low molecular weight pectin. Strips treated are fried in two (2) gallons of oil at 170° C. for three (3) minutes. At the completion of frying, the frying basket is removed from the oil and shaken by hand 5 seconds over the hot oil. The strips are then removed to paper towels to drain until cool. The product strips have an oil content of about 4 g of oil per 100 g of product.

EXAMPLE 20

The procedure of Example 17 (Prefried Section) is followed except that arabic acid having a molecular weight of about 10,000 is substituted for low molecular weight pectin. Strips treated are fried in two (2) gallons of oil at 170° C. for two (2) minutes. At the completion of frying, the frying basket is removed from the oil and shaken by hand 5 seconds over the hot oil. The product strips have an oil content of about 3.5 g of oil per 100 g of product.

EXAMPLE 21

The procedure of Example 20 (Prefried Section) is followed except that carboxymethylcellulose having a molecular weight of about 10,000 is substituted for low molecular weight pectin. Strips treated are fried in two (2) gallons of oil at 170° C. for three (3) minutes. At the completion of frying, the frying basket is removed from the oil and shaken by hand 5 seconds over the hot oil. The product strips have an oil content of about 3.5 g of oil per 100 g of product.

EXAMPLE 22

The product of Example 20 (Prefried Section) is followed except that carboxymethylcellulose having a molecular weight of about 100,000 is substituted for low molecular weight pectin. Strips treated are fried in two (2) gallons of oil at 170° C. for three (3) minutes. At the completion of frying, the frying basket is removed from the oil and shaken by hand 5 seconds over the hot oil. The product strips have an oil content of about 3.5 g of oil per 100 g of product.

EXAMPLE 23

The procedure of Example 4 (Prefried Section) is followed except that the low molecular weight pectin is prepared in solvent of 3 parts of ethanol and 7 parts of water rather than water alone. Strips treated are fried in two (2) gallons of oil at 170° C. for three (3) minutes. At the completion of frying, the frying basket is removed from the oil and shaken by hand 5 seconds over the hot oil. The product strips have an oil content of about 4 g per 100 g of product.

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EXAMPLE 24

The procedure of Example 23 (Prefried Section) is followed except that the drying time is reduced to seven (7) minutes from ten (10) minutes. Strips treated are fried in two (2) gallons of oil at 170° C. for three (3) minutes. At the completion of frying, the frying basket is removed from the oil and shaken by hand 5 seconds over the hot oil. The product strips have an oil content of about 4 g per 100 g of product.

EXAMPLE 25

The procedure of Example 4 (Prefried Section) is followed except that methylcellulose of low molecular weight is prepared in a solvent composed of 3 parts ethanol and 7 parts of water. Strips treated are fried in two (2) gallons of oil at 170° C. for three (3) minutes. At the completion of frying, the frying basket is removed from the oil and shaken by hand 5 seconds over the hot oil. The product strips have an oil content of about 3.5 g of oil per 100 g of product.

EXAMPLE 26

The procedure of Example 25 (Prefried Section) is followed except that drying is done for seven (7) minutes (rather than ten (10) minutes). Strips treated are fried in two (2) gallons of oil at 170° C. for three (3) minutes. At the completion of frying, the frying basket is removed from the oil and shaken by hand 5 seconds over the hot oil. The product strips have about 4 g of oil per 100 g of product.

EXAMPLE 27

The procedure of Example 4 (Prefried Section) is followed except ethanol is substituted for water in the 5% solution. Strips treated are fried in two (2) gallons of oil at 170° C. for three (3) minutes. At the completion of frying, the frying basket is removed from the oil and shaken by hand 5 seconds over the hot oil. The product strips have about 4 g of oil per 100 g of product.

EXAMPLE 28

The procedure of Example 27 (Prefried Section) is followed except that drying is carried out for seven (7) minutes rather than ten (10) minutes. Strips treated are fried in two (2) gallons of oil at 170° C. for three (3) minutes. At the completion of frying, the frying basket is removed from the oil and shaken by hand 5 seconds over the hot oil. The product strips have about 4 g of oil per 100 g of product.

As shown in Table 1, significant reductions in oil retention are obtained using dried coatings of low and high molecular weight hydrocolloids. These hydrocolloids are representative of those in the general formula.

Example 29 and 30 below are illustrative of the use of par frying and freezing in forming the compositions of the invention.

EXAMPLE 29

The potato strips treated as in control 1 (prefried section) but with the use of 0.5% aqueous solution of calcium chloride as blanch water. The strips are then are soaked in a 5% aqueous solution of low molecular weight pectin for 5 minutes at 37° C. The strips are then dried in a convection oven at 150° C. for 10 minutes. The strips are then par fried in 2 gallons of oil at 170° C. for 45 seconds. The strips are

then frozen. These product strips have an oil content of about 2 g oil per 100 g of product.

EXAMPLE 30

The potato strips treated as in Example 29 are fried in two (2) gallons of oil at 170° C. for three (3) minutes. At the completion of frying, the frying basket is removed from the oil and shaken by hand 2.5 seconds over the hot oil. The strips are then removed to paper towels to drain until cool. These product strips have an oil content of about 5 g oil per 100 g of product.

EXAMPLE 31

The potato strips treated as in Control I (prefried) except for blanching, are soaked in a 5% aqueous solution of low molecular weight pectin and 0.3% calcium for 6 minutes at 85° C. Strips treated are fried in two (2) gallons of oil at 170° C. for three (3) minutes. At the completion of frying, the frying basket is removed from the oil and shaken by hand 5 seconds over the hot oil. The strips are then removed to paper towels to drain until cool. These product strips have an oil content of about 5 g oil per 100 g of product.

EXAMPLE 32

The potato strips are treated as in Control I (prefried section) but with the use of 0.5% aqueous solution of calcium chloride as blanch water. The strips then are soaked in a 5% aqueous solution of low molecular weight pectin for 5 minutes at 37° C. The strips are then soaked in a 5% aqueous solution of high molecular weight methylcellulose for 2 minutes at 37° C. The strips are then dried in a convection oven at 150° C. for 10 minutes. The strips are then per fried in 2 gallons of oil at 170° C. for 45 seconds. The strips are then shaken and steam stripped for 1 minute. The strips are then frozen. These product strips have an oil content of about 1.5 g oil per 100 g of product.

TABLE 1

OIL REDUCTIONS	
EXAMPLE NO.	% REDUCTION
1 (Control)	—
1	33
2	53
3	58
4	56
5	56
6	56
7	56
8	56
9	56
10	62
11	62
12	62
13	56
14	56
15	73
16	56
17	56
18	56
19	56
20	62
21	62
22	62
23	56
24	56
25	62
26	56
27	56

TABLE 1-continued

OIL REDUCTIONS	
EXAMPLE NO.	% REDUCTION
28	56
29	78
30	45
31	45
32	84

Other features, advantages and specific embodiments of this invention will become readily apparent to those exercising ordinary skill in the art after reading the foregoing disclosures. In this regard, while specific embodiments of this invention have been described in considerable detail, variations and modifications of these embodiments can be effected without departing from the spirit and scope of the invention as disclosed and claimed.

What is claimed is:

1. A method for preparing fried potato food with reduced oil or fat absorption comprising

- blanching the food,
- treating the food with an aqueous solution having at least about 0.2% by weight of calcium ions,
- at least partially coating the food with at least one calcium crosslinkable hydrocolloid gel forming compound having a molecular weight in the range of 2,000 to 30,000, and selected from the group consisting of pectin, amidated pectin, polygalacturonates, polygalacturonic acid, pectinic acid, pectinates, and mixtures thereof,
- drying the coated food, and
- frying the dried, coated food in cooking oil or fat in a temperature range of 100 to 200 degrees C. to form an at least partially coated, fried potato food product having reduced oil or fat content,

wherein steps b and c are performed separately.

2. The method of claim 1 wherein the food is blanched with said aqueous solution.

3. The method of claim 1 wherein said frying step comprises per frying the food and wherein said per fried food is then frozen.

4. The method of claim 1 wherein prior to drying, the amount of calcium ions is at least 0.05% by weight in the gel coating on the food.

5. The method of claim 1 wherein said food product has texture, color, gloss, and flavor similar to that of uncoated oil fried potatoes.

6. The method of claim 1 wherein the food is treated with multiple coatings.

7. The method of claim 1 wherein the food is also treated with additives.

8. The method of claim 1 wherein the additives are included in the gel forming compound.

9. The method of claim 1 wherein the coating is selected from pectates and the food comprises potatoes cut in the form of a matrix, french fries or chips.

10. The method of claim 9 wherein the food is french fries.

11. The method of claim 1 wherein said fried potato food has oil on its outer surface and said oil is substantially removed from said food.

* * * * *

[54] PROCESS FOR PREPARING
BLISTER-INHIBITED POTATO CHIPS[75] Inventors: Otto E. Schroeder, Arlington; Alan
Wehmann, Richardson; Michael G.
Tepor, Farmer's Branch, all of Tex.

[73] Assignee: Frito-Lay, Inc., Dallas, Tex.

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426/441; 426/637; 426/808[58] Field of Search 426/321, 637, 438, 441,
426/518, 808

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Primary Examiner—Arthur L. Corbin

Attorney, Agent, or Firm—Bernard & Brown

[57]

ABSTRACT

Potato chips that are inhibited against blister formation during frying are obtained by providing a small, but limited, amount of very dilute calcium, e.g., calcium chloride, in the potato slices prior to frying.

11 Claims, No Drawings

PROCESS FOR PREPARING BLISTER-INHIBITED POTATO CHIPS

The present invention relates to a process for inhibiting the blistering of potato slices during frying by providing a small, but limited, amount of very dilute calcium in the slices prior to frying. The invention also relates to blister-inhibited potato chips having a small amount of calcium added thereto.

In the manufacture of potato chips, undesirable blistering is often obtained during frying of the raw or pretreated potato slices. Blistering is disadvantageous since the product has a relatively non-uniform appearance and is fragile, particularly in the blistered areas, which results in undue breakage of the chips during their packaging and during storage, transporting and handling of the package and consumption of the chips. Also, additional amounts of oil may accumulate in the blistered area to give products having an oily appearance or an unduly high oil-content. There have been prior attempts to avoid such blistering with varying extents of improvement in this respect. For example, an article entitled "Effect of Precooking Heating on Blistering of Potato Chips" by Neel, Potter and Hendel, *Potato Chipper*, pages 46, 48, 52, May, 1959, is concerned with this problem and is a progress report of work conducted with respect to the control of blistering by heating the potato slices in water before they are fried. See also U.S. Pat. No. 3,883,671 to Shatila. The Neel, Potter and Hendel article refers to prior work in which the firmness of potatoes during cooking in water was improved by adding calcium, apparently due to the removal of water-soluble substances and ion exchange.

An article dealing with the structure of potato chips is "Microscopic Structure of Potato Chips", by Reeve and Neel, *American Potato Journal*, 37, pages 45 to 52, 1960. See also, for example, "Observations on the Decrease in Sloughing of Potato Tissue Slices on Soaking in Distilled Water", by Zachringer, Cunningham and Le Tournesse, *American Potato Journal*, 40, pages 333 to 343, 1963; "The Texture of Cooked Potatoes: A Review", by Warren and Woodman, *J. Sci. Fd. Agric.*, 25, pages 429 to 438, 1974; and *Factors Associated With Potato Texture. III Physical Attributes and General Conclusions*, by Sterling and Bettelheim, *Food Research*, 20, pages 130 to 138, 1955. Another article of possible interest is "Effects of Various Chemical Blanchings on the Texture of French Fries", by Jaswal, *American Potato Journal*, 47, pages 13-18, 1970, which considers the role of added calcium salts in blanching potatoes.

The present invention is directed to a novel manner of inhibiting blister formation during the frying of potato slices by providing in the slices, a small, limited amount of very dilute calcium sufficient to be effective for such inhibition. The fried chips have a relatively uniform and natural appearance, are less fragile than their blistered counterparts, and generally are less oily. Although we do not wish to be bound by theory, it may be that inhibition of blister formation is by the calcium serving to increase intercellular adhesion in the potato slices as they are fried. Several literature articles, for instance, "Texture of Cooked Potato II. Relationships Between Intercellular Adhesion and Chemical Composition of the Tuber", and "III. Intercellular Adhesion of Chemically-Treated Tuber Sections", by Lincham and Hughes, *J. Sci. Fd. Agric.* 20, pages 113 to 123, 1969; "Firming of Potatoes: Biochemical Effects of Preheat-

ing", by Bartolome and Hoff, *J. Agric. Fd. Chem.*, 20, pages 266 to 270, 1972; "The Chemistry of Protopectin: A Critical Review of Historical Data and Recent Developments", by Joslyn, "Advances in Food Research", II., pages 1, 83 to 107, 1962; and references cited thereby, indicate that a factor in intercellular adhesion in potatoes and other vegetables and fruits is the calcium ion which forms a linkage between pectin molecules. Our studies of blistered potato chips led to the observation of certain physical changes in potato slices that occur during frying and our conclusion that blistering may be the result of a lack of sufficient adhesive forces between the large areas of the cells of the potato slices. We then postulated that the addition of calcium in water-soluble form may serve to strengthen this bond and, thereby, reduce cell separation and blistering of the surfaces of the potato chips during frying.

In accordance with the present invention, calcium may be added to potato slices by contact with a very dilute, aqueous solution of a calcium compound after, for instance, washing or other pretreatment of the slices has occurred. Alternatively, the calcium compound may be added as part of the treating agent in one or more of such pretreating operations. Preferably, the calcium is added more or less immediately before frying. In any event, the added calcium is present in a quite small amount in the slices when they are fried. The calcium can be added as a water-soluble salt, preferably calcium chloride. Other calcium compounds that have sufficient water-solubility and are compatible with food use may be employed and include, for example, calcium sulfamate, calcium acetate and calcium citrate.

The amount of calcium added to the potato slices is sufficient to be effective in inhibiting blistering to a substantial extent during frying. The amount added is generally a minor or small percentage of the weight of the fried potato chips, for example, at least about 100 ppm, e.g., about 200 to 1000 ppm or somewhat more. If too much calcium is added the chips may become brittle or have objectionable taste. The aqueous solution by which the calcium can be added to the chips is quite dilute, for instance, up to about 0.05 molar, often at least about 0.003 or 0.005 molar. The better results have been obtained when the concentration was at least about 0.01 molar. The preferred concentrations are about 0.02 to 0.04 molar, although solutions of somewhat higher concentration may be used. When the solution was 0.05 molar, the brittleness and oiliness of the chips seemed to increase, so the use of solutions of higher concentration is usually avoided.

Contact between the potato slices and the calcium solution may be at various suitable temperatures. Studies of the effects of different temperatures did not show a significant result, so temperatures of about 10° to 40° C., advantageously about 15° to 30° C., are generally employed.

The calcium solution may be contacted with the potato slices in any desired way, for instance, by spraying, dipping or the like, and in the case of dipping, the immersion time may be quite short, for instance, about 1 second or more. The length of the immersion time was varied without any particular effect being observed, except, perhaps, when the calcium concentration in the solution was quite low. If the time is too extended, adverse effects may be encountered and, generally, one would keep the immersion time low as a matter of convenience. The addition of calcium to the potato slices is very easily and conveniently accomplished in present

potato chip manufacturing procedures and, thus, the latter do not have to be materially altered to adopt the present invention which is quite flexible and can be readily incorporated into different types of processing systems.

The potato slices used in the present invention have a thickness suitable for making potato chips. For example, essentially uncooked, natural potatoes can be cut into slices by means of any of the various devices that are available for such use. Typically, whole, raw potatoes may be scrubbed prior to slicing and they may be either peeled or left unpeeled. Generally, individual potato slices have a thickness of up to about 0.1 inch, e.g., from about 0.03 to 0.1 inch, usually about 0.04 to 0.07 inch, and these slices are suitable for making into potato chips according to the process of the invention. The potato slices may be washed in water to improve their handling characteristics during further processing according to the invention. Specifically, washing of the potatoes removes surface starch and diminishes the tendency of the slices to stick together or to stick to machinery. It may be desired to blanch the potatoes prior to slicing. Blanching at this and/or another time, e.g., after slicing, can be accomplished by chemical or steam treatment.

The slices containing calcium are fried by any suitable means for frying potato chips such as deep fat frying. Typically, the slices are more or less immersed in a cooking oil, e.g., cottonseed oil, for a period of from about 60 to 160 seconds, preferably about 90 to 130 seconds, at a temperature of from about 150° C. to 200° C., preferably about 160° to 190° C. to fry the slices. The slices are then removed from the fryer, cooled and, if desired, salt or other flavoring agents may be added. The resulting slices are ready for packaging.

The present invention was further illustrated by peeling raw potatoes using an abrasive-type peeler. The peeled potatoes were cut by a centrifugal slicer into slices about 0.055 inch thick. The slices were washed in tap water to remove excess starch. In the standard procedure, the slices were submerged momentarily in a 0.025 M aqueous solution of analytical grade calcium chloride at ambient temperature and then fried in additive-free cottonseed oil at about 355° F. This procedure was, in essence, followed in the various examples below, except when noted otherwise. The resulting fried chips exhibited significantly less blistering than did chips similarly prepared, but without being subjected to dipping in the calcium chloride solution. The chips prepared in accordance with the invention had better uniformity and less greasy surfaces, and were less fragile.

Representative results are reported in Table I.

TABLE I

Conditions				Results ¹		
Molarity	Immersion Time, Sec.	Temp. °C.	pH	0%	25-50%	>50%
CONTROL						
0.005	1	21	—	44	41	15
0.005	40	21	—	58	37	5
0.015	20	21	—	80	16	4
0.015	120	21	—	85	15	0
0.025	1	21	—	95	5	0
0.025	40	21	—	98	2	0
0.035	20	21	—	100	0	0
0.035	60	21	—	100	0	0
CONTROL						
0.005	—	3	—	53	33	14
0.005	—	80	—	38	46	16
0.015	—	10	—	54	34	12
				49	46	5

TABLE I-continued

Conditions				Results ¹		
Molarity	Immersion Time, Sec.	Temp. °C.	pH	0%	25-50%	>50%
0.015	—	20	—	61	31	8
0.025	—	20	—	92	8	0
0.025	—	40	—	89	11	0
0.035	—	20	—	98	2	0
0.035	—	80	—	95	5	0
CONTROL						
0.010	—	24	6.75	67	25	8
0.020	—	24	6.7	82	14	4
0.030	—	24	6.8	94	6	0
0.045	—	24	6.8	98	2	0
CONTROL						
0.005	—	—	42	61	34	5
0.015	—	—	71	26	3	3
0.035	—	—	6	71	23	6
0.005	—	—	7	100	0	0
0.005	—	—	8	62	36	2
0.025	—	—	8	93	7	0
0.035	—	—	10	100	0	0

¹0% = Wt. % of chips having no blisters.

²25-50% = Wt. % of chips whose surface is 25% to 50% blistered.

³>50% = Wt. % of chips whose surface is greater than 50% blistered.

⁴The pH was adjusted as needed by addition of HCl or NaOH.

In another study, potato chips were fried essentially under the standard conditions, with or without prior immersion in a 0.025 or 0.035 molar calcium chloride solution, and an operation with a given oil bath continued over a period of 2, 4 or 6 hours to determine the calcium content of the chips and the oil at the start and finish of the period, and the effect on the blistering of the chips. The results are reported in Table II.

TABLE II

Time		Molarity of CaCl ₂ Soln.	Ca++ Content		Blistering		
Run	of Run		Oil Wt. %	Chips, ppm	0%	25-50%	50%
1	30 minutes ²	None	0.08	284	—	—	1
1	90 minutes	None	0.21	243	60	32	8
2	30 minutes	0.025	0.19	595	—	—	—
2	90 minutes	0.025	1.89	630	87	11	2
3	5 minutes	None	—	358.3	—	—	—
4	5 minutes	0.035	—	641.7	—	—	—
3	2 hours	None	—	426.6	—	—	—
4	2 hours	0.035	—	909.4	—	—	—
3	4 hours	None	—	352.7	—	—	—
4	4 hours	0.035	—	1033	—	—	—
3	6 hours	None	—	416.4	—	52.3% ¹	—
4	6 hours	0.035	—	959.1	—	12.6%	—

¹A sample of chips was taken every 2 hours from each run and then all samples of a given run were mixed and evaluated for blistering. The value reported is weight % of the chips whose surface area was over 25% blistered.

²In Runs 1 and 2 the samples were taken at the 30th and 90th minutes of the run.

It is claimed:

1. A process for making potato chips which comprises contacting potato slices, having a thickness of up to about 0.1 inch, with an aqueous solution having calcium dissolved therein to add to said slices a small amount of calcium sufficient to inhibit the formation of blisters on the slices upon frying, said aqueous solution having calcium dissolved therein in a concentration of up to about 0.05 molar, said contacting being at a temperature of about 10° to 40° C., and frying the resulting calcium-containing slices to provide said chips.

2. A process of claim 1 wherein said added amount of calcium is about 200 to 1000 parts per million based on the weight of the fried chips.

3. A process of claim 1 or 2 wherein the calcium is added to said slices by contact with an aqueous calcium chloride solution.

4. A process of claim 3 wherein said aqueous solution is about 0.02 to 0.04 molar in calcium.

5. A process for making potato chips which comprises slicing potatoes to provide slices having a thickness of about 0.03 to 0.07 inch, contacting said slices with an aqueous solution having calcium dissolved therein in a concentration of about 0.02 to 0.04 molar to add a small amount of calcium to said slices sufficient to inhibit blistering of the slices upon frying, said contacting being at a temperature of about 10° to 40° C., and frying the calcium-containing slices to provide said chips.

6. A process of claim 5 wherein said added amount of calcium is about 200 to 1000 parts per million based on the weight of the fried chips.

7. A process of claim 5 or 6 wherein the calcium is added to said slices by contact with an aqueous calcium chloride solution.

8. A process for making potato chips which comprises contacting potato slices having a thickness of up to about 0.1 inch, with an aqueous solution having calcium dissolved therein to add to said slices a small amount of calcium sufficient to inhibit the formation of blisters on the slices upon frying, said aqueous solution having calcium dissolved therein in a concentration of up to about 0.05 molar, said contacting being at about 10° to 40° C., and frying the resulting calcium-containing slices to provide said chips, said amount of calcium added being about 100 to 1000 parts per million based on the weight of the fried chips.

9. The process of claim 8 wherein the calcium is added to said slices by contact with an aqueous calcium chloride solution.

10. The process of claim 8 or 9 wherein said contact is by momentarily immersing said potato slices in said solution.

11. The process of claim 10 in which the time of said immersion is about 1 to 120 seconds.

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[54] METHOD FOR IMPROVING THE FLAVOUR CHARACTERISTICS OF POTATO PRODUCTS

[75] Inventors: Johannes F. M. De Rooij, Hilversum; John D. Simmons, Naarden, both of Netherlands; Willem Van Osnabrugge, Hunt Valley, Md.

[73] Assignee: Unilever Patent Holdings B.V., Vlaardingen, Netherlands

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Related U.S. Application Data

[63] Continuation of Ser. No. 361,378, Jun. 12, 1989, abandoned, which is a continuation-in-part of Ser. No. 129,775, Dec. 7, 1987, abandoned.

[30] Foreign Application Priority Data

Dec. 5, 1988 [EP] European Pat. Off. 88202772

[51] Int. CL³ A23L 1/217

[52] U.S. CL. 426/533; 426/438; 426/637

[58] Field of Search 426/533, 637, 438

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Primary Examiner—Arthur L. Corbin

Attorney, Agent, or Firm—Cushman, Darby & Cushman

[57] ABSTRACT

A method for improving the flavour characteristics of potato products which are to be fried, which comprises treating the potato product before frying with a flavour mixture consisting essentially of the product obtained by heating a mixture of a reducing sugar, amino acid and a sulphur donor compound to a temperature between 70 and 180° C.

9 Claims, No Drawings

METHOD FOR IMPROVING THE FLAVOUR CHARACTERISTICS OF POTATO PRODUCTS

This is a continuation of application Ser. No. 364,378, filed on June 12, 1989, which was abandoned upon the filing hereof, and which is a continuation-in-part of Ser. No. 129,775, filed Dec. 7, 1987, now abandoned.

INTRODUCTION

The invention relates to a process for improving the flavour characteristics of potato products in which the potato material is treated with a flavour mixture prepared by heating a mixture containing a reducing sugar and amino acid(s). More in particular, the invention relates to improving the flavour of potato products like French fried potatoes, chips and crisps so that these potato products have a beef or meat-like flavour.

BACKGROUND OF THE INVENTION

A process for improving the flavour of potato is known from U.S. Pat. No. 3,814,818 by preparing an edible oil composition, which oil composition is prepared by adding 0.001-4.0% by weight methionine to an oil and heating the oil to 120°-220° C. It might be preferred according to that U.S. patent to further add a reducing sugar in an amount of 1-25% by weight of said methionine. At all event, the end product is an oil mixture in which the potato can be fried. According to the invention, the flavour is prepared without using the oil by reacting the starting materials for the flavour product at an elevated temperature after which the potato product is treated with the preferably aqueous solution of the processed flavour mixture so that a surface layer containing an effective amount of the processed flavour mixture is present on the potato product.

From U.S. Pat. No. 2,589,591, a method for controlling color and flavour of potato chips is known in which the potato is immersed in an aqueous solution of a reducing sugar and a protein hydrolyzate derived from raw potatoes. The protein hydrolyzate gives a number of amino acids and an example of such a mixture is given in Column 3, lines 4-16 of the above-mentioned U.S. patent indicating 13 different amino acids.

SUMMARY OF THE INVENTION

The flavour characteristics of a potato product can further be improved by using specific amino acids and by further controlling the reaction between the reducing sugar and the amino acid.

DESCRIPTION OF PREFERRED EMBODIMENTS

It has now been found that better and more economic results can be obtained if potatoes or potato parts are subjected to treatment with a dilute solution of a specific processed flavour before frying takes place. The processed flavour generally is a heated aqueous mixture of a reducing sugar and amino acid(s) characterized in that the flavour mixture is prepared by heating the mixture of a reducing sugar and amino acid(s) to a temperature between 70° and 180° C. in which mixture a sulphur donor compound is present.

The sulphur donor is present in the mixture for preparing the flavour or in the flavour mixture in the form of an amino acid chosen from the group consisting of cysteine, cystine and methionine. The sulphur donor can also be present by the addition of Alliums such as

onion products, garlic, egg products, thiamine and/or by the addition of H₂S or salts thereof. The flavour mixture also can comprise a peptide and/or protein. In the process flavour mixture, a reducing sugar like ribose, arabinose, glucose, galactose, mannose, rhamnose, sucrose, xylose or ascorbic acid should be present. The amino acid mixture should preferably contain glutamic acid, but amino acid(s) such as lysine and alanine can have a positive effect depending on the organoleptic profile required. The amino acid(s) employed to prepare the process flavour can conveniently be obtained in the form of protein hydrolysates or a fraction thereof and from casein, gluten or yeast hydrolysates.

The weight ratio of the various ingredients is preferably as follows. Reducing sugar: amino acids (containing 2 to 100% of cysteine, cystine or methionine and preferably 10 to 90% of glutamic acid), peptide and/or protein between 1:1 and 1:10. A suitable processed flavour can be obtained by heating an aqueous mixture containing the ingredients specified above to a temperature between 70° and 140° C. for a period varying between a few seconds and several hours and at least during part of the heating some water should be present.

Also of benefit can be the use of phosphate and/or organic acids such as citric, acetic, tartaric and lactic acids or their salts.

It is obvious that the process flavour can be made into a commercial product, in the form of liquid, paste or powder, by mixing with a proper carrier which might be by choice salts (e.g. NaCl), proteins (e.g. gelatin, casein) or polysaccharides such as starches, gums, dextrins, etc.

For plain chips (usually called crisps in the United Kingdom) and French fried potatoes, having at most a slight savoury note, the potato parts are dipped in an aqueous solution containing from 0.005 to 0.2, preferably from 0.01 to 0.1% by weight of the processed flavour, but more strongly flavoured potato products up to 2%, preferably up to 1% of the processed flavour mixture is used.

One convenient method for processing potato parts according to the present invention is to treat the potato (parts) during thermal blanching in an aqueous solution of the processed flavour in the concentrations indicated above. Another convenient method is to incorporate the processed flavour in a sugar dip step, which is often included in the processing of potato material, more in particular, in the preparation of French fried potatoes. Also it has been found advantageous, in particular when preparing extruded potato products, to incorporate the processed flavour in the mash. Furthermore, it has been found useful for certain products to add the processed flavour by a spraying operation before deep-frying or oven-frying takes place.

During the frying operation, the processed flavour mixture, which contains flavour precursor compounds like addition products of reducing sugars, amino acids, and sulphhydryl compounds, which have attached to the potato material react upon heating further to form flavour compounds like maltois, furanones, thiazolidins, thiophene derivatives, etc. The mildly heating step to which the processed flavour has been subjected serves to form coupling products, which act as flavour precursors but the mild condition prevent substantial conversion into actual flavour compounds at this stage of the processing.

The potato material processed according to the present invention can be whole potatoes (but then prefera-

bly small ones), but generally only potato parts like cubes, sticks, slices or powder is processed leading to products like fried potatoes, fried cubes, French fried potatoes, potato chips and potato crisps.

The processing of the potato parts usually comprises a number of steps such as:
immerse potato parts in (nearly) boiling water, containing some salt (thermal blanching), bringing back to (near) boiling temperature, leave boiling for a short period, sieve out the potato parts, dip potato parts in cold water, dry the potato parts, fry potato parts for a few minutes, freeze the sieved-out potato parts, fry frozen pre-fried potato parts for longer period.

Optional steps include sulphite treatment of the potatoes, to standardize the colour and a sugar dip, which serves to standardize the flavour and these may replace one or more of other steps mentioned above.

Frying of the potato parts takes place in an oven or in heated oil or fat at a temperature between 140° and 180° C. The oil or fat can be of animal or vegetable origin and beef tallow and soybean oil are preferred. The terms oil and fat are regarded as synonyms in this application. Oils and fats are not only understood to be triglycerides, but also non-toxic material with physical properties comparable to those of triglycerides and which may be indigestible as e.g. jojoba oil or fatty acid esters of mono- and disaccharides or mixtures of several materials.

The invention is illustrated by the following examples.

EXAMPLE 1

A processed flavour composition was prepared by heating an aqueous slurry of 45% solids content to 100° C. for 2 hours. The solid material consisted of: xylose (2 parts by weight), yeast autolysate (5 parts by weight), cysteine (2 parts by weight), malt powder (0.5 parts by weight), monosodium glutamate (2 parts by weight) and a suitable amount of a phosphate buffer as to obtain an end pH of 6.0.

The procedure to obtain French fried potatoes included the preparation of a solution of tap water containing 1% of salt, which was heated to the boil, the processed flavour described above was added to a level of 0.2%, the potato parts (French fries of 1/4 cm cross section) were added, water and potato material were brought back to the boil and left boiling for 1 minute, the potatoes were sieved out and dipped in cold (20° C.) water and were dried on a paper towel followed by 3 minutes deep-frying in maize oil of 140° C., the potatoes were sieved out and frozen and after some rest deep-fried again in maize oil of 160° C. The French fried potatoes so obtained were tested by a panel of six experienced tasters, all of whom indicated a rich beef-like flavour note which was not noted in the unflavoured chips also fried in vegetable oil.

EXAMPLE 2

Flavoured crisps were prepared by adding thinly sliced potatoes (cross section of approximately 0.2 cm) to a blanching bath consisting of tap water containing 1.5% of the spray-dried flavour described in Example 1. The blanching of the potatoes was carried out for 5 minutes at a temperature of 80°-85° C. Next, the potatoes were washed thoroughly with cold water to remove excess starch and then dried with paper towels. Subsequently, the sliced potatoes were fried in peanut

oil for 3 minutes and 45 seconds at 170° C. A panel of six experienced tasters compared these crisps against crisps made by the same procedure, but without the flavour being added to the blanching water. There was a unanimous opinion of the tasters that the crisps prepared with the flavour in the blanching water had a full-flavoured meaty character, which was not present in the unflavoured crisps.

EXAMPLE 3

The process of Example 1 is repeated by using gelatin (100 bloom) in place of malt powder and citrate in place of phosphate.

EXAMPLE 4

The process of Example 1 is repeated but by heating now a processed flavour paste of 80-95% solids at a temperature of 80° C. for 3 hours.

EXAMPLE 5

The process of Example 1 is repeated but by using now thiamine and onion in place of cysteine. Lysine is used instead of yeast autolysate, glucose in place of xylose and heating the mixture at a solids level of 38% at 120° C. for 30 minutes.

What is claimed is:

1. A method for improving the flavour characteristics of a potato product so as to provide the potato product with a meat-like flavor on frying, which comprises treating the potato product before frying with a previously prepared aqueous flavour mixture consisting essentially of the product obtained by heating an aqueous slurry of a mixture of a reducing sugar, and amino acid selected from the group consisting of lysine, glutamic acid and alanine and a sulphur donor compound selected from the group consisting of cysteine, cystine, allium, H₂S or salts of H₂S to a temperature between 70° and 180° C. whereby the reducing sugar, amino acid and sulphur donor are preliminarily reacted together to form said flavour mixture and thereafter frying the thus-treated potato product in oil.

2. A method according to claim 1 wherein the reducing sugar is chosen from the group consisting of ribose, arabinose, glucose, galactose, mannose, rhamnose, sucrose, xylose and ascorbic acid.

3. A method according to claim 2 wherein the weight ratio of reducing sugar: amino acid is 1:1-1:10.

4. A method according to claim 3 in which the potato product comprises chips or French fries.

5. A method according to claim 1 in which the potato product is subjected to a treatment with an aqueous solution of the processed flavour mixture.

6. A method according to claim 5 in which the potato product is subjected to a blanching step or to a sugar dip step and the treatment with said flavour mixture is carried out during the blanching step or during the sugar dip step.

7. A method according to claim 5 in which the potato product is fried and the treatment comprises spraying the potato product with said flavour mixture prior to the frying step.

8. A method according to claim 1 in which, after contacting with the flavour mixture, the potato product is heated to a temperature up to 120° C. in heated oil or fat.

9. A method according to claim 1 in which the potato product is treated so that it comprises a surface layer containing an amount of the flavour mixture effective to improve the flavour of said potato product.

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United States Patent [19]

Beck

[11] Patent Number: 5,389,389

[45] Date of Patent: Feb. 14, 1995

- [54] COMPOSITIONS AND METHODS FOR INHIBITING BROWNING OF PROCESSED PRODUCE
- [75] Inventor: Roderick G. Beck, King City, Calif.
- [73] Assignee: Basic American Foods, San Francisco, Calif.
- [21] Appl. No.: 733,951
- [22] Filed: Mar. 14, 1991

Related U.S. Application Data

- [63] Continuation of Ser. No. 193,723, May 13, 1988, abandoned.
- [51] Int. Cl.⁶ A23B 7/02
- [52] U.S. Cl. 426/269; 426/637
- [58] Field of Search 426/269, 637, 259, 310, 426/615

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Primary Examiner—Carolyn Paden

Attorney, Agent, or Firm—Henderson & Sturm

[57]

ABSTRACT

Methods for treating produce to minimize browning upon subsequent processing, handling and/or storage wherein the processing involves exposing produce, such as fruits, vegetables and tubers, and particularly potatoes, to discoloration inhibitors including cysteine, calcium chloride, sodium acid pyrophosphate and/or a sulfiting agent in synergistic amounts so as to result with a treated product containing less than about 30 ppm sulfite, and preferably less than about 10 ppm or essentially no sulfite, which may be stored for extended periods of time without exhibiting browning which would otherwise occur unless the produce were treated to have a sulfite content substantially greater than 30 ppm. Dehydrated, storage stable produce containing less than about 30 ppm sulfite, and preferably less than about 10 ppm or essentially no sulfite.

56 Claims, 1 Drawing Sheet

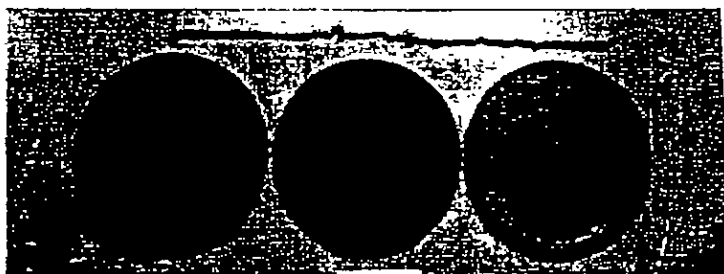


Fig- 1



Fig- 2



Fig- 3

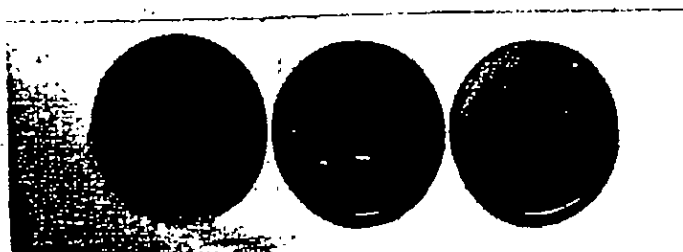


Fig- 4

COMPOSITIONS AND METHODS FOR
INHIBITING BROWNING OF PROCESSED
PRODUCE

This is a continuation of application Ser. No. 5
07/193,723, filed May 13, 1988, now abandoned.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention is directed to compositions and methods for treating produce to inhibit and eliminate browning reactions. In particular, the present invention is directed to compositions and methods for treating produce with a synergistic composition including cysteine to inhibit enzymatic and non-enzymatic browning reactions during the processing of produce.

2. Discussion of Background and Material Information

As is well known in the food industry, most produce, i.e., fruits and vegetables, such as potatoes, and particularly dehydrated potatoes, have a pronounced tendency to discolor to a grayish-brown upon prolonged periods of storage. This discoloration phenomenon is commonly referred to as a "browning reaction". Although the discolored produce is neither toxic, nor lacking in nutritive value, the discoloration nevertheless gives the produce an objectionable appearance and flavor which makes the produce unacceptable to a majority of prospective consumers. The various causes for browning reactions have been the object of considerable study over the years, and it is generally agreed that there are two primary reactions responsible for such discoloration of produce, i.e., enzymatic action, and certain non-enzymatic processes.

With respect to the former, i.e., enzymatic browning, it is believed that the deleterious changes manifested in stored produce are attributed to various chemical reactions catalyzed by the enzymes naturally present in the plant material. Typically, most fruits and vegetables are subjected to various processing techniques wherein they are subjected to disorganization of their natural structure, as by peeling, cutting, comminuting, pitting, pulping, freezing and dehydrating. As a result, the produce tends to suffer deteriorative changes including the development of dark and unnatural colors, because the disorganization of the natural structure disrupts the natural segregation of substrates and enzymes, and thus permits the enzymes to contact various substrates with the previously-mentioned results.

In general, for these reactions to occur in fruits and vegetables, there must be sufficient enzyme, substrate and oxygen. Certain fruits, such as kiwi fruit and sun-beam peach, do not tend to brown because they have no substrate. Cantaloupe and oranges do not brown because of low enzyme activity at the pH of these fruits. The browning in avocados is believed to be controlled by their phenolase activities.

In potato processing, it has been observed that substantial enzymatic browning occurs if the surfaces of the potatoes are exposed to oxygen prior to cooking. Enzymatic breakdown also occurs in diseased or bruised potato tubers. In potatoes, it is believed that polyphenol oxidase, i.e. phenolase, enzymes catalyze the breakdown of the substrates chlorogenic acid and tyrosine, to quinones and other compounds which can react with amino acids in a similar manner as sugars to produce Maillard reaction products.

Over the years, various techniques have been used for preventing or inhibiting enzyme activity. For example, it is conventional in the food industry to subject raw fruit or vegetables to blanching with steam or hot water so as to inactivate the enzymes. Although this treatment is generally effective, blanching has the disadvantage that the produce is at least partially cooked so that it no longer tastes like fresh food. In addition, the blanching may also cause leaching of valuable nutrient materials from the produce.

The use of sulfiting agents, such as sulphur dioxide and sodium bisulfite, to inactivate enzymes is also well known in the industry. Indeed, sulfite is believed to be the most effective chemical additive used to prevent enzymatic discoloration in most produce, and particularly potatoes and some fruits. In addition to sulfiting agents, other chemical preservation agents have been used for this purpose. Representative examples of such chemical preservation agents include discoloration inhibitors such as ascorbic acid, citric acid, sorbic acid, and malic acid, in addition to other additives such as salt, EDTA, dextrose, calcium chloride, sodium acid pyrophosphate and sodium citrate. However, none of these discoloration inhibitors have been found to be as effective as sulfites.

Use of these reagents, however, has the disadvantage in that the flavor of the food is typically affected to some degree and at times in an adverse, objectionable manner.

Notwithstanding effective treatment to inhibit enzymatic browning in produce, many types of produce, such as potatoes, which contain sugars and amino compounds, still suffer from browning, particularly in the dehydrated state. This is a paramount concern for the produce dehydrator, and particularly the potato processor, because certain types of potatoes tend to brown more than others.

In this regard, one of the most studied chemical changes in food products is the reaction of amino acids and sugars, first observed and described by Louis Camille Maillard, for whom the Maillard reaction is named. The Maillard reaction begins with sugars and amino compounds forming a reactive intermediate, i.e. 1-amino-1-deoxy-2-ketose, which breaks down by several alternative reaction pathways to form brown polymers, i.e., melanoidins. This type of non-enzymatic browning is one of the major causes of off-flavor in produce, and particularly in dehydrated potatoes.

Prior attempts to combat the discoloration of potatoes, and other produce which tend to experience browning reactions, includes pre-treatments with a sulfiting agent, such as sulphur dioxide, sodium bisulfite and/or sodium sulfite. It has also been proposed to protect produce against such browning reactions by treatments with other chemical agents and preservatives including sodium dithionite, sulfur, bromine, potassium bromate, furfuryl mercaptan, 2-mercaptosuccinic acid, 3-mercaptopropionic acid, 4-mercaptobutyric acid, 1-propanthiol, ethane thiol, 2-mercaptoethanol, and iso-amyl nitrite. It is believed that these compounds exhibit an effect in preventing the formation of 1-amino-1-deoxy-2-ketose in the Maillard reaction. Sulfur dioxide is believed to accomplish this by attacking the double bonds of fructosamino acid.

Related to this, the prior art is replete with numerous patents which have attempted to overcome the problems of browning of produce. For example, U.S. Pat. No. 2,890,120, MAKOWER, treats edible plant mate-

rial with an aqueous solution containing alcohol, alkyl benzene sodium sulphinate, and sufficient hydrochloric acid to give the solution a pH of 1.5. U.S. Pat. No. 2,893,878, SIMON, is directed to a process for treating potatoes with calcium chloride and a water-soluble sulfiting agent dissolved in water in such concentration as to deposit certain effective amounts of calcium chloride and sulphite on the potato to protect the potato against non-enzymatic discoloration during storage. U.S. Pat. No. 2,475,838, JOHNSON, treats fruit with a sulfiting agent, ascorbic acid, and an inorganic chloride to prevent browning. U.S. Pat. No. 2,857,282, JANSEN, treats edible plant material with N-acyl derivatives of mercapto amines which exhibit the ability to inhibit enzyme activity and thus prevent deleterious changes, such as browning, normally caused by enzyme action. U.S. Pat. No. 2,860,055, JANSEN, treats edible plant material with an enzyme inhibiting agent containing aliphatic compounds containing 1-mercapto radicals in a particular spatial relation to another mercapto radical. U.S. Pat. No. 2,874,059, POWERS, treats produce with an aqueous solution containing salt and citric acid in order to inhibit browning. U.S. Pat. No. 3,987,208, RAHMAN, treats lettuce for use in salads with an aqueous solution of sodium meta bisulfites, citric acid, ascorbic acid and potassium sorbate so as to extend the storage life of the cut lettuce. U.S. Pat. No. 2,620,277, SCALERA, is directed to the treatment of peeled white potatoes with a solution of sodium sulphite and citric acid to prevent discoloration. U.S. Pat. No. 3,049,427, FELLERS, contacts vegetables with a solution of a soluble compound of ethylene diamine tetraacetic acid during a blanching operation so as to minimize the discoloration of processed potatoes. U.S. Pat. No. 4,097,612, POWRIE et al., treats potatoes with an aqueous solution of citrate in combination with sulphur dioxide, followed by immersion in an aqueous solution of an alkali metal pyrophosphate, and optionally a reducing saccharide, followed by immersion in an aqueous solution of an alkaline earth metal salt, and optionally an alkali metal chloride, so as to enhance the retention of potato whiteness, in addition to improving other organoleptic characteristics of the tuber.

As previously mentioned, the dehydrated potato industry has a particularly acute concern for preventing browning of the potatoes, which would otherwise render commercial dehydrated potato products unsuitable for extended storage prior to consumption. In this regard, the assignee of the instant application has used sulfur dioxide as a preservative in potato granules to stop non-enzymatic browning since its entry into the potato processing industry. Representative samples of patents which disclose the use of sulfiting agents in dehydrated potato processes include U.S. Pat. No. 3,027,264, IRMITER et al.; U.S. Pat. No. 3,220,857, HOLLES, Jr. et al.; U.S. Pat. No. 3,343,970, PADER; and U.S. Pat. No. 3,968,260, SHATILA et al., the latter embodying prior attempts of the assignee of this application to produce low-sulfite dehydrated potato granules.

Cysteine has also been used as a food additive in various processed food products. In most applications, cysteine and other amino acids are incorporated for their flavoring effect. In this regard, U.S. Pat. No. 4,218,487, JABGGI, is directed to synthetic flavorants made by heating a mixture of an amino sugar, cysteine or cysteine hydrochloride, a polyalcohol and/or water. U.S. Pat. No. 3,681,088, KATZ et al., is directed to a

flavoring composition containing thiazole-based flavoring agents in combination with cysteine hydrochloride. U.S. Pat. No. 3,214,276, SAKAKIBARA et al., disclose the use of sodium cysteine-S-sulfinate as a food seasoning composition.

In addition to the common usage of cysteine as a flavoring ingredient, cysteine is also recognized for its effect on the color and preservation of the various animal flesh food products. In this regard, U.S. Pat. No. 3,851,078, KHAYAT et al., disclose that cysteine may enhance the color of tuna-type fish. U.S. Pat. No. 3,552,978, INKLAAR, discloses that cysteine, among other monobasic amino acids, are effective in improving color retention in meat-containing food. U.S. Pat. No. 3,637,772, KLAUI et al., disclose that anti-oxidants are often employed in combination with synergists, including cysteine. The BRAVERMAN, Introduction to the Biochemistry of Foods (Elsevier Publishing Co., New York 1963 pp. 246-247) publication discloses that cysteine, as well as certain other amino acids, have been suggested as an alternative to sulphur dioxide and sulfites for preventing oxidation.

L-cysteine HCl has been used in food products over the last 25 years. For example, L-cysteine HCl is approved in bakery products in amounts up to 0.009% of the flour used as a dough conditioner and as a nutrient supplement. L-cysteine HCl has also been used to prevent discoloration in pears, onions, fruit concentrates, as well as other foods. Related to this, L-cysteine, L-cysteine and their derivatives have been used in bakery products to enhance dough softening and homogenization, and to accelerate dough development, in addition to being used as baking additives as functional ingredients for maintaining dough elasticity, as well as to adjust the gluten quality of flour. In addition, L-cysteine has been used as curing and tenderizing agents in meat products, as well as a stabilizer in milk and dietetic foods. L-cysteine also exhibits antioxidative stabilization in mayonnaise, in addition to antioxidative stabilization and activation in dry yeast. L-cysteine has also been used as a colorant for ham, sausage, bacon and similar meats. In addition, L-cysteine is known to function as an antibrowning agent, and a stabilizer for vitamin C in fruit juice concentrates. Related to this, U.S. Pat. No. 3,352,691, discloses the use of 0.05 to 0.3% cysteine to prevent pink discoloration of comminuted white onions.

Notwithstanding the various alternatives which have been suggested and tried by the prior art over the years to find effective anti-browning agents and preservatives, sulfite continues to be generally recognized as the most effective chemical agent useful for minimizing discoloration of fruits and vegetables, and notably potatoes, processed by commercial production methods.

Nevertheless, there has been a growing concern for and an aversion to the use of sulfites in food products. Recently, the use of sulfites has been banned by the Food and Drug Administration for treating fresh fruits and vegetables. In view of the related concerns expressed for the use of sulfites in processing produce, there is a real need for a preservative composition which minimizes or completely eliminates the need for sulfites in the preservation of produce without compromising the effects on inhibiting or preventing the occurrence of browning reactions.

The present invention, therefore, is directed to compositions and methods for treating produce, and particularly processed potatoes, such as dehydrated potatoes,

i.e., potato granules, with a composition including cysteine so as to prevent the adverse effects of enzymatic and non-enzymatic browning. In accordance with the present invention, the processing of produce involves subjecting produce to a composition containing synergistically effective amounts of cysteine, in combination with calcium chloride and sodium acid pyrophosphates, and/or relatively minor amounts of a sulfiting agent, in a manner which results with a finished product containing less than about 50 ppm, and preferably less than 30 ppm sulfite, but most preferably wherein the finished product contains less than 10 ppm or essentially no sulfite.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a method for treating produce to minimize enzymatic browning upon subsequent processing, handling and/or storage which involves treating produce with discoloration inhibitors selected from the group consisting of a source of available cysteine, and a mixture consisting of a source of available cysteine and a sulfiting agent. Preferably the cysteine is present in a solution on a total weight basis within the following ranges: up to about 0.5% cysteine; preferably about 0.1-0.5% cysteine and more preferably about 0.2-0.5% cysteine. In the former instance the produce should be pretreated with a source of sulfite prior to treating with cysteine. Where a mixture of a source of available cysteine and a sulfiting agent is used, the sulfiting agent may be present in amounts up to about 0.5% and preferably 0.05-0.5% sulfiting agent.

Another object of the present invention is to provide methods for treating produce to minimize non-enzymatic browning upon subsequent processing, handling and/or storage, which involves exposing produce to discoloration inhibitors including synergistically effective amounts of cysteine, calcium chloride, and sodium acid pyrophosphate (SAPP) wherein the discoloration inhibitors are present on a total weight basis in the finished product within the following ranges: 0.025-0.2% cysteine, 0.025-0.2% calcium chloride, and 0.025-0.2% SAPP. Other calcium salts and sequestrants and chelating agents, such as EDTA or citric acid may also be used in combination with cysteine sequestrants and chelating agents which may be used include polycarboxylic acids, such as oxalic and succinic acids, hydroxycarboxylic acids, such as malic and tartaric acids as well as citric acid, polyphosphoric acids, such as ATP, hexametaphosphate, and pyrophosphate, and amino acids, such as glycine and leucine. These discoloration inhibitors can be added dry or in aqueous solution during blanching, cooking and/or during preparation after cooking and prior to dehydration or other processing such as freezing or canning.

Another further object of the present invention is to provide methods for treating produce to minimize browning upon subsequent processing, handling and storage, which involves preparing the produce for processing, for example, by cleaning, trimming, and/or peeling the produce, followed by subdividing the produce into pieces such as slices, dices, strips or shreds, treating the produce with a discoloration inhibitor, preferably in an aqueous solution, comprising effective amounts of cysteine to prevent browning upon subsequent processing including a treatment at elevated temperatures. As used herein, the term "elevated temperatures" is meant to include temperatures substantially

above ambient temperature under normal conditions, for example of about 70°-575° F. Thus, elevated temperatures include temperatures experienced during pre-cooking and cooking operations, in addition to temperatures used during dehydration procedures, for example used in processing potato pieces into dehydrated mashed potatoes, such as granules and flakes, as well as temperatures to which produce are exposed during storage and handling, for example in a closed container or shipper. Therefore, elevated temperatures for purposes of the present invention are temperatures above about 70° F. and preferably above about 80° F. to about 550°-575° F., and preferably within the range of about 120° F. to about 550° F.

In accordance with the present invention, therefore, produce such as potatoes which may have been subjected to minor amounts of a sulfiting agent during a preliminary stage of preparation and handling, are treated with discoloration inhibitors selected from the group consisting of cysteine, a combination of cysteine and sulfite, a combination of cysteine and calcium chloride, a combination of cysteine, calcium chloride, and sodium acid pyrophosphate (SAPP), and a combination of cysteine, calcium chloride, SAPP and sodium sulfite, in amounts effective to minimize browning of the product during subsequent processing, handling and/or storage. Preferably, sulfite-treated potatoes are treated with discoloration inhibitors in accordance with the present invention to produce dry potato products that contain less than 30 ppm of a sulfiting agent and preferably less than 10 ppm or essentially no sulfiting agent, and contain 0.025-0.2% cysteine, 0.025-0.2% calcium chloride and 0.025-0.2% SAPP. The effectiveness of treating potato granules with discoloration inhibitors in accordance with the present invention is characterized by an Agtron reflectance meter reading of above 40 and preferably within the range of 40-50 which indicates the whiteness manifested by the final product. Therefore, produce treated with discoloration inhibitors in accordance with the present invention contains essentially no or only incidental amounts of sulfite and yet does not tend to experience browning which would normally occur unless greater amounts of sulfite were used during processing.

BRIEF DESCRIPTION OF PHOTOGRAPHS

FIGS. 1-4 are photographs illustrating the comparison of the test samples of Examples IV-VII, respectively.

DETAILED DESCRIPTION

In general, the present invention is directed to methods for treating produce pieces to minimize browning upon subsequent processing, handling and storage, as described above, wherein the produce pieces are immersed in an aqueous solution containing a sulfiting agent followed by treatment with an aqueous solution containing cysteine, preferably prior to processing which involves dehydration. Alternatively, the produce pieces are treated with an aqueous solution containing discoloration inhibitors including synergistic amounts of cysteine and sulfite effective to prevent browning of the produce.

In accordance with the present invention, the method for treating produce to minimize browning upon subsequent processing, handling, and storage involves exposing produce to a discoloration inhibitor selected from the group consisting of a source of available cysteine,

and a mixture consisting of a source of available cysteine and a sulfiting agent, preferably wherein the step of exposing the produce to the discoloration inhibitor is accomplished in a step selected from the group of steps consisting of immersing the produce in a solution containing the discoloration inhibitor and spraying the produce with the solution. For purposes of the present invention the solution includes discoloration inhibitors preferably selected from the group of consisting of an amount up to about 0.5% cysteine and more preferably 0.2-0.5% cysteine; and an amount up to about 0.5% cysteine and more preferably 0.2-0.5% cysteine and 0.50-0.1% sulfiting agent although the solution may contain discoloration inhibitors in an amount up to about 0.1% sulfiting agent, and an amount up to about 0.5% sodium acid pyrophosphate. More preferred are solutions containing discoloration inhibitors selected from the group consisting of 0.2-0.5% cysteine; 0.2-0.5% cysteine and 0.05-0.1% sulfiting agent; 0.025-0.5% cysteine, 0.025-0.5% sodium acid pyrophosphate 0.05-0.1% sulfiting agent. Subsequently the produce treated with the previously mentioned discoloration inhibitors may be processed by a procedure selected from the group consisting of dehydrating, cooking, canning, aseptic, refrigerating and freezing.

In the embodiments where potatoes are sprayed aqueous solutions containing cysteine, and cysteine with sodium acid pyrophosphate, and cysteine with sodium acid pyrophosphate, and a sulfiting agent, the aqueous solution preferably include an amount of cysteine to result in a cysteine content of less than 0.1% in the dry product, contains cysteine and sodium acid pyrophosphate to result in a cysteine content of less than 0.1% and a sodium acid pyrophosphate content less than 0.2% in the dry product; or contains cysteine, sodium acid pyrophosphate, and a sulfiting agent to result in a cysteine content of less than 0.1%, a sodium acid pyrophosphate content of less than 0.2% and a sulfite content (as sulfur dioxide) of less than 0.003% in the dry product.

Preferred products produced in accordance with the present invention include potato products containing cysteine provided by extraneously added cysteine and less than about 30 ppm sulfur dioxide exhibiting a color measured by an Agtron reflectance meter rating of above 40, preferably wherein the Agtron reflectance rating is above 50, and the sulfur dioxide is present in amounts less than 10 ppm, and most preferably wherein the products contain essentially no sulfur dioxide. Preferred potato products are selected from the group consisting of dehydrated potato pieces and dehydrated mashed potato products wherein the dehydrated mashed potato products are selected from the group consisting of dehydrated potato granules, dehydrated potato flakes and agglomerates of dehydrated potato granules, and preferably dehydrated potato granules.

A suitable composition for treating produce in accordance with the present invention contains an amount up to about 0.5% cysteine and an amount up to about 0.1% sulfiting agent, and preferably 0.2-0.5% cysteine and 0.05-0.1% sulfiting agent.

Another suitable composition for treating produce in accordance with the present invention includes an amount that the dehydrated produce contains up to about 0.2% cysteine, and amount up to about 0.2% calcium chloride, and an amount up to about 0.2% sodium acid pyrophosphate, i.e., 0.025-0.2% cysteine,

0.025-0.2% calcium chloride, and 0.025-0.2% sodium acid pyrophosphate; and more preferably 0.1-0.15% cysteine, 0.1% calcium chloride, and 0.1% sodium acid pyrophosphate.

A yet another suitable composition for treating produce in accordance with the present invention includes an amount up to about 0.2% cysteine, an amount up to about 0.003% sulfiting agent, an amount up to about 0.2% calcium chloride, and an amount up to about 0.2% sodium acid pyrophosphate, and preferably 0.025-0.2% cysteine, 0.001-0.003% sulfiting agent, 0.025-0.2% calcium chloride, and 0.025-0.2% sodium acid pyrophosphate, and most preferably 0.05-0.15% cysteine, less than 0.001% sulfiting agent, 0.1% calcium chloride, and 0.1% sodium acid pyrophosphate. The process of the present invention has been developed in an attempt to substantially reduce and essentially eliminate the use levels of sulfiting agents in the processing of produce, and particularly potatoes, which are subjected to elevated temperatures, and particularly temperatures to which the produce are exposed during dehydration.

In this regard, it has been discovered that exposing produce to discoloration inhibitors including cysteine preferably together with sulfite, and more preferably also calcium chloride and sodium acid pyrophosphate, in synergistically effective amounts, essentially eliminates the need for treating the produce with sulfiting agents at conventional levels and yet minimizes browning and discoloration of the produce upon subsequent processing, handling and storage. In accordance with the present invention, therefore, produce may be processed by a method which involves treating the produce in a manner so as to result with a finished product which contains less than about 50 ppm, and preferably less than about 30 ppm, and most preferably less than 10 ppm or essentially no sulfiting agent.

As used herein, "cysteine" is provided by any suitable source of cysteine. The common or usual name of cysteine used in accordance with the present invention is L-cysteine hydrochloride monohydrate, the chemical name for which is L-2-amino-3-mercaptopropanoic acid hydrochloride monohydrate having the following structural formula:



The L-cysteine hydrochloride monohydrate is manufactured by first extracting L-cysteine from keratine which is then dissolved in HCl, subjected to electrical reduction, concentrated, crystallized, and centrifuged to result in L-cysteine hydrochloride monohydrate.

Although the discovery of the present invention may be used in conjunction with processing various fruits, such as apples, apricots, avocados, bananas, peaches and pears; vegetables such as beans, bell peppers, carrots, celery, corn, garlic, horseradish, leek, lentils, lima beans, mushrooms, onions, parsnips, peas, pimientos, tomatoes and turnips; and tubers, such as Russet, Kennebec, Hillite, Norbota and Norgold varieties of solanum tuberosum, into dehydrated piece products, such as slices, discs, strips, shreds and the like, the present invention finds special utility in the processing of potatoes such as the previously mentioned varieties of solanum tuberosum into dehydrated mashed potato products, such as granules, flakes and agglomerates. Accordingly, the detailed description of the present invention

will be given with respect to the processing of potatoes, and particularly with respect to the production of dehydrated potatoes, such as potato pieces, potato granules, and potato flakes.

As previously indicated, the present invention is based on the discovery that the need for sulfite can be substantially reduced or essentially eliminated in the processing of produce without sacrificing the organoleptic characteristics of the finished product by exposing the produce to an effective amount of cysteine to minimize browning upon subsequent processing, handling and storage, particularly as part of a process which involves subjecting the produce to elevated temperatures.

For purposes of the present invention, the elevated temperatures to which the produce are subsequently subjected fall within the range of about 70° F.-575° F. and typically within the range of 120° F.-550° F. for example as a result of subjecting the produce to a process step selected from the group of steps consisting of blanching, cooking, dehydrating, a sequence of blanching and dehydrating steps, and a sequence of cooking and dehydrating steps, preferably wherein the blanching step involves subjecting the produce to a medium selected from the group consisting of water, steam and a mixture of water and steam at temperatures within range of about 120° F.-212° F.

More specifically, one embodiment of the present invention is directed to the production of dehydrated potato pieces, such as dices, slices, shreds, strips and the like. The following description is a representative example of a process for producing such dehydrated potato piece products modified to provide for a treatment with the discoloration inhibitors in accordance with the present invention.

Potatoes are first cut, after having been washed, trimmed and optionally peeled, into large pieces which may have a size of about $\frac{1}{2}$ inch $\times$ $\frac{1}{2}$ inch $\times$ $\frac{1}{2}$ inch. The potatoes may also be cut into pieces having other shapes and sizes, such as $\frac{1}{16}$ $\times$ $\frac{1}{2}$ inch slices and dices, in addition to strips, for example french-fry cuts, and shreds, suitable for hashbrowns. The potato pieces are then immersed in a holding tank of water which contains certain additives found to be effective in minimizing the discoloration of the potatoes in this stage of the process. Suitable additives include cysteine, and sulfiting agents, such as sodium sulfite and sodium bisulfite. Acids, such as citric and phosphoric acids, may also be included in the holding tank, preferably in lieu of sulfiting agents.

The potato pieces may then be subjected to treatments which include heating with steam or water having a temperature within the range of 120°-212° F., and preferably between about 165°-200° F., for between 2 to 75 minutes, optionally followed by cooling in tap water to a temperature below about 80° F. Most preferably, the pieces are blanched in steam or water at 200° F.-212° F. for between 2 to 12 minutes. After blanching, or blanching and cooking the potatoes under such conditions, the potatoes are treated with a discoloration inhibitor containing between 0.015% and 0.15% cysteine. Particularly preferred results are achieved, however, by using a solution containing synergistically effective amounts of cysteine and sodium acid pyrophosphate (SAPP) within the ranges of up to about 0.2% and preferably about 0.025%-0.2% cysteine and SAPP. The potatoes may be sprayed with or dipped in the solution. Alternatively, the discoloration inhibitors in accordance with the present invention may be included

in the blanch water so as to eliminate a separate treatment for this purpose. The heat-treated potato pieces are then fed into a conventional dryer, such as cabinet, tunnel, and conveyor dryers, and most preferably continuous belt or conveyor dryers. Typically air temperatures within the range of about 130°-285° F. are used. Drying times and temperatures are normally controlled so as to avoid scorching the finish-dried product. Thus temperatures are generally within the range of 140° F.-225° F. so as not to raise the product temperature to an unacceptably high level. Also the temperatures and times may be varied in the various stages of drying as is conventional in the art. In any event, the potato pieces are permitted to remain in the dryer for a sufficient period of time to reduce their moisture content to a storage stable extent of less than about 10%, i.e. about 7%.

Upon extended storage, it is observed that the dehydrated potato pieces treated with discoloration inhibitors in accordance with the present invention do not discolor to an appreciable extent, but maintained a substantially light color despite containing essentially no sulfite, i.e., a sulfite content of less than 10 ppm. Thus, the present invention produces acceptable products wherein the solution in the holding tank contains essentially no sulfiting agent, i.e., an amount of sulfite in the holding tank which results in a finish dried product containing less than about 10 ppm sulfite.

The discovery of the present invention is particularly suitable in the production of dehydrated mashed potato products, such as potato granules. A typical process for the production of potato granules involves first preparing raw potatoes for cooking in a usual manner, for example by washing, trimming and cutting, and optionally peeling. The prepared pieces of potato are then transferred to a holding tank containing water and conventional additives, such as a sodium bisulfite solution, to prevent discoloration. As disclosed in U.S. Pat. No. 3,986,260, the holding tank normally contains an aqueous solution of sodium bisulfite present in an amount of at least 0.5% by weight of sulfite. In contrast to conventional potato granule production methods, including the process which is referred to as a low-additive process by U.S. Pat. No. 3,986,260, the present invention uses less than about 0.5%, and preferably on the order of 0.1%, sulfiting agent in the solution of the holding tank. In accordance with the present invention, a source of cysteine may be substituted for all or part of the sulfiting agent in the holding tank. This results in a SO₂ content in the finished product which is less than about 30 ppm sulfite, and preferably less than 10 ppm sulfite, i.e., essentially no sulfite, in contrast to the sulfite content of conventional mashed potato products which typically contain at least 200-500 ppm SO₂. Thus, processing potatoes in a manner in accordance with the present invention results in a finished product containing sulfites at levels far below the amount normally found in dehydrated instant mashed potato products.

The next stage of processing involves cooking the prepared potatoes. As will be appreciated by one skilled in the art, any conventional method of cooking potatoes to completion can be employed at this stage of the process. Although it is preferred to cook with atmospheric steam, hot water, and in certain instances even hot oil, may be used with satisfactory results.

Prior to subjecting the potatoes to cooking, however, it is preferred to subject the prepared potatoes to pre-cooking and cooling steps. It is generally recognized in

the art that this particular sequence of steps results in a tougher cell structure that resists rupture during processing and results with a more mealy finished mash. Notwithstanding the preference of this sequence of steps, the process of the present invention can be carried out by eliminating the pre-cook and cool steps prior to cooking if this is so desired.

The next stage of processing involves separating the cooked potato cells by partially mashing the cooked potatoes, as by ricing. This is the step wherein additives, such as starch complexing emulsifiers, e.g., glycerol monostearate, are incorporated into the mash. It is this stage of processing wherein it is preferred to expose the potatoes to discoloration inhibitors including a source of available cysteine in accordance with the present invention. Accordingly, the potatoes at this stage of processing are exposed to discoloration inhibitors in accordance with the present invention, including a source of available cysteine, in addition to other additives such as calcium chloride, other calcium salts, EDTA, sodium acid pyrophosphate, and/or optionally a sulfiting agent. The discoloration inhibitors in accordance with the present invention are preferably incorporated into the potatoes at this stage of processing in amounts which result in the following synergistic amounts by total weight of the potato product: an amount up to about 0.2% and preferably in the range of about 0.025-0.2% cysteine, an amount up to about 0.2% and preferably in the range of about 0.025-0.2% calcium chloride, and an amount up to about 0.2% and preferably in the range of about 0.025-0.2% sodium acid pyrophosphate. If a sulfiting agent is introduced to the potatoes at this stage of processing, it is added in an amount to result in preferably less than 100 ppm sulfite, and more preferably less than 30 ppm sulfite, and most preferably less than about 10 ppm or essentially no sulfite in the finish-dried product. In those instances where sulfite has been included in the holding tank, as previously described, the discoloration inhibitors used at this stage of processing preferably result with about 0.05-0.15% cysteine, about 0.1% calcium chloride and about 0.1% sodium acid pyrophosphate in the finish-dried product. More preferably, the discoloration inhibitors used at this stage of processing result with about 0.1% cysteine, about 0.1% calcium chloride, and about 0.1% sodium acid pyrophosphate in the finish-dried product.

As the discoloration inhibitors, as well the starch complexing emulsifiers and other additives, are introduced during this stage of processing, the potatoes are continuously mixed to accomplish complete cell separation. In so doing, the emulsifier, as well the discoloration inhibitors in accordance with the present invention, are uniformly distributed throughout the mash, and the separated cells are uniformly exposed to and coated with the additives.

The next stages of processing follow conventional add-back dehydrated potato granule processing which is well known to those skilled in the art of potato dehydration.

For example, the process of the present invention may be applied to any potato dehydration process, such as processes for producing dehydrated granules disclosed by TALBURT & SMITH, Potato Processing, Chapter 12 entitled "Dehydrated Mashed Potato Granules", AVI Publishing Co., Westport, Conn., Third Edition, 1975, pp. 443-459.

Granules made in accordance with the present invention may then be used to form a variety of granular-based dehydrated potato products suitable for forming mashed potatoes or reconstituted into a formed potato product.

The present invention is also useful in minimizing browning of potatoes processed into dehydrated mashed potato flakes. In this regard, the discoloration inhibitors in accordance with the present invention are added to the potatoes at the stage in an otherwise conventional flake production process wherein additives, such as sulfites, antioxidants and the like, are normally introduced.

Suitable processes for purposes of the present invention are disclosed by TALBURT & SMITH, Potato Processing, Chapter 13 entitled "Potato Flakes", AVI Publishing Co., Westport, Conn., Third Edition, 1975, pp. 463-512.

In such a conventional flake production process, potatoes are first peeled and trimmed in a conventional manner prior to being sliced, for example, into one-half inch slabs. The potato pieces are then preferably pre-cooked in water followed by first cooling prior to cooking and then mashing, ricing for example by using conventional equipment for this purpose.

Additives, such as agents to improve the flavor, stability and texture of the product, are normally incorporated into the riced material before drying. In conventional potato flake processes, a source of sulfite, such as sodium sulfite or sodium bisulfite, is normally used to prevent oxidative changes during processing and to improve shelf life. Typically, sulfite is used in amounts so as to result in 400-500 ppm SO_2 in the riced potatoes. Inasmuch as subsequent processing by dehydration removes some of the previously added SO_2 , conventional dehydrated potato flakes normally contain about 150-200 ppm SO_2 . Other additives which are normally included into the riced potatoes at this stage of processing include antioxidants and monoglycerides. In accordance with the present invention, therefore, cysteine, preferably in combination with SAPP in synergistically effective amounts within the ranges of up to about 0.2% and preferably 0.025%-0.2% cysteine and SAPP are mixed with the riced potatoes at this stage of processing in lieu of a source of sulfite. The resultant dehydrated potato product, therefore, is essentially sulfite-free.

Following addition and mixing of the potatoes with the discoloration inhibitors in accordance with the present invention, the potato mash is then fed to a conventional drum dryer on which the mash is spread into a thin film and dehydrated to a storage stable moisture content. The dried sheet of mashed potato is then peeled away from the drum and subdivided into pieces which are further broken into random-sized flakes which are then packaged for subsequent storage, handling and shipping.

The following examples are intended to be representative of the processes and products of this invention. It will be apparent, however, that the details of the examples are not to be regarded as limitations, as they may be varied to a certain extent, as will be understood by one skilled in the art.

For purposes of the present invention, the sulfite content of the products has been analyzed using a procedure known as the "Monier-Williams Procedure" mentioned in 21 C.F.R. 101 (Appendix A—Monier-Williams Procedure for Sulfites in Food). In brief, the AOAC official method for sulfites has been modified by

the Monier-Williams Procedure to facilitate the determination of sulfites at or near 10 ppm in food. Thus, the methodology used in analyzing the sulfite content of products produced in accordance with the present invention is the technique which has been approved by the FDA as being effective in detecting as little as 10 ppm of sulfite in a finished food product.

EXAMPLE I

Potatoes prepared for processing in a conventional manner by washing, peeling and trimming were immersed in a holding tank. For the control run, no sulfite or other discoloration inhibitor was included in the holding tank water, and no cysteine was used in the process. In the other runs conducted for purposes of comparison, the amount of sulfite in the holding tank is indicated in the table below. The potatoes were then subjected to a cooking procedure which involved pre-cooking the potatoes to an internal piece temperature within the range of 150° F.-180° F., followed by cooling to a piece temperature within the range of 60° F.-70° F. Subsequently, the potatoes were cooked after which discoloration inhibitors in accordance with the present invention in the amounts listed in the table below were introduced. The cooked potatoes are mashed, mixed and conditioned prior to being introduced to an air-lift dryer, the air temperature in which is controlled such that hot air having a temperature within the range of 525° F.-560° F., when introduced into the air-lift dryer, exits at a temperature within the range of 150° F.-220° F., so as to effect a product temperature on the order of about 130° F. The granular potatoes collected from the air-lift dryer are then finish-dried in a conventional fluid bed dryer using hot air at a temperature within the range of about 150° F.-120° F. which effects a product temperature of about 108° F.-110° F. until the moisture content is reduced to about 7-8%. Granular products in accordance with the previously described procedure were then measured for color using an Agtron reflectance meter, and judged by a taste panel for flavor. In this regard, Agtron reflectance meter readings above 40 are considered acceptable, and above 50 good to excellent. Flavor ratings of 3.0 are acceptable, and 4.0 are considered excellent. The results of these tests are tabulated below:

TABLE

Run	Sulfite in Holding Tank	Discoloration Inhibitor				Color	Flavor
		Cysteine	CaCl ₂	SAPP			
Control	0	0	0.1	0.1		20	2.5
#1	.1%	0	0.1	0.1		35	3.0
#2	0	0.14	0.14	0.14		52	4.0
#3	.1%	0.14	0.14	0.14		62	4.0

(1) Percentage - Dry Wt. Basis

Results

Run	SO ₂ (ppm) Concentration	Color	Flavor
Control	0	20	3.0
#1	<3	35	3.0
#2	0	52	4.0
#3	<3	62	4.0

As can be seen, the control sample was unacceptable in color and marginal in flavor. The color and flavor of the dehydrated potato granules were improved somewhat when 0.1% sulfite was included in the holding tank. Treating the potatoes with a discoloration inhibitor solution containing cysteine showed markedly superior

rior results, with the best results achieved when the potatoes are first exposed to a sulfiting agent in the holding tank, followed by treatment with a discoloration inhibitor solution containing cysteine, calcium chloride, and SAPP.

EXAMPLE II

The following test was conducted to visually compare the effect of discoloration inhibitor solutions containing a combination of a minor amount of sulfite and L-cysteine in minimizing the discoloration of raw produce versus the use of a solution containing only sulfite and a solution containing only L-cysteine.

Russet Burbank potatoes were washed, trimmed, and peeled before being cut into French-Fry strips, and divided into even batches which were treated with aqueous solutions having the following compositions:

Batch A	0.5% NaHSO ₂
Batch B	0.5% L-Cysteine
Batch C	0.45% L-Cysteine 0.05% NaHSO ₂

Each batch was immersed in a respective discoloration inhibitor solution for ten (10) minutes prior to draining to remove excess solution followed by storage for seven (7) days at 40° F.

Following storage, each batch was evaluated by visual color change. Each of the strips treated with the 0.5% NaHSO₂ solution had developed a moderately brown color over their entire surface. The strips treated with the 0.5% L-cysteine solution were even darker in color. In contrast, the strips of potatoes treated with the aqueous solution containing 0.45% L-cysteine and 0.05% NaHSO₂ exhibited a uniformly light color which was not noticeably darker than the color of the fresh-cut slice.

The results of this test indicate that a discoloration inhibitor solution containing minor amounts of sulfiting agent together with a source of cysteine are synergistically effective in a manner superior to either sulfite or cysteine used alone in minimizing the discoloration of cut surfaces of raw potatoes upon storage.

EXAMPLE III

The following tests were conducted to show the effectiveness of a solution containing a combination of relatively minor amounts of sulfite and cysteine in reducing enzyme activity responsible for browning of produce compared to solutions containing significantly greater amounts of only a sulfiting agent or cysteine.

Russet Burbank potatoes were left unpeeled and sliced raw prior to dividing into batches for treatment in the following solutions:

Solution	Enzyme Activity
Control (no discoloration inhibitor)	No inactivation of enzyme activity
NaHSO ₂ alone	
a) 0.1%	slight but uniform
b) 0.3%	substantially none except in area adjacent the peel
c) 0.5%	essentially none
L-cysteine alone	
a) 0.1%	about half the activity manifested in the control
b) 0.3%	slight but uniform
c) 0.5%	substantially none except in area

-continued	
<u>NaHSO₃ + L-cysteine</u>	adjacent the peel
a) 0.1% + 0.1%	substantially none except in the area adjacent the peel
b) 0.1% + 0.3%	essentially none
c) 0.1% + 0.5%	essentially none

The slices of each batch were dipped in their respective discoloration inhibitor solutions and held for five (5) minutes. After draining to remove excess solution the slices were dipped in catechol for the purpose of assessing the enzymatic activity of the treated slices versus the control after 1 hour by visual color change.

The foregoing tests showed the slices treated with the discoloration inhibitor solution containing a combination of 0.1% NaHSO₃ and 0.1% L-cysteine experienced only slight discoloration near the peel to an extent similar to slices treated with solutions containing 0.3% NaHSO₃ and 0.5% L-cysteine alone. Thus, the combination of a sulfiting agent and a source of cysteine is synergistically effective in retarding enzyme activity and consequently enzymatic browning of raw produce.

The following examples are presented as an indication of the effectiveness of the L-cysteine compositions of the present invention for other fruits and vegetables by way of comparison with potatoes. In each of the following examples, a puree of the fruit, vegetable and potato was treated with amounts of L-cysteine HCl and compared to show the effectiveness of L-cysteine in minimizing discoloration.

EXAMPLE IV

Idaho Russet potatoes were peeled and ground into a puree in a Waring blender. Three samples were prepared. Sample 1 was the control which was not exposed to a discoloration inhibitor; 0.02% L-cysteine HCl was added to Sample 2; and 0.04% L-cysteine HCl was added to Sample 3. FIG. 1 is a photograph of the sample after exposure to air for two hours. As can clearly be seen, only Sample 3, with 0.04% L-cysteine added, remained substantially white.

EXAMPLE V

Red delicious apples were peeled, cored and pureed in a Waring blender. Three samples were prepared. No additive was added to Sample 1; 0.015% L-cysteine HCl was added to Sample 2; and 0.03% L-cysteine HCl was added to Sample 3. FIG. 2 is a photograph showing the difference in color developed immediately after the puree was made. As clearly indicated in the photograph, Sample 3 has the most desirable color with enzymatic darkening substantially completely inhibited.

EXAMPLE VI

Apples were sliced about $\frac{1}{4}$ inch thick and dried using 120° F. air for 3 hours. Sample 1 was untreated. Prior to drying, Sample 2 was dipped in a 0.5% solution of L-cysteine for 15 minutes. The photograph of FIG. 3 clearly shows that the treated Sample 2 is much whiter than the untreated sample.

EXAMPLE VII

Avocados were peeled and the pits removed. The remaining pulp was ground to a puree in a Waring blender. Three samples were prepared. Sample 1 was treated with no additive, 0.035% L-cysteine HCl was added to Sample 2, and 0.07% L-cysteine HCl was

added to Sample 3. FIG. 4 is a photograph of the three samples after exposure to air for 3 hours. As can be seen, only Sample 3, with 0.07% L-cysteine HCl added was satisfactory in color and flavor.

The previous examples show that L-cysteine HCl is effective in preventing color changes in purees and dried products made from fruits and vegetables, in addition to potatoes.

Table 1, appearing below, shows the level of L-cysteine most effective in apples, avocados and potatoes as tested. The level of addition that was effective in all three products was calculated to be 0.2% on a dry weight basis.

TABLE 1

LEVELS OF L-CYSTEINE HCl REQUIRED TO STOP DISCOLORATION OF PRODUCTS SHOWN IN EXAMPLES IV-VII

Product	Solids	L-cysteine HCl	L-cysteine HCl Dry Basis
Apples	15%	.03%	0.2%
Dry Apple Slices		Slices held 15 minutes in 0.5% solution	—
Avocado	35%	.07%	0.2%
Raw Potato	20%	.04%	0.2%

EXAMPLE VIII

The following comparison is given to show that added cysteine is readily oxidized to its dimer form, i.e. cystine, is evidenced by the comparison of the relative cystine content of fresh potatoes (Table A), conventional dehydrated potato granules processed without extraneously added cysteine otherwise produced in accordance with the previously described process (Table B), and dehydrated potato granules processed with added cysteine in accordance with the present invention as disclosed herein (Table C):

Summary of Results

TABLE A

Cystine in Raw Potatoes		
Raw Potatoes Source		Cystine mg/100 g As Is
Clements	A	2.40
	B	2.49
	C	2.71
	D	2.76
		Avg. 2.59
Boondox	A	2.92
	B	2.31
	C	4.30
	D	4.00
		Avg. 3.38
Holmes	A	3.71
	B	4.97
	C	3.56
	D	2.54
		Avg. 3.69

Avg 12 Samples - 3.22

TABLE B

Cystine in Processed Potato Granules		
Run		Cystine mg/100 g As Is
RP 012457 (no added cysteine)	A	13.80
	B	10.83
	C	18.82
	D	—
		Avg. 14.48
RP 092686 (no added cysteine)	A	12.79
	B	11.13

TABLE B-continued

Cystine in Processed Potato Granules		
Run		Cystine mg/100 g As Is
	C	9.66
	D	26.73
		Avg. 14.97
BP 062287	A	20.03
(no added cysteine)	B	13.06
	C	12.61
	D	17.96
		Avg. 15.92

Avg 12 Samples - 15 mg

TABLE C

Cystine in Processed Potato Granules		
Run		Cystine mg/100 g As Is
ML 051487	A	21.64
(.10% cysteine added)	B	19.70
	C	22.67
	D	24.67
		Avg. 23.67
ML 3110586	A	42.44
(.14% cysteine added)	B	18.57
984-1	C	14.14
	D	20.73
		Avg. 23.97
ML 3110686	A	24.87
(.10% cysteine added)	B	17.85
984-1	C	22.61
	D	6.01
		Avg. 25.34

Avg 12 Samples - 24 mg

As shown above in Table A, fresh potatoes average 3.22 mg cystine/100 g raw or about 16 mg cystine/100 g on a dry solids basis. Dehydrated potato granules average about 15 mg cystine/100 g (Table B); and dehydrated potato granules with 100 to 140 mg cysteine added/100 g dry average about 24 mg cystine/100 g (Table C).

In accordance with the present invention, the total cystine content of dehydrated potato granules is increased only 9 mg/100 g when 100 to 140 mg cysteine is added in process over what would otherwise be present in the potato granules. Nevertheless, despite such a small increase in the cystine content as a result of processing in accordance with the present invention, the use of cysteine in processing potatoes has been discovered to be effective in minimizing browning of potatoes which could otherwise occur, and has been found to be an effective substitute for sulfites in the prevention of browning.

From the foregoing description, one skilled in the art can easily ascertain the essential characteristics of this invention and, without departing from the spirit and scope thereof, make various changes and modifications of the invention to adapt it to various usages and conditions.

What is claimed is:

1. A method for treating produce to minimize browning of said produce, said process comprising: exposing produce to a discoloration inhibiting agent comprising a mixture of a source of available cysteine and a sulfiting agent in amounts effective to minimize browning of said produce upon subsequent processing, handling and storage, and subjecting said produce to a procedure selected from the group consisting of processing, handling, and storage.

2. The method for treating produce to minimize browning in accordance with claim 1, wherein said produce is a member selected from the group consisting of fruits, vegetables, and tubers.

3. The method for treating produce to minimize browning in accordance with claim 2, wherein said fruits are members selected from the group consisting of apples, apricots, avocados, bananas, peaches, and pears.

4. The method for treating produce to minimize browning in accordance with claim 2, wherein said vegetables are members selected from the group consisting of beans, bell peppers, carrots, celery, corn, garlic, horseradish, leeks, lima beans, mushrooms, onions, parsnips, peas, pimiento, tomato, and turnips.

5. The method for treating produce to minimize browning in accordance with claim 2, wherein said tubers are varieties of *solanum tuberosum*.

6. The method for treating produce to minimize browning in accordance with claim 5, wherein said varieties of *solanum tuberosum* are selected from the group consisting of Russet potatoes, Kennebec potatoes, Hilite potatoes, Norkata potatoes, and Norgold potatoes.

7. The method for treating produce to minimize browning in accordance with claim 6, wherein said Russet potatoes are Russet Burbank potatoes.

8. The method for treating produce to minimize browning in accordance with claim 1, wherein said exposing is accomplished in a step selected from the group of steps consisting of immersing said produce in a solution containing said discoloration inhibitor and spraying said produce with a solution containing said discoloration inhibitor.

9. The method for treating produce to minimize browning in accordance with claim 8, wherein said mixture comprises an amount up to about 0.5% cysteine, and an amount up to about 0.1% sulfiting agent.

10. The method for treating produce to minimize browning in accordance with claim 9, wherein said mixture comprises 0.2-0.5% cysteine, and 0.5-0.1% sulfiting agent.

11. The method of treating produce to minimize browning in accordance with claim 1, wherein said processing comprises a technique selected from the group consisting of dehydrating, cooking, canning, aseptic treating, refrigerating and freezing.

12. The method of treating produce to minimize browning in accordance with claim 1, wherein said storage is under refrigerated conditions.

13. The method of treating produce to minimize browning in accordance with claim 12, wherein said refrigerated conditions comprise freezing temperatures.

14. A method for treating potatoes to minimize browning upon subsequent handling, processing, and storage comprising:

- a) preparing potatoes for processing;
- b) exposing said potatoes to a discoloration inhibitor comprising an effective amount of cysteine and a member selected from the group consisting a sulfiting agent, sodium acid pyrophosphate, calcium chloride, and mixtures of a sulfiting agent, sodium acid pyrophosphate, and calcium chloride, for preventing browning upon subsequent processing involving subjecting said potatoes to elevated temperatures; and
- c) dehydrating said potatoes to produce a dry product having a storage-stable moisture content.

15. The method for treating potatoes in accordance with claim 14, where the potatoes are pieces selected from the group consisting of slices, shreds, and dice.

16. The method for treating potatoes in accordance with claim 15, wherein said pieces have a dimension in the range of 1/16 to 3/16" inch.

17. The method for treating produce to minimize browning in accordance with claim 14, wherein said processing involves blanching said potatoes in an aqueous medium having a temperature within the range of about 120° F.-212° F.

18. The method for treating produce to minimize browning in accordance with claim 17, wherein said aqueous medium is selected from the group consisting of water, steam, and a mixture of water and steam.

19. The method for treating potatoes to minimize browning in accordance with claim 14, wherein said dehydrating is performed in a conveyor type dryer.

20. The method for treating potatoes to minimize browning in accordance with claim 14, wherein said discoloration inhibitor is in an aqueous solution.

21. The method for treating potatoes to minimize browning in accordance with claim 20, wherein said aqueous solution comprises discoloration inhibitors selected from the group consisting of a mixture consisting of a source of available cysteine and a sulfiting agent; a mixture consisting of a source of available cysteine, and sodium acid pyrophosphate; and a mixture consisting of a source of available cysteine, a sulfiting agent, and sodium acid pyrophosphate.

22. The method for treating potatoes to minimize browning in accordance with claim 21, wherein said aqueous solution comprises synergistic amounts of a mixture consisting of cysteine and a sulfiting agent effective to prevent browning of said potatoes.

23. The method for treating potatoes to minimize browning in accordance with claim 21, wherein said aqueous solution comprises discoloration inhibitors selected from the group consisting of:

- a) an amount up to about 0.5% cysteine, and an amount up to about 0.1% sulfiting agent; and
- b) an amount up to about 0.5% cysteine, an amount up to about 0.1% sulfiting agent, and an amount up to about 0.5% sodium acid pyrophosphate.

24. The method for treating potatoes to minimize browning in accordance with claim 23, wherein said solution comprises discoloration inhibitors selected from the group consisting of:

- a) 0.2-0.5% cysteine, and 0.05-0.1% sulfiting agent; and
- b) 0.025-0.5% cysteine, 0.025-0.5% sodium acid pyrophosphate, and 0.05-0.1% sulfiting agent.

25. The method for treating potatoes to minimize browning in accordance with claim 14, wherein said exposing said potatoes to a discoloration inhibitor comprises a step selected from the group consisting of immersing said potatoes in a solution comprising said discoloration inhibitor and spraying said potatoes with a solution comprising said discoloration inhibitor.

26. The method for treating potatoes to minimize browning in accordance with claim 25, wherein said step comprising spraying said potatoes with an aqueous solution comprising a member selected from the group consisting of cysteine, a mixture of cysteine and sodium acid pyrophosphate, and a mixture of cysteine, sodium acid pyrophosphate, and a sulfiting agent.

27. The method for treating potatoes to minimize browning in accordance with claim 26, wherein said

cysteine is present in said aqueous solution in an amount to result in a cysteine content of less than 0.1% in said dry product.

28. The method for treating potatoes to minimize browning in accordance with claim 27, wherein said sodium acid pyrophosphate is present in said aqueous solution in an amount of said sodium acid pyrophosphate to result in a sodium acid pyrophosphate content less than 0.2% in the dry product.

29. The method of treating potatoes to minimum browning in accordance with claim 28, wherein said sulfiting agent is present in said aqueous solution in an amount to result in a sulfite content as sulfur dioxide of less than 0.003%.

30. A composition for treating produce comprising an amount up to about 0.5% cysteine and an amount up to about 0.1% sulfiting agent.

31. The composition for treating produce in accordance with claim 30, comprising 0.2-0.5% cysteine and 0.05-0.1% sulfiting agent.

32. A composition for treating produce comprising an amount up to about 0.2% cysteine, an amount up to about 0.2% calcium chloride, and an amount up to about 0.2% sodium acid pyrophosphate.

33. The composition for treating produce in accordance with claim 32, comprising 0.025-0.2% cysteine, 0.025-2% calcium chloride, and 0.025-0.2% sodium acid pyrophosphate.

34. The composition for treating produce in accordance with claim 33, comprising 0.1-0.15% cysteine, 0.1% calcium chloride, and 0.1% sodium acid pyrophosphate.

35. A composition for treating produce comprising an amount up to about 0.2% cysteine, an amount up to about 0.003% sulfiting agent, an amount up to about 0.2% calcium chloride, and an amount up to about 0.2% sodium acid pyrophosphate.

36. The composition for treating produce in accordance with claim 35, comprising 0.025%-0.2% cysteine, 0.0001-0.003% sulfiting agent, 0.025-0.2% calcium chloride, and 0.025-0.2% sodium acid pyrophosphate.

37. The composition for treating produce in accordance with claim 36, comprising 0.05-0.15% cysteine, 0.0002-0.0003% sulfiting agent, 0.1% calcium chloride, and 0.1% sodium acid pyrophosphate.

38. A method for treating produce to minimize non-enzymatic browning upon subsequent processing, handling and storage comprising:

exposing produce to a discoloration inhibitor selected from the group consisting of a mixture consisting of a source of available cysteine and a sulfiting agent, a mixture consisting of a source of available cysteine, calcium chloride and sodium acid pyrophosphate, and a mixture consisting of a source of available cysteine, a sulfiting agent, calcium chloride, and sodium acid pyrophosphate in amounts effective to minimize non-enzymatic browning, and subjecting said produce to elevated temperatures.

39. The method for treating produce to minimize browning in accordance with claim 38, wherein said elevated temperatures fall within the range of about 120° F.-550° F.

40. The method for treating produce to minimize browning in accordance with claim 39, wherein said exposing is accomplished in a step selected from the group of steps consisting of immersing said produce in a solution containing said discoloration inhibitor and spraying said produce with said solution.

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41. The method for treating produce to minimize browning in accordance with claim 39, wherein said subjecting said produce to elevated temperatures comprises a process step selected from the group of steps consisting of blanching, cooking, dehydrating, a sequence of blanching and dehydrating steps, and a sequence of cooking and dehydrating steps.

42. The method for treating produce to minimize browning in accordance with claim 41, wherein said process step involves blanching said produce using a medium selected from the group consisting of water, steam, and a mixture of water and steam at temperatures within the range of 120° F.-212° F.

43. The method for treating produce to minimize browning in accordance with claim 42, wherein said produce is a member selected from the group consisting of fruits, vegetables and tubers.

44. The method for treating produce to minimize browning in accordance with claim 43, wherein said fruits are members selected from the group consisting of apples, apricots, avocados, bananas, peaches and pears.

45. The method for treating produce to minimize browning in accordance with claim 43, wherein said vegetables are members selected from the group consisting of beans, bell peppers, carrots, celery, corn, garlic, horseradish, leeks, lima beans, mushrooms, onions, pumpkins, peas, pimiento, tomato and turnips.

46. The method for treating produce to minimize browning in accordance with claim 43, wherein said tubers are varieties of *solanum tuberosum*.

47. The method for treating produce to minimize browning in accordance with claim 46, wherein said varieties of *solanum tuberosum* are selected from the group consisting of Russet potatoes, Kennebec potatoes, Hilite potatoes, Norkota potatoes, and Norgold potatoes.

48. The method for treating produce to minimize browning in accordance with claim 47, wherein said Russet potatoes are Russet Burbank potatoes.

49. The method for treating produce to minimize browning in accordance with claim 41, wherein said process step comprises dehydrating said produce in hot air to remove at least a portion of natural moisture from said produce.

50. The method for treating produce to minimize browning in accordance with claim 49, wherein said produce are tubers selected from varieties of *solanum tuberosum*.

51. The method for treating produce to minimize browning in accordance with claim 50, wherein said solution comprises discoloration inhibitors selected from the group consisting of:

- a) an amount up to about 0.5% cysteine and an amount up to about 0.1% sulfiting agent;
- b) an amount up to about 0.2% cysteine, an amount up to about 0.2% calcium chloride, and an amount up to about 0.2% sodium acid pyrophosphate; and
- c) an amount up to about 0.2% cysteine, an amount up to about 0.0003% sulfiting agent, an amount up to about 0.2% calcium chloride, and an amount up to about 0.2% sodium acid pyrophosphate.

52. The method for treating produce to minimize browning in accordance with claim 51, wherein said solution comprises discoloration inhibitors selected from the group consisting of:

- a) 0.2-0.5% cysteine and 0.05-0.1% sulfiting agent;

b) 0.025-0.2% cysteine, 0.025-0.2% calcium chloride; and 0.025-0.2% sodium acid pyrophosphate; and

c) 0.025-0.2% cysteine, 0.0001-0.0003% sulfiting agent, 0.025-0.2% calcium chloride, and 0.025-0.2% sodium acid pyrophosphate.

53. A method for treating potatoes to minimize browning upon subsequent handling, processing, and storage comprising:

- a) preparing potatoes for processing;
- b) exposing said potatoes to a discoloration inhibitor selected from the group consisting of:
 - 1) an amount up to about 0.5% cysteine, and an amount up to about 0.1% sulfiting agent; and
 - 2) an amount up to about 0.5% cysteine, an amount up to about 0.1% sulfiting agent and an amount up to about 0.5% sodium acid pyrophosphate for preventing browning upon subsequent processing involving subjecting said potatoes to elevated temperatures; and
- c) dehydrating said potatoes to produce a dry product having a storage-stable moisture content.

54. A method for treating potatoes to minimize browning upon subsequent handling, processing, and storage comprising:

- a) preparing potatoes for processing;
- b) exposing said potatoes to a discoloration inhibitor selected from the group consisting of:
 - 1) 0.2-0.5% cysteine, and 0.05-0.1% sulfiting agent; and
 - 2) 0.025-0.5% cysteine, 0.025-0.5% sodium acid pyrophosphate, and 0.05-0.1% sulfiting agent for preventing browning upon subsequent processing involving subjecting said potatoes to elevated temperature; and
- c) dehydrating said potatoes to produce a dry product having a storage-stable moisture content.

55. A method for treating produce to minimize browning upon subsequent processing, handling and storage comprising:

- exposing produce to a discoloration inhibitor selected from the group consisting of
 - a) an amount up to about 0.5% cysteine and an amount up to about 0.1% sulfiting agent;
 - b) an amount up to about 0.2% cysteine, an amount up to about 0.2% calcium chloride, and an amount up to about 0.2% sodium acid pyrophosphate; and
 - c) an amount up to about 0.2% cysteine, an amount up to about 0.0003% sulfiting agent, an amount up to about 0.2% calcium chloride, and an amount up to about 0.2% sodium acid pyrophosphate and subjecting said produce to elevated temperatures.

56. A method for treating produce to minimize browning upon subsequent processing, handling and storage comprising:

- exposing produce to a discoloration inhibitor selected from the group consisting of
 - a) 0.2-0.5% cysteine and 0.05-0.1% sulfiting agent;
 - b) 0.025-0.2% cysteine, 0.025-0.2% calcium chloride, and 0.025-0.2% sodium acid pyrophosphate; and
 - c) 0.025-0.2% cysteine, 0.0001-0.0003% sulfiting agent, 0.025-0.2% calcium chloride, and 0.025-0.2% sodium acid pyrophosphate and subjecting said produce to elevated temperatures.

* * * * *

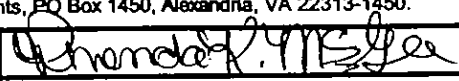
TRANSMITTAL LETTER TO THE UNITED STATES RECEIVING OFFICE

Date	06 Feb 2004 (06.02.2004)
International Application No.	PCT/US2004/003375
Attorney Docket No.	CFLAY.00178P

I. **Certification under 37 CFR 1.10 (If applicable)**

EV 601141258 US	March 30, 2005
Express Mail mailing number	Date of Deposit

I hereby certify that the application/correspondence attached hereto is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to Mail Stop PCT, Commissioner for Patents, PO Box 1450, Alexandria, VA 22313-1450.

	Rhonda K. McGee
Signature of person mailing correspondence	Typed or printed name of person mailing correspondence

II. ☐ **New International Application**

TITLE	Method for Reducing Acrylamide Formation in Thermally Processed Foods	Earliest priority date (Day/Month/Year)
		21 Feb 2003 (21.02.2003)

SCREENING DISCLOSURE INFORMATION: In order to assist in screening the accompanying International application for purposes of determining whether a license for foreign transmittal should and could be granted and for other purposes, the following information is supplied. (Note: check as many boxes as apply):

A. ☐ The invention disclosed was not made in the United States.

B. ☐ There is no prior U.S. application relating to this invention.

C. ☒ The following prior U.S. application(s) contain subject matter which is related to the invention disclosed in the attached international application. (NOTE: priority to these applications may or may not be claimed on form PCT/RO/101 (Request) and this listing does not constitute a claim for priority.)

application no.	10/372,738	filed on	21 Feb 2003 (21.02.2003)
application no.		filed on	

D. ☐ The present international application contains additional subject matter not found in the prior U.S. application(s) identified in paragraph C. above. The additional subject matter is found on pages and ☐ DOES NOT ALTER ☐ MIGHT BE CONSIDERED TO ALTER the general nature of the invention in a manner which would require the U.S. application to have been made available for inspection by the appropriate defense agencies under 35 U.S.C. 181 and 37 CFR 5.1. See 37 CFR 5.15.

III. ☐ **A Response to an Invitation from the RO/US. The following document(s) is (are) enclosed:**

A. ☐ A Request for An Extension of Time to File a Response

B. ☐ A Power of Attorney (General or Regular)

C. ☐ Replacement pages:

pages		of the request (PCT/RO/101)	pages		of the figures
pages		of the description	pages		of the abstract
pages		of the claims			

D. ☐ Submission of Priority Documents

Priority document		Priority document	
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E. ☐ Fees as specified on attached Fee Calculation sheet form PCT/RO/101 annex

IV. ☐ **A Request for Rectification under PCT 91** ☐ **A Petition** ☐ **A Sequence Listing Diskette**

V. ☒ **Other (please specify):** PCT Demand; Reply to Written Opinion and Article 34 Amendment; Postcard Receipt

The person signing this form is the:	☐ Applicant	Chad E. Walter, Registration No. 54,625
	☒ Attorney/Agent (Reg. No.)	
	☐ Common Representative	Signature

The demand must be filed directly with the competent International Preliminary Examining Authority or, if two or more Authorities are competent, with the one chosen by the applicant. The full name or two-letter code of that Authority may be indicated by the applicant on the line below:

IPEA/ _____

PCT

CHAPTER II

DEMAND

under Article 31 of the Patent Cooperation Treaty:
The undersigned requests that the international application specified below be the subject of international preliminary examination according to the Patent Cooperation Treaty.

For International Preliminary Examining Authority use only	
Identification of IPEA	Date of receipt of DEMAND
Box No. I IDENTIFICATION OF THE INTERNATIONAL APPLICATION	
Applicant's or agent's file reference CFLAY.00178PCT	
International application No. PCT/US2004/003375	International filing date (day/month/year) 06 February 2004 (06.02.2004)
(Earliest) Priority date (day/month/year) 21 February 2003 (21.02.2003)	
Title of invention Method for Reducing Acrylamide Formation in Thermally Processed Foods	
Box No. II APPLICANT(S)	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) FRITO-LAY NORTH AMERICA, INC. 7701 Legacy Drive Plano, TX 75024-4099 US	Telephone No.
	Facsimile No.
	Teleprinter No.
	Applicant's registration No. with the Office
State (that is, country) of nationality: US	State (that is, country) of residence: US
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) ELDER, Vincent Allen 2903 Ontario Lane Dallas, TX 75220 US	
State (that is, country) of nationality: US	State (that is, country) of residence: US
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) FULCHER, John Gregory 9930 Ontario Lane Dallas, TX 75220 US	
State (that is, country) of nationality: US	State (that is, country) of residence: US
☐ Further applicants are indicated on a continuation sheet.	

Continuation of Box No. II APPLICANT(S)

*If none of the following sub-boxes is used, this sheet should not be included in the demand.*Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*LEUNG, Henry Kin-Hang
3704 Ellington Drive
Plano, Collin County, Texas 75093
USState *(that is, country)* of nationality:
USState *(that is, country)* of residence:
USName and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*TOPOR, Michael Grant
2312 Evergreen
Carrollton, Dallas County, Texas 75006
USState *(that is, country)* of nationality:
USState *(that is, country)* of residence:
USName and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*State *(that is, country)* of nationality:State *(that is, country)* of residence:Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*State *(that is, country)* of nationality:State *(that is, country)* of residence:☐ Further applicants are indicated on another continuation sheet.

Box No. III AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCEThe following person is ☒ agent ☐ common representativeand ☒ has been appointed earlier and represents the applicant(s) also for international preliminary examination.☐ is hereby appointed and any earlier appointment of (an) agent(s)/common representative is hereby revoked.☐ is hereby appointed, specifically for the procedure before the International Preliminary Examining Authority, in addition to the agent(s)/common representative appointed earlier.Name and address: (Family name followed by given name; for a legal entity, full official designation.
The address must include postal code and name of country.)CAHOON, Colin P.; WALTER, Chad
Carstens & Cahoon, LLP
Customer No. 22,858
P. O. Box 802334
Dallas, TX 75380
US

Telephone No.

972-367-2001

Facsimile No.

972-367-2002

Teleprinter No.

Agent's registration No. with the Office

38,836; 54,625

☐ Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.**Box No. IV BASIS FOR INTERNATIONAL PRELIMINARY EXAMINATION****Statement concerning amendments:***

1. The applicant wishes the international preliminary examination to start on the basis of:

☒ the international application as originally filedthe description ☒ as originally filed☐ as amended under Article 34the claims ☒ as originally filed☐ as amended under Article 19 (together with any accompanying statement)☐ as amended under Article 34the drawings ☒ as originally filed☐ as amended under Article 342. ☐ The applicant wishes any amendment to the claims under Article 19 to be considered as reversed.3. ☐ The applicant wishes the start of the international preliminary examination to be postponed until the expiration of the applicable time limit under Rule 69.1(d).4. ☒ The applicant expressly wishes the international preliminary examination to start earlier than at the expiration of the applicable time limit under Rule 54bis.1(a).

* Where no check-box is marked, international preliminary examination will start on the basis of the international application as originally filed or, where a copy of amendments to the claims under Article 19 and/or amendments of the international application under Article 34 are received by the International Preliminary Examining Authority before it has begun to draw up a written opinion or the international preliminary examination report, as so amended.

Language for the purposes of international preliminary examination: English

☒ which is the language in which the international application was filed.☐ which is the language of a translation furnished for the purposes of international search.☐ which is the language of publication of the international application.☐ which is the language of the translation (to be) furnished for the purposes of international preliminary examination.**Box No. V ELECTION OF STATES**

The filing of this demand constitutes the election of all Contracting States which are designated and are bound by Chapter II of the PCT.

Box No. VI CHECK LIST

The demand is accompanied by the following elements, in the language referred to in Box No. IV, for the purposes of international preliminary examination:

- | | | |
|---|---|-----------|
| 1. translation of international application | : | sheets |
| 2. amendments under Article 34 | : | sheets |
| 3. copy (or, where required, translation) of amendments under Article 19 | : | sheets |
| 4. copy (or, where required, translation) of statement under Article 19 | : | sheets |
| 5. letter | : | 1 sheets |
| 6. other (specify) Reply to Written Opinion, check in the amount of \$773.00; postcard | : | 13 sheets |

For International Preliminary Examining Authority use only

received	not received
----------	--------------

- | | |
|--------------------------|--------------------------|
| ☐ | ☐ |
| ☐ | ☐ |
| ☐ | ☐ |
| ☐ | ☐ |
| ☐ | ☐ |
| ☐ | ☐ |

The demand is also accompanied by the item(s) marked below:

- | | |
|--|--|
| 1. ☒ fee calculation sheet | 5. ☐ statement explaining lack of signature |
| 2. ☐ original separate power of attorney | 6. ☐ sequence listing in computer readable form |
| 3. ☐ original general power of attorney | 7. ☐ tables in computer readable form related to a sequence listing |
| 4. ☐ copy of general power of attorney; reference number, if any: | 8. ☐ other (specify): |

Box No. VII SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the demand).



Chad Walter
Registration No. 54,625

For International Preliminary Examining Authority use only

1. Date of actual receipt of DEMAND:

2. Adjusted date of receipt of demand due to CORRECTIONS under Rule 60.1(b):

3. ☐ The date of receipt of the demand is AFTER the expiration of 19 months from the priority date and item 4 or 5, below, does not apply.
☐ The applicant has been informed accordingly.
4. ☐ The date of receipt of the demand is WITHIN the time limit of 19 months from the priority date as extended by virtue of Rule 80.5.
5. ☐ Although the date of receipt of the demand is after the expiration of 19 months from the priority date, the delay in arrival is EXCUSED pursuant to Rule 82.

6. ☐ The date of receipt of the demand is AFTER the expiration of the time limit under Rule 54bis.1(a) and item 7 or 8, below, does not apply.
7. ☐ The date of receipt of the demand is WITHIN the time limit under Rule 54bis.1(a) as extended by virtue of Rule 80.5.
8. ☐ Although the date of receipt of the demand is after the expiration of the time limit under Rule 54bis.1(a), the delay in arrival is EXCUSED pursuant to Rule 82.

For International Bureau use only

Demand received from IPEA on:

PCT

FEE CALCULATION SHEET

Annex to the Demand

International application No. PCT/US2004/003375	For International Preliminary Examining Authority use only
Applicant's or agent's file reference CFLAY.00178PCT	Date stamp of the IPEA
Applicant FRITO-LAY NORTH AMERICA, INC.	
CALCULATION OF PRESCRIBED FEES	
1. Preliminary examination fee	600.00 P
2. Handling fee (<i>Applicants from certain States are entitled to a reduction of 75% of the handling fee. Where the applicant is (or all applicants are) so entitled, the amount to be entered as H is 25% of the handling fee.</i>)	173.00 H
3. Total of prescribed fees Add the amounts entered at P and H and enter total in the TOTAL box	773.00 TOTAL
MODE OF PAYMENT	
☐ authorization to charge deposit account with the IPEA (see below)	☐ cash
☒ cheque	☐ revenue stamps
☐ postal money order	☐ coupons
☐ bank draft	☐ other (specify):
AUTHORIZATION TO CHARGE (OR CREDIT) DEPOSIT ACCOUNT <i>(This mode of payment may not be available at all IPEAs)</i>	
☐ Authorization to charge the total fees indicated above.	IPEA/ <u>RO/US</u>
☐ <i>(This check-box may be marked only if the conditions for deposit accounts of the IPEA so permit) Authorization to charge any deficiency or credit any overpayment in the total fees indicated above.</i>	Deposit Account No.: <u>50-0392</u>
	Date: <u>3-30-2005</u>
	Name: <u>Chad Walter</u>
	Signature:

IN THE INTERNATIONAL BUREAU OF WIPO

Int'l Application: PCT/US2004/003375
 Applicant: FRITO-LAY NORTH AMERICA, INC. FKA RECOT, Inc.
 Filing Date: 06 February 2004 (06.02.2004)
 Priority Date: 21 February 2003 (21.02.2003)
 Title: Method for Reducing Acrylamide Formation in Thermally Processed Foods
 Attorney Docket No.: CFLAY.00178PCT

**REPLY TO THE WRITTEN OPINION AND
 AMENDMENT PURSUANT TO ARTICLE 34
 OF THE PATENT COOPERATION TREATY**

This is in timely reply to the Written Opinion issued in this matter on 24 February 2005, and to place the above-identified application claims in better condition for International Preliminary Examination. The Applicant offers the following reply:

COMMENT

Claims 1-49 are pending. No substantive changes were made to Claims 1-49.

Claims:

1. A method of lowering the level of acrylamide in a thermally processed food containing free asparagine and simple sugars, said method comprising the steps of:
 - a) adding an ingredient containing a free amino acid to a food product, wherein said ingredient is added in an amount sufficient to reduce the final level of acrylamide in said thermally processed food to an acceptable level;
 - b) thermally processing said food product.
2. The method of Claim 1, wherein said adding step a) adds an amount of said ingredient that is sufficient to reduce said final level of acrylamide in said thermally processed food by at least 20 percent.
3. The method of Claim 1, wherein said adding step a) adds an amount of said ingredient that is sufficient to reduce said final level of acrylamide in said thermally processed food by at least 35 percent.
4. The method of Claim 1, wherein said adding step a) adds an amount of said ingredient that is sufficient to reduce said final level of acrylamide in said thermally processed food by at least 50 percent.
5. The method of Claim 1, wherein said adding step a) adds an amount of said ingredient that is sufficient to reduce said final level of acrylamide in said thermally processed food by at least 65 percent.
6. The method of Claim 1, wherein said adding step a) adds at least 100 parts per million of cysteine.

7. The method of Claim 1, wherein said adding step a) adds about 1,000 parts per million of cysteine.
8. The method of Claim 1, wherein said adding step a) adds up to 10,000 parts per million of cysteine.
9. The method of Claim 1, wherein said adding step a) adds at least 0.1 moles of an amino acid for each mole of reducing sugar in said food product.
10. The method of Claim 1, wherein said adding step a) adds about 1.0 moles of an amino acid for each mole of reducing sugar in said food product.
11. The method of Claim 1, wherein said adding step a) adds up to 2.0 moles of an amino acid for each mole of reducing sugar in said food product.
12. The method of Claim 1, wherein said free amino acid is chosen from the group consisting of cysteine, lysine, glycine, histidine, alanine, methionine, glutamic acid, aspartic acid, proline, phenylalanine, valine, and arginine.
13. The method of Claim 1, wherein said adding step a) adds a commercially available amino acid to said food product.
14. The method of Claim 1, wherein said adding step a) adds a food containing said free amino acid to said food product.
15. The method of Claim 1, wherein, in said adding step a), said food product is soaked in a solution containing said ingredient.

16. The method of Claim 1, wherein said ingredient is mixed with other ingredients to form dough.
17. The method of Claim 1, wherein said cooking step b) comprises frying said food product.
18. The method of Claim 1, wherein said cooking step b) comprises baking said food product.
19. The method of Claim 1, wherein the adding step a) further comprises adding an ingredient containing calcium to said food product.
20. The method of Claim 19, wherein said ingredient containing calcium comprises calcium chloride.
21. The thermally processed food produced by the method of Claim 1.

22. A method of reducing the production of acrylamide in a fabricated food product, said method comprising the steps of:
 - a) adding an ingredient containing a free amino acid to a mixture for a fabricated food product, wherein said ingredient is added in an amount sufficient to reduce the final level of acrylamide in said fabricated food product to a predetermined level;
 - b) thermally processing said mixture.
23. The method of Claim 22, wherein said free amino acid is chosen from the group consisting of cysteine, lysine, glycine, histidine, alanine, methionine, glutamic acid, aspartic acid, proline, phenylalanine, valine, and arginine.
24. The method of Claim 22, wherein said adding step a) adds a commercially available amino acid to said mixture.
25. The method of Claim 22, wherein said adding step a) adds a food containing said free amino acid to said mixture.
26. The method of Claim 22, wherein said cooking step b) comprises frying said food product.
27. The method of Claim 22, wherein said cooking step b) comprises baking said food product.
28. The fabricated food product produced by the method of Claim 22.

29. A method of preparing fabricated potato chips, said method comprising the steps of:

- a) preparing a dough comprising potato flakes, water, and an ingredient containing a free amino acid, wherein said ingredient is added in an amount sufficient to reduce the final level of acrylamide in said fabricated potato chips to a predetermined level;
- b) sheeting and cutting said mixture to form cut pieces;
- c) thermally processing said cut pieces to form chips.

30. The method of Claim 29, wherein said free amino acid is chosen from the group consisting of cysteine, lysine, glycine, histidine, alanine, methionine, glutamic acid, aspartic acid, proline, phenylalanine, valine, and arginine.

31. The method of Claim 29, wherein said thermally processing step a) comprises baking.

32. The method of Claim 29, wherein said thermally processing step c) comprises frying.

33. The method of Claim 29, further comprising the step of:

- d) seasoning said fabricated potato chips.

34. The method of Claim 29, further comprising the step of:

- d) packaging said fabricated potato chips.

35. The fabricated potato chips produced by the method of Claim 29.

36. A method of preparing potato chips, said method comprising the steps of:
 - a) slicing raw potatoes to form potato slices;
 - b) soaking said potato slices in a solution containing a quantity of an amino acid sufficient to reduce the level of acrylamide in said potato chips to an acceptable level;
 - c) thermally processing said potato slices to form potato chips.
37. The method of claim 36, wherein said amino acid is chosen from the group consisting of cysteine, lysine, glycine, histidine, alanine, methionine, glutamic acid, aspartic acid, proline, phenylalanine, valine, and arginine.
38. The method of Claim 36, wherein said thermally processing step a) comprises baking.
39. The method of Claim 36, wherein said thermally processing step c) comprises frying.
40. The method of Claim 36, wherein said soaking step b) reduces said final level of acrylamide by at least 20 percent.
41. The method of Claim 36, wherein said soaking step b) reduces said final level of acrylamide by at least 50 percent.
42. The potato chips produced by the method of Claim 36.

43. A method of preparing corn chips, said method comprising the steps of:
- a) preparing a mixture containing ground corn, water, and an ingredient containing a free amino acid in a quantity sufficient to reduce the formation of acrylamide in said corn chips to a predetermined level;
 - b) sheeting and cutting said mixture to form chips; and
 - c) thermally processing said chips.
44. The method of Claim 43, wherein said free amino acid is chosen from the group consisting of cysteine, lysine, glycine, histidine, alanine, methionine, glutamic acid, aspartic acid, proline, phenylalanine, valine, and arginine.
45. The method of Claim 43, wherein said thermally processing step c) comprises baking.
46. The method of Claim 43, wherein said thermally processing step c) comprises frying.
47. The method of Claim 43, further comprising the step of:
- d) seasoning said corn chips.
48. The method of Claim 43, further comprising the step of:
- d) packaging said corn chips.
49. A corn chip produced by the method of Claim 43.

Comments in Response to the Written Opinion

The written opinion states:

Claims 1-49 lack an inventive step under PCT Article 33(3) as being obvious over Beck (U.S. Pat. No. 5,389,389).

Regarding claims 1-49 Beck discloses adding an amino acid, e.g. upto 0.5% cysteine, and calcium chloride to a potato or corn product before cooking thereof. It would have been obvious that the addition of amino acid will reduce the acrylamide level in the cooked food product since the amount of the amino acid used in BECK is within applicant's claimed range.

Applicant's Response:

Whether an invention has an "inventive step" is analogous to whether an invention is obvious. Under the European Patent Convention, for example, "[a]n invention shall be considered as involving an inventive step if, having regard to the state of the art, it is not obvious to a person skilled in the art."¹ The European Patent Office uses a three step problem and solution approach to assessing inventive step: 1) the closest prior art is determined; 2) the technical problem is determined by comparing the results achieved in the invention with the closest prior art; and 3) the obviousness of the solution is assessed in light of other art and the knowledge of a person with ordinary skill in the art.

Regarding the first step, the International Searching Authority has indicated that Beck (U.S. Pat. No. 5,389,389) is the closest prior art.

Regarding the second step, the present invention in claims 1-49 includes the feature of lowering the level of acrylamide in a food product. In contrast, *Beck* teaches methods to inhibit and eliminate browning reactions, but does not teach or suggest acrylamide reduction. Where the claims require that an element serve a specific purpose to solve a technical problem, the fact that a similar element was used for to solve another technical problem in the prior art or that the claimed

¹ EUROPEAN PATENT CONVENTION art. 36 [hereinafter EPC]

element has a prior art attribute should not equate to lack of inventive step. Thus, the second required element to prove lack of inventive step has not been met.

Regarding the third step, when the solution to the proposed problem, namely the reduction of acrylamide in food products, is assessed in light of *Beck* and the knowledge of a person with ordinary skill in the art, it is clear that the solution to problem would not be obvious to one skilled in the art from the *Beck* reference. A particular parameter must first be recognized as a result-effective variable, i.e., a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation. The claimed invention lies in recognition of the problem, namely, acrylamide reduction. The combination of known elements is patentable when invention lies in recognition of problem. Here, the problem addressed is acrylamide in a thermally processed food. The prior art fails to disclose, teach or suggest that acrylamide can be reduced by adding an amino acid to a food product. The word "acrylamide" appears nowhere in the *Beck* reference. It is thus not evident what would cause one skilled in the art looking at the *Beck* reference, to use an amino acid to lower the level of acrylamide in a thermally processed food. Therefore, *Beck* fails to disclose the claimed invention in claims 1-49, and fails to suggest the modifications necessary to make the claims obvious.

The examiner is invited to call the undersigned at the below-listed telephone number, in the opinion of the examiner, such a telephone conference would expedite or aid the prosecution and examination of this application.

Date: 3-30, 2005

Respectfully submitted,



Chad Walter
Registration No. 54,625
Attorney for Applicant

CARSTENS & CAHOON, L.L.P.
P.O. Box 802334
Dallas, TX 75380
Telephone 972.367.2001
Facsimile 972.367.2002

162
163

Date Mailed	March 30, 2005
Attorney	Colin P. Cahoon
Applicants	Elder, et al
Title of Invention	Method for Reducing Acrylamide Formation in Thermally Processed Foods
U.S. Serial No.	10/372,738
U.S. Filing Date	21 February 2003 (21.02.2003)
Int'l Serial No	PCT/US2004/03375
Int'l Filing Date	06 February 2004 (06.02.2004)
Docket No	CFLAY 00178PCT

On the date stamped hereon, the United States Patent and Trademark Office received the following

- 1 PCT Transmittal Form (1 pg).
- 2 PCT Demand (3 pgs);
- 3 PCT Fee Calculation Sheet (1 pg).
- 4 Reply to Written Opinion and PCT Article 34 Amendment (11 pgs).
- 5 Check in the amount of \$773.00 (1 pg), and
- 6 Postcard Receipt (1 pg)

Total Pages = 18

CARSTENS & CAHOON, LLP
OPERATING ACCOUNT

P.O. BOX 60284
DALLAS, TX 75380

BANK ONE, NA
DALLAS, TEXAS 75201
32-61-1110

1507

3/29/2005

PAY TO THE
ORDER OF Director, U.S. PTO

\$ **773.00

Seven Hundred Seventy-Three and 00/100***** DOLLAR

Director, U.S. PTO

MEMO

CFLAY.00178PCT- PCT Demand

⑈015077⑈ ⑆111000614⑆

1889985121⑈

CARSTENS & CAHOON, LLP

OPERATING ACCOUNT
Director, U.S. PTO

Fees: Patent Fees

CFLAY.00178PCT- PCT Demand

3/29/2005

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773.00

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CFLAY.00178PCT- PCT Demand

773.00

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT: Vincent Allen Elder, §
John Gregory Fulcher, §
Henry Kin-Hang Leung, and §
Michael Grant Topor §

GROUP ART UNIT: 1761

FILED: February 21, 2003

INVENTION: Method for Reducing
Acrylamide Formation in Thermally
Processed Foods

EXAMINER:

SERIAL No: 10/372,738

ATTY FILE: CFLAY.00178

CORRECTED

DECLARATION AND POWER OF ATTORNEY - JOINT INVENTORS

As below-named inventors, we hereby declare that:

Our residence, post office address, and citizenship are as stated below next to our respective names.

We believe that we are the original, first, joint, and sole inventors of the subject matter which is claimed and for which a patent is sought on the invention, design, or discovery entitled:

**METHOD FOR REDUCING ACRYLAMIDE FORMATION
IN THERMALLY PROCESSED FOODS**

the specification of which is attached hereto.

We have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above;

We acknowledge the duty to disclose to the Office all information known to us to be material to the patentability of this application as defined by Title 37, Code of Federal Regulations, §1.56.

We hereby claim no foreign priority benefits under 35 U.S.C. §119 of any foreign application(s) for patent or inventor's certificate.

We hereby claim no foreign priority benefits under 35 U.S.C. §120 of any United States application for patent.

We acknowledge the duty to disclose to the Office all information known to us to be material to patentability as defined in §1.56 which became available between the filing date of any prior application(s) and the national or PCT international filing date of this application.

CFLAY.00178

-1-

DECLARATION AND POA

We hereby appoint Colin P. Cahoon, Registration No. 38,836; David W. Carstena, Registration No. 34,134; Duke W. Yee, Registration No. 34,285; Vincent J. Allen, Registration No. 45,514; Jeffrey G. Degenfelder, Registration No. 44,647; Priscilla L. Ferguson, Registration No. 42,531; Betty G. Formby, Registration No. 36,536; Casey L. Griffith, Registration No. 47,610; Scott L. Harper, Registration No. 45,783; Patrick C.R. Holmes, Registration No. 46,380; Michael R. Nichols, Registration No. 46,959; Christopher P. O'Hagan, Registration No. 46,966; Stephen R. Tkacs, Registration No. 46,430; Stephen J. Walder, Registration No. 41,534; William S. Wang, Registration No. 52,341; and Lisa L.B. Yociss, Registration No. 36,975, of the firm of Carstena, Yee & Cahoon, L.L.P., my attorneys/agents with full power of substitution and revocation, to prosecute this application, and to transact all business in the United States Patent and Trademark Office connected therewith, and to file and prosecute any international patent applications filed thereon before any international authorities under the Patent Cooperation Treaty.

Send all correspondence to: Carstena, Yee & Cahoon, L.L.P.
P.O. Box 802334
Dallas, TX 75380

Direct telephone calls to: (972) 367-2001

Attorney Docket No.: CFLAY.00178

We hereby declare that all statements made herein of our own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Full name of first inventor: Vincent Allen Elder

Inventor's signature:

Vincent A. Elder

Date:

May 12, 2003.

Residence (City, County, State):

2903 Panorama Drive
Carrollton, Dallas County, Texas 75007

Residence Telephone:

972-242-0342

Citizenship:

United States

Post Office Address:

Same as residence.

Full name of second inventor:

John Gregory Fulcher

Inventor's signature:

John G. Fulcher

Date:

May 15, 2003.

Residence (City, County, State):

9930 Ontario Lane
Dallas, Dallas County, Texas 75220

Residence Telephone:

214-358-5498

Citizenship:

United States

Post Office Address:

Same as residence.

Full name of third inventor:

Henry Kin-Hang Leung

Inventor's signature:

Henry Kin-Hang Leung

Date:

May 12, 2003.

Residence (City, County, State):

3704 Ellington Drive
Plano, Collin County, Texas 75093

Residence Telephone:

972-403-9038

Citizenship:

United States

Post Office Address:

Same as residence.

Full name of fourth inventor:

Michael Grant Topor

Inventor's signature:

Michael Grant Topor

Date:

May 13, 2003.

Residence (City, County, State):

2312 Evergreen
Carrollton, Dallas County, Texas 75006

Residence Telephone:

972-446-4047

Citizenship:

United States

Post Office Address:

Same as residence.

ucción Oficial código: PCT-CARTA de un documento escrito en inglés, sellada por el suscrito Traductor Oficial, septiembre 1° de dos mil cinco, Bogotá, D.C., República de Colombia.

**CARTA DE ENVÍO PARA LA OFICINA RECEPTORA
DE ESTADOS UNIDOS**

Fecha: 6 de febrero de 2004

Solicitud Internacional No. PCT/US2004/003375

Registro jurídico No. CFLAY.00178P

I. Certificación según el CFR 37 1.10 (si es aplicable):

Número de envío por correo expreso: EV 601141258 US

Fecha de depósito: Marzo 30 de 2005

Por medio de la presente certifico que la solicitud/correspondencia adjuntada al presente documento está siendo depositada en el Servicio Postal de Estados Unidos, en el servicio "Oficina Postal de Correo Expreso para el Destinatario", según el CFR 37 1.10, en la fecha antes indicada y está dirigido a Mail Stop PCT, Comisionado de Patentes, PO Box 1450, Alexandria, VA 22313-1450.

(Firmado) Rhonda K. McGee, persona que envía la correspondencia

Silvio A. PUERTAS P.
TRADUCTOR E INTERPRETE OFICIAL - INGLES
Autorización No. 094 - 30/05/94 Registrado

II. Nueva solicitud internacional

TÍTULO: Método para reducir la formación de acrilamida en los alimentos procesados térmicamente

Fecha prioritaria: 21 de febrero de 2003

INFORMACIÓN DE DIVULGACIÓN DE LA INSPECCIÓN: Se suministra la siguiente información para ayudar a inspeccionar la solicitud internacional adjunta con el fin de determinar si se debe y si se puede conceder una licencia para el envío al exterior y para otros efectos.

C. La siguiente solicitud previa para Estados Unidos contiene un asunto que se relaciona con la invención divulgada en la solicitud internacional adjunta.

(NOTA: la prioridad para estas aplicaciones puede o no puede ser reclamada en un formulario PCT/RO/101 (de Solicitud) y dicho listado no constituye una afirmación de prioridad.)

Solicitud No. 10/372,738	Archivada el día: 21 de febrero de 2003
--------------------------	---

V. Otras [solicitudes de rectificación]:

Demanda PCT; respuesta a una opinión escrita y enmienda del Artículo 34;

Tarjeta postal recibida

La persona que firma este formulario es un: Abogado / Representante

Silvio A. PUERTAS P.
TRADUCTOR E INTERPRETE OFICIAL - INGLÉS
Resolución No. 0943 - 30/08/96 Ministerio

(Firmado)

Chad. E. Walter, Registro No. 54,625

Departamento de Comercio de Estados Unidos: Oficina de Patentes y Marcas

Registradas

PTO-1382 (Rev. 04-2003)

PCT – CAPÍTULO II

(Tratado de Cooperación para Patentes)

PETICIÓN

según el artículo 31 del Tratado de Cooperación para Patentes:

**el suscrito solicita que la solicitud internacional especificada a continuación sea
objeto de un examen preliminar internacional según el Tratado de Cooperación para
Patentes:**

Cuadro No. I – Identificación de la solicitud internacional

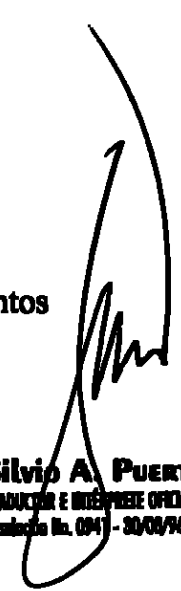
Referencia del archivo del solicitante o representante: CFLAY.00178PCT

Solicitud internacional No. PCT/US2004/003375

Fecha de presentación internacional: 6 de febrero de 2004

Fecha prioritaria: 21 de febrero de 2003

**Título del invento: Método para reducir la formación de acrilamida en alimentos
procesados térmicamente**



Silvio A. PUERTAS P.
TRADUCTOR E INTERPRETE OFICIAL - INGLÉS
Inscripción No. 0041 - 30/03/94 Alajuela

+62
170

Cuadro No. II – Solicitante(s)

Nombre y dirección: FRITO-LAY NORTH AMERICA, INC.

7701 Legacy Drive

Plano, TX 75024-4099

US

Nacionalidad: Estadounidense

País de residencia: Estados Unidos de América

Nombre y dirección: ELDER, Vincent Allen

2930 Ontario Lane

Dallas, TX 75220

US

Nacionalidad: Estadounidense

País de residencia: Estados Unidos de América

Nombre y dirección: FULCHER, John Gregory

9930 Ontario Lane

Dallas, TX 75220

US

Nacionalidad: Estadounidense



Silvio A. PUERTAS P.
TRADUCTOR E INTERPRETE OFICIAL - ORALES
Resolución No. 0947 - 88/08/96 Ministerio

País de residencia: Estados Unidos de América

Nombre y dirección: LEUNG, Henry Kin-Hang

3704 Ellington Drive

Piano, Collin County, Texas 75093

US

Nacionalidad: Estadounidense

País de residencia: Estados Unidos de América

Nombre y dirección: TOPOR, Michael Grant

2312 Evergreen

Carrollton, Dallas County, Texas 75006

US

Nacionalidad: Estadounidense

País de residencia: Estados Unidos de América

Cuadro No. III – Agente o representante común; o dirección para correspondencia

La siguiente persona es un: Agente [Representante] y ha sido designado previamente y también representa al solicitante(s) para el examen preliminar internacional.

Nombre y dirección: CAHOON, Colin P.; WALTER, Chad



Silvio A. PUERTAS P.
TRADUCTOR E INTÉRPRETE OFICIAL - INMIGRACIÓN
Resolución No. 0941 30/02/94 Ministerio

Carstens & Cahoon, LLP

Customer No. 22,858

P.O. Box 802334

Dallas, TX 75380

US

Número telefónico: 972-367-2001

Facsímil No. 972-367-2002

Número de registro del representante en la oficina: 38,836; 54,625

Cuadro No. IV – Base para el examen preliminar internacional

Declaración sobre las enmiendas:

1. El solicitante desea que se inicie un examen preliminar internacional con base

en:

La solicitud internacional tal como se presentó originalmente

La descripción tal como se presentó originalmente

Las afirmaciones tal como se presentaron originalmente

Los dibujos tal como se presentaron originalmente

4. El solicitante desea expresamente que el examen preliminar internacional se inicie antes de la fecha de expiración de límite de tiempo aplicable según la Regla 54bis.1(a).

Silvio A. PUERTAS P.
TRANSCOR E INTERPRETE OFICIAL - TMELES
Certificación No. 0941 - 30/08/96 Alapaido

Idioma para efectos del examen preliminar internacional: Inglés

Que es el idioma en el que se presentó la solicitud internacional.

Cuadro No. V – Elección de estados

Presentar esta demanda constituye la elección de todos los Estados Contractuales que están designados y vinculados por el Capítulo II del PCT.

Cuadro No. VI – Lista de verificación

La demanda viene acompañada de los siguientes elementos, en la lengua mencionada en el Cuadro No. IV, para efectos de examen preliminar internacional.

5. Carta: Respuesta a opinión escrita (1 hoja)

6. Otro (especifique): Cheque por el monto de \$773.00, tarjeta postal (13 hojas)

La demanda también va a acompañada de los elementos marcados a continuación:

1. Hoja de cálculo de los honorarios

Cuadro No. VII – Firma del solicitante, agente/representante o representante común

(Firmado) Chad Walter

Registro No. 54,625



Silvio A. PUERTAS P.
TITULAR E INTERPRETE OFICIAL - INGLÉS
Resolución No. 0941 / 30/05/96

Ver Notas para el formulario de demanda

Formulario PCT/IPEA/401 (enero de 2004)

PCT – CAPÍTULO II

HOJA DE CÁLCULO DE LOS HONORARIOS

Anexo a la Demanda

Solicitud internacional No. PCT/US2004/003375

Referencia del archivo del solicitante o representante: CFLAY.00178PCT

Solicitante: FRITO-LAY NORTH AMERICA, INC

Cálculo de los honorarios prescritos

- 1. Cuota del examen preliminar.....600.00 (P)
 - 2. Honorarios de manejo (*Los solicitantes de ciertos Estados tienen derecho a una reducción del 75% en los honorarios de manejo. Cuando al solicitante (o a todos los solicitantes) se les concede tal reducción, la cantidad a anotar en H es un 25% de la cuota de entrega.*) 173.00 (H)
 - 3. Total de los honorarios prescritos
- Sumar las cantidades de (P) y (H) y anotar
- el total en cuadro de total.....TOTAL 773.00

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TRADUCTOR E INTERPRETE OFICIAL - ORLES
Licencia No. 0941 / 30/08/96

Modo de pago

Cheque

AUTORIZACIÓN DE CARGO (O CRÉDITO) A CUENTA DE DEPÓSITO (Es posible que este modo de pago no esté disponible para todos los IPEAs)

IPEA/RO/US

Cuenta de depósito No. 50-0392

Fecha: 30 de marzo de 2005

Nombre: Chad Walter

Firma: (firmado)

Ver notas para la hoja de cálculos de los honorarios

Formulario PCT/IPEA/401 (Enero de 2004)

EN LA OFICINA INTERNACIONAL DE WIPO

Solicitud internacional: PCT/US2004/003375

Solicitante: FRITO-LAY NORTH AMERICA, INC FKA RECOT, Inc

Fecha de presentación: 6 de febrero de 2004

Fecha prioritaria: 21 de febrero de 2003

Silvio A. PUERTAS P.
TRADUCTOR E INTERPRETE OFICIAL - DELES
Resolución No. 0041 - 20/02/94 Modificada

Título: Método para reducir la formación de acrilamida en alimentos procesados térmicamente

Registro jurídico No.: CFLAY.00178PCT

Respuesta a la opinión escrita y enmienda según el Artículo 34 del Tratado de Cooperación para Patentes

Esta es una respuesta oportuna a la Opinión Escrita emitida sobre este asunto el 24 de febrero de 2005 y dejar las afirmaciones de la solicitud previamente identificada en la mejor condición para el Examen Preliminar Internacional. El Solicitante ofrece la siguiente respuesta:

Comentario

Las afirmaciones de la 1 a la 49 están pendientes. No se hicieron cambios sustanciales a las Afirmaciones de la 1 a la 49.

Afirmaciones:

1. Un método para disminuir el nivel de acrilamida en un alimento procesado térmicamente que contenga asparagina libre y azúcares simples, incluyendo dicho método los pasos de:

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 TRADUCTOR E INTERPRETE OFICIAL - INGLÉS
 Matrícula No. 0740 30/08/96 Ministerio

- a) agregar un ingrediente que contiene un aminoácido libre a un producto alimenticio, agregándose dicho ingrediente en una cantidad suficiente para reducir el nivel final de acrilamida en ese alimento procesado térmicamente hasta un nivel aceptable;
 - b) procesar térmicamente dicho producto alimenticio.
2. El método de la Afirmación 1, donde en el paso de adición a) se agrega una cantidad del ingrediente mencionado que sea suficiente para reducir dicho nivel final de acrilamida al menos en un 20% en dicho alimento procesado térmicamente.
 3. El método de la Afirmación 1, donde en el paso de adición a) se agrega una cantidad del ingrediente mencionado que sea suficiente para reducir dicho nivel final de acrilamida al menos en un 35% en dicho alimento procesado térmicamente.
 4. El método de la Afirmación 1, donde en el paso de adición a) se agrega una cantidad del ingrediente mencionado que sea suficiente para reducir dicho nivel final de acrilamida al menos en un 50% en dicho alimento procesado térmicamente.
 5. El método de la Afirmación 1, donde en el paso de adición a) se agrega una cantidad del ingrediente mencionado que sea suficiente para reducir dicho nivel final de acrilamida al menos en un 65% en dicho alimento procesado térmicamente.

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 TRADUCTOR E INTERPRETE OFICIAL - INELIS
 Inscripción No. 0740 30/03/96 Ministerio

6. El método de la Afirmación 1, donde en el paso de adición a) se agregan al menos 100 partes por millón, de cisteína.
7. El método de la Afirmación 1, donde en el paso de adición a) se agregan al menos 1.000 partes por millón, de cisteína.
8. El método de la Afirmación 1, donde en el paso de adición a) se agregan al menos 10.000 partes por millón, de cisteína.
9. El método de la Afirmación 1, donde en el paso de adición a) se agregan al menos 0.1 moles de un aminoácido por cada mol de azúcar reductor en dicho producto.
10. El método de la Afirmación 1, donde en el paso de adición a) se agregan al menos 1.0 moles de un aminoácido por cada mol de azúcar reductor en dicho producto.
11. El método de la Afirmación 1, donde en el paso de adición a) se agregan al menos 2.0 moles de un aminoácido por cada mol de azúcar reductor en dicho producto.
12. El método de la Afirmación 1, donde dicho aminoácido libre se escoge entre el grupo que consta de cisteína, lisina, glicina, histidina, alanina, metionina, ácido glutámico, ácido aspártico, prolina, fenilalanina, valina y arginina.
13. El método de la Afirmación 1, donde en el paso de adición a) se le agrega a dicho producto alimenticio un aminoácido disponible comercialmente.



Silvio A. PUERTAS P.
TRADUCCIÓN E INTERPRETE OFICIAL - INGLÉS
Certificado No. 0947 22/08/96 H. H. H. H.

14. El método de la Afirmación 1, donde en el paso de adición a) se le agrega a dicho producto alimenticio un alimento que contiene dicho aminoácido libre.
15. El método de la Afirmación 1, donde en el paso de adición a), dicho producto alimenticio se remoja en una solución que contiene dicho ingrediente.
16. El método de la Afirmación 1, donde dicho ingrediente se mezcla con otros ingredientes para formar una masa.
17. El método de la Afirmación 1, donde dicho paso de cocción b) comprende freír dicho producto alimenticio.
18. El método de la Afirmación 1, donde dicho paso de cocción b) comprende hornear dicho producto alimenticio.
19. El método de la Afirmación 1, donde el paso de adición a) comprende, además, agregarle a dicho producto alimenticio un ingrediente que contiene calcio.
20. El método de la Afirmación 19, donde dicho ingrediente que contiene calcio incluye cloruro de calcio.
21. El alimento procesado térmicamente producido mediante el método de la Afirmación 1.
22. Un método para reducir la producción de acrilamida en un producto alimenticio fabricado, comprendiendo dicho método los pasos de:
 - a) agregar un ingrediente que contiene un aminoácido libre a una mezcla para hacer un producto fabricado, donde dicho ingrediente se agrega en una

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Resolución No. 0941 - 20/03/96 del Poder Judicial

cantidad suficiente para reducir el nivel final de acrilamida en dicho producto alimenticio fabricado hasta un nivel predeterminado;

b) procesar térmicamente dicha mezcla.

23. El método de la Afirmación 22, donde dicho aminoácido libre se escoge entre el grupo que consta de cisteína, lisina, glicina, histidina, alanina, metionina, ácido glutámico, ácido aspártico, prolina, fenilalanina, valina y arginina.

24. El método de la Afirmación 22, donde en el paso de adición a) a dicha mezcla se le agrega un aminoácido disponible comercialmente.

25. El método de la Afirmación 22, donde en el paso de adición a) a dicha mezcla se le agrega un alimento que contiene dicho aminoácido libre.

26. El método de la Afirmación 22, donde el paso de cocción b) comprende freír dicho producto alimenticio.

27. El método de la Afirmación 22, donde el paso de cocción b) comprende hornear dicho producto alimenticio.

28. El producto alimenticio fabricado producido mediante el método de la Afirmación 22.

29. Un método para preparar papas fritas fabricadas, comprendiendo dicho método los pasos de:

a) preparar una masa que incluye hojuelas de papa, agua y un ingrediente que contiene un aminoácido libre, agregándose dicho ingrediente en una

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Especialista No. 0941 / 20/08/96 Alajuela

- cantidad suficiente para reducir el nivel final de acrilamida en esas papas fritas fabricadas hasta un nivel determinado;
- b) aplanar y cortar dicha mezcla para formar piezas cortadas;
 - c) procesar térmicamente dichas piezas cortadas para formar papas fritas.
30. El método de la Afirmación 29, donde dicho aminoácido libre se escoge entre el grupo que consta de cisteína, lisina, glicina, histidina, alanina, metionina, ácido glutámico, ácido aspártico, prolina, fenilalanina, valina y arginina.
31. El método de la Afirmación 29, donde el paso de procesar térmicamente a) comprende hornear.
32. El método de la Afirmación 29, donde el paso de procesar térmicamente c) comprende freír.
33. El método de la Afirmación 29, incluyendo además el paso de:
- d) sazonar dichas papas fritas fabricadas.
34. El método de la Afirmación 29, incluyendo además el paso de:
- d) empacar dichas papas fritas fabricadas.
35. Las papas fritas fabricadas producidas mediante el método de la Afirmación 29.
36. Un método de preparar papas fritas, comprendiendo dicho método los pasos de:
- a) rebanar papas crudas para formar tajadas de papa;
 - b) remojar dicha tajadas de papa en una solución que contiene una cantidad de aminoácido suficiente para reducir el nivel de acrilamida en dichas papas fritas hasta un nivel aceptable;

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 Registro No. 094 30/08/96 Alajuela

- c) procesar térmicamente dichas tajadas de papa para formar papas fritas.
37. El método de la Afirmación 36, donde dicho aminoácido se escoge entre el grupo que consta de cisteína, lisina, glicina, histidina, alanina, metionina, ácido glutámico, ácido aspártico, prolina, fenilalanina, valina y arginina.
38. El método de la Afirmación 36, donde dicho paso de procesar térmicamente a) comprende hornear.
39. El método de la Afirmación 36, donde dicho paso de procesar térmicamente c) comprende freír.
40. El método de la Afirmación 36, donde dicho paso de remojo b) reduce dicho nivel final de acrilamida al menos en un 20%.
41. El método de la Afirmación 36, donde dicho paso de remojo b) reduce dicho nivel final de acrilamida al menos en un 50%.
42. Las papas fritas producidas mediante el método de la Afirmación 36.
43. Un método de preparar tajaditas de maíz, comprendiendo dicho método los pasos de:
- a) preparar una mezcla que contiene maíz molido, agua y un ingrediente que contiene un aminoácido libre en una cantidad suficiente para reducir la formación de acrilamida en dichas tajaditas de maíz hasta un nivel predeterminado;
 - b) aplanar y cortar dicha mezcla para formar las tajaditas; y
 - c) procesar térmicamente dichas tajaditas.

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 ADJUNTO E INTERPRETE OFICIAL - INDIAS
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44. El método de la Afirmación 43; donde dicho aminoácido libre se escoge entre el grupo que consta de cisteína, lisina, glicina, histidina, alanina, metionina, ácido glutámico, ácido aspártico, prolina, fenilalanina, valina y arginina.
45. El método de la Afirmación 43; donde dicho paso de procesar térmicamente c) comprende hornear.
46. El método de la Afirmación 43; donde dicho paso de procesar térmicamente c) comprende freír.
47. El método de la Afirmación 43; incluyendo además el paso de:
 - d) sazonar dichas tajaditas de maíz.
48. El método de la Afirmación 43; incluyendo además el paso de:
 - d) empacar dichas tajaditas de maíz.
49. Una tajadita de maíz producida mediante el método de la Afirmación 43.

Comentarios en respuesta a la opinión escrita

La opinión escrita dice:

A las afirmaciones 1-49 les falta un paso de invención de acuerdo con el Artículo 33(3) del PCT, ya que son obvias con respecto a Beck (Patente estadounidense No. 5,389,389).

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TRANSCRIBIDOR E INTERPRETE OFICIAL - INGLÉS
Registrado No. 0941 - 30/08/96 Minnesota

Sobre las afirmaciones 1-49. Beck expone la adición de un aminoácido, por ejemplo, hasta un 0.5% de cisteína y cloruro de calcio a un producto de papa o maíz antes de la cocción del mismo. Habría sido obvia que la adición de aminoácido reduciría el nivel de acrilamida en el producto alimenticio cocido dado que la cantidad de aminoácido usada en BECK está dentro del rango afirmado por el solicitante.

Respuesta del solicitante:

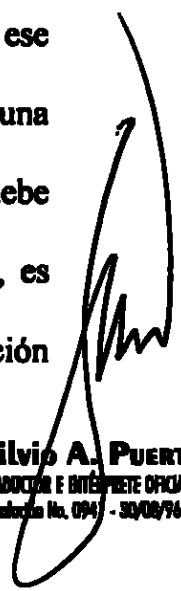
El que un invento tenga o no un "paso inventivo" es algo análogo a si un invento es obvio. Según la Convención Europea de Patentes, por ejemplo, "se debe considerar que un invento incluye un paso inventivo si, teniendo en cuenta el estado del arte, no es obvio para una persona diestra en ese arte." (Artículo 56 de la Convención Europea de Patentes; de ahora en adelante, EPC). La Oficina Europea de Patentes usa un enfoque de problema y solución de tres pasos para evaluar el paso inventivo: 1) se determinar el arte/técnica previo más cercano; 2) el problema técnico se determina comparando los resultados logrados en el invento con los que lograron con el arte/técnica más cercano; y 3) lo obvio de la solución se evalúa a la luz de otro arte/técnica y del conocimiento de una persona que tenga una destreza normal en ese arte/técnica.

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TRANSCRIPCION E INTERPRETE OFICIAL - INGLÉS
Credencial No. 0741 - 20/05/94 República

Con respecto al primer paso, la Autoridad de Investigación Internacional ha indicado que Beck (Patente Estadounidense No. 5,389,389) es el arte/técnica más cercana.

Con respecto al segundo paso, el presente invento – de las afirmaciones 1 a la 49 – incluye la característica de disminuir el nivel de acrilamida en un producto alimenticio. En contraste, *Beck* enseña un método para inhibir y eliminar las reacciones de doramiento, pero no enseña ni sugiere la reducción de acrilamida. Cuando las afirmaciones requieren que un elemento sirva para un propósito específico con el fin de resolver un problema técnico, el hecho que un elemento similar se use para resolver otro problema técnico en el arte/técnica previo o que el elemento propuesto tenga un arte/técnica previo atribuible, no debe igualarse a la falta de un paso inventivo. Así, el segundo elemento requerido para probar la falta de un paso inventivo no se ha cumplido.

Con respecto al tercer paso, cuando la solución al problema propuesto, a saber, la reducción de la acrilamida en los productos alimenticios, se evalúa a la luz de *Beck* y el conocimiento de una persona que tenga un conocimiento normal de ese arte/técnica; está claro que la solución a un problema no sería obvia para una persona diestra en el arte/técnica a partir de la referencia de *Beck*. Primero se debe reconocer un parámetro particular como variable que da resultados efectivos, es decir, una variable que logra un resultado reconocido, antes de que la determinación



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Resolución No. 094 / - 30/08/96 Ministerio

de los rangos óptimos o viables de dicha variable pudiera ser caracterizada como un experimento de rutina. El invento reclamado se basa en el reconocimiento del problema, es decir, la formación de acrilamida. La combinación de elementos conocidos es patentable cuando el invento se basa en el reconocimiento del problema. Aquí, el problema tratado es la acrilamida en un alimento procesado térmicamente. El arte/técnica previo no divulga, ni enseña ni sugiere que la acrilamida se pueda reducir mediante la adición de un aminoácido a un producto alimenticio. La palabra "acrilamida" no aparece en ninguna parte en la referencia de *Beck*. Por ende, no es evidente qué podría hacer que una persona – diestra en el arte/técnica y que mire la referencia de *Beck* – use un aminoácido para reducir el nivel de acrilamida en un alimento procesado térmicamente. Por consiguiente, *Beck* no divulga el invento reclamado en las afirmaciones 1-49 y no sugiere las modificaciones necesarias para hacer que las afirmaciones sean obvias.

Se invita al examinador a llamar al signatario al número telefónico que aparece al final. En opinión del examinador, dicha conferencia telefónica agilizaría o ayudaría a la continuación o examen de esta solicitud.

Fecha: Marzo 30 de 2005

Muy atentamente,

(Firmado) Chad Walter, Registro No. 54,625, Defensor del solicitante

Silvio A. PUERTAS P.
TRANSCRIPTOR E INTERPRETE OFICIAL - INGRES
Expediente No. 0941 20/03/04 Ingresado

CARTENS & CAHOON, L.L.P.

P.O.Box 802334

Dallas, TX 75380

Teléfono: 972.367.2001

Facsímil: 972.367.2002

CFLAY.00178PCT – RESPUESTA A LA OPINIÓN ESCRITA

Fecha de envío: Marzo 30 de 2005

Abogado: Colin P. Cahoon

Solicitantes: Elder, et al.

**Título del invento: Método para reducir la formación de acrilamida en
alimentos procesados térmicamente**

No. de serie en EE.UU.: 10/372,738

Fecha de presentación en EE.UU.: 21 de febrero de 2003

No. de serie internacional: PCT/US2004/03375

Fecha de presentación internacional: 6 de febrero de 2004

Registro No. CFLAY.00178PCT

Silvio A. PUERTAS P.
TRADUCCIONES E INTERPRETE OFICIAL - INGLÉS
Resolución No. 17941 30/01/96 Notación

En la fecha timbrada en esta hoja, la Oficina de Patentes y Marcas Registradas de Estados Unidos recibió lo siguiente:

1. Formulario de envío PCT (1 página);
2. Demanda PCT (3 páginas);
3. Hoja de cálculos de los honorarios PCT (1 página);
4. Respuesta a la opinión escrita y enmienda del artículo 34 del PCT (11 páginas);
5. Cheque por la suma de \$773.00 (1 página); y
6. Recibo de la tarjeta postal (1 página).

Total de páginas = 18

[CHEQUE]

CARSTENS & CAHOON, LLP

OPERATION ACCOUNT

P.O. BOX 602334

DALLAS, TX 75380

15077

Marzo 29 de 2005

BANK ONE, NA

DALLAS, TEXAS 75201

32-61-1110

Silvio A. Puertas P.
TRADUCCION E INTERPRETE OFICIAL - TAMEL
Licencia No. 0941 - 30/08/96

Páguese a la orden del Director de la PTO de Estados Unidos la suma de \$773.00,
setecientos setenta y tres dólares

(Firmado)

ARSTENS & CAHOON, LLP

Cuenta de operación

Director de la PTO de Estados Unidos

Cuotas: honorarios para patentes

EN LA OFICINA DE PATENTES Y MARCAS REGISTRADAS
DE ESTADOS UNIDOS

SOLICITANTE: Vicent Allen Elder

John Gregory Fulcher,

Henry Kin-Hang Leung, y

Michael Grant Topor

PRESENTADO: febrero 21 de 2003

INVENTO: Método para reducir la formación de acrilamida en alimentos
procesados térmicamente

No. DE SERIE: 10/372,738

UNIDAD DEL GRUPO DE TÉCNICA: 1761


Silvio A. PUERTAS P.
TRADUCTOR E INTERPRETE OFICIAL - INGLÉS
Inscripción No. 0941 - 30/08/96 (Mojito)

EXAMINADOR:

ARCHIVO JURÍDICO: CFLAY.00178

CORREGIDO

DECLARACIÓN Y PODER – CO-INVENTORES

Como los suscritos inventores, por medio la presente, declaramos que:

Nuestra residencia, dirección postal y ciudadanía son las que se nombran después de nuestros respectivos nombres.

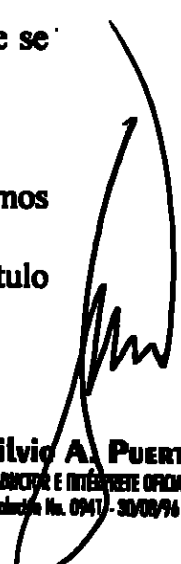
Creemos que somos los primeros y únicos co-inventores originales del asunto que se reclama y por el cual se busca la patente del invento, diseño o descubrimiento a que da lugar:

**MÉTODO PARA REDUCIR LA FORMACIÓN DE ACRILAMIDA EN LOS
ALIMENTOS PROCESADOS TÉRMICAMENTE**

cuya especificación se anexa a este documento.

Hemos revisado y entendido los contenidos de la especificación antes identificada, incluyendo las afirmaciones, enmendadas mediante cualquier enmienda a la que se haya hecho previa referencia;

Reconocemos el deber de divulgarle a la Oficina toda la información que sabemos que es material para la patentabilidad de esta aplicación, según lo define el Título 37, Código de Reglamentos Federales, §1.56.



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TRADUCTOR E INTERPRETE OFICIAL - INEEL
Resolución No. 0947 - 30/08/96 Ministerio

Por medio de este documento no reclamamos beneficios de prioridad en el exterior de acuerdo con el numeral 35 U.S.C. §119 para cualquier solicitud extranjera de patente o certificado de inventor.

Por medio de este documento, no reclamamos beneficios de prioridad en el exterior de acuerdo con el numeral 35 U.S.C. §120 para cualquier solicitud de patente en Estados Unidos.

Reconocemos el deber de divulgarle a la Oficina toda la información que sabemos que es material para la patentabilidad, según se define en §1.56, que estuviera disponible entre la fecha de presentación de cualquier solicitud previa y la fecha de presentación PCT nacional o internacional de esta solicitud.

Por medio de la presente, designamos a Colin P. Cahoon, Registro No. 38,836; David W. Carstens, Registro No. 34,134; Duke W. Yee, Registro No. 34,285; Vincent J. Allen, Registro No. 45,514; Jeffrey G. Degenfelder, Registro No. 44,647; Priscilla L. Ferguson, Registro No. 42,531; Betty G. Formby, Registro No. 36,536; Casey L. Griffith, Registro No. 47,610; Scott L. Harper, Registro No. 45,783; Patrick C.R. Holmes, Registro No. 46,380; Michael R. Nichols, Registro No. 46,959; Christopher P. O'Hagan, Registro No. 46,966; Stephen R. Tkacs, Registro No. 46,430; Stephen J. Walder, Registro No. 41,534; William S. Wang, Registro No. 52,341; y Lisa L.B. Yociss, Registro No. 36,975; de la firma de Carstens, Yee & Cahoon, L.L.P., como nuestros abogados/representantes con poder suficiente de


Silvio A. PUERTAS P.
TRADUCTOR E INTERPRETE OFICIAL - INGLÉS
Registación No. 0947 - 30/08/96

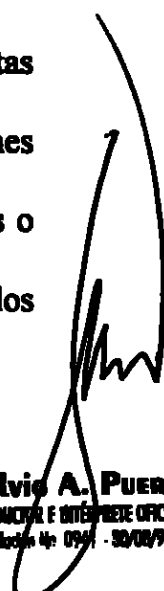
sustitución y revocación, para proceder con esta solicitud y para negociar en la Oficina de Patentes y Marcas Registradas de los Estados Unidos todos los negocios relacionados con nuestro asunto, y para presentar y procesar cualquier solicitud de patente internacional presentada sobre el mismo asunto ante cualquier autoridad internacional según el Tratado de Cooperación para Patentes.

Enviar correspondencia a: Carstens, Yee & Cahoon, L.L.P.
P.O. Box 802334
Dallas, TX 75380

Llamar telefónicamente a: (972) 367-2001

Registro jurídico No.: CFLAY.00178

Por medio de la presente expresamos que todas declaraciones hechas aquí son de nuestro conocimiento y son verdaderas, y que todas las declaraciones hechas sobre la información y creencia se consideran verdaderas; y además que estas declaraciones se hicieron con el conocimiento de que las declaraciones deliberadamente falsas y obrar de esa manera, son cosas punibles con sanciones o encarcelación, o ambas, según el numeral §1001 del Título 18 del Código de los



Silvio A. PUERTAS P.
TRANSCRIPTOR E INTERPRETE OFICIAL - INGLÉS
Licencia No. 0141 - 30/03/96 Alagoastado

Estados Unidos y que dichas declaraciones deliberadamente falsas pueden poner en riesgo la validez de la solicitud o cualquier patente expedida sobre el asunto.

Nombre completo del primer inventor: **Vincent Allen Elder**

Firma del inventor: (Firmado)

Fecha: Mayo 12 de 2003

Residencia (ciudad, condado, estado): 2903 Panorama Drive
Carrollton, Dallas County, Texas 75007

Teléfono de la residencia: 972-242-0342

Ciudadanía: Estados Unidos

Dirección de la oficina postal: La misma de residencia

Nombre completo del segundo inventor: **John Gregory Fulcher**

Firma del inventor: (Firmado)

Fecha: Mayo 15 de 2003

Residencia (ciudad, condado, estado): 9930 Ontario Lane
Dallas, Dallas County, Texas 75220

Teléfono de la residencia: 214-358-5498

Ciudadanía: Estados Unidos

Dirección de la oficina postal: La misma de residencia

Silvio A. Puertas P.
TRADUCTOR E INTERPRETE OFICIAL - INGLÉS
Excedente No. 0041 00/08/96

Nombre completo del tercer inventor: **Henry Kin-Hang Leung**

Firma del inventor: (Firmado)

Fecha: Mayo 12 de 2003

Residencia (ciudad, condado, estado): 3704 Ellington Drive
Plano, Collin County, Texas 75093

Teléfono de la residencia: 972-403-9038

Ciudadanía: Estados Unidos

Dirección de la oficina postal: La misma de residencia

Nombre completo del cuarto inventor: **Michael Grant Topor**

Firma del inventor: (Firmado)

Fecha: Mayo 13 de 2003

Residencia (ciudad, condado, estado): 2312 Evergreen
Carrollton, Dallas County, Texas 75006

Teléfono de la residencia: 972-446-4047

Ciudadanía: Estados Unidos

Dirección de la oficina postal: La misma de residencia

CFLAY.00178

DECLARACIÓN Y PODER

Traductor: **SILVIO ALEJANDRO PUERTAS PINO**

Resolución 0941 del 30 de agosto de 1996 del Ministerio de Justicia y del Derecho

Silvio A. PUERTAS P.
TRADUCTOR E INTERPRETE OFICIAL - INGLÉS
Licencia No. 17981 30/08/96 Alajuela

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

PCT

To:

COLIN P. CAHOON
CARSTENS, YEE & CAHOON, L.L.P.
PO BOX 802334
DALLAS, TEXAS 75380

RECEIVED

JUN 13 2005

BY: *Booker*

NOTIFICATION OF RECEIPT
OF DEMAND BY COMPETENT INTERNATIONAL
PRELIMINARY EXAMINING AUTHORITY

(PCT Rules 59.3(e) and 61.1(b), first sentence
and Administrative Instructions, Section 601(a))

Date of mailing
(day/month/year)

08 JUN 2005

Applicant's or agent's file reference

CFLAY.00178P

IMPORTANT NOTIFICATION

International application No.

PCT/US2004/003375

International filing date (day/month/year)

08 Feb 2004

Priority date (day/month/year)

21 Feb 2003

Applicant

FRITO-LAY NORTH AMERICA, INC.

1. The applicant is hereby notified that this International Preliminary Examining Authority considers the following date as the date of receipt of the demand for international preliminary examination of the international application:

30 March 2005

2. That date of receipt is:

- ☒ the actual date of receipt of the demand by this Authority (Rule 61.1(b)).
- ☐ the actual date of receipt of the demand on behalf of this Authority (Rule 59.3(e)).
- ☐ the date on which this Authority has, in response to the invitation to correct defects in the demand (Form PCT/IPEA/404), received the required corrections.

3. ☐ **ATTENTION:** That date of receipt is after the expiration of 19 months from the priority date. Consequently, in respect of some Offices, the demand does not have the effect of postponing the entry into the national phase until 30 months from the priority date (or later in some Offices) (Article 39(1)) and the acts for entry into the national phase must therefore be performed within 20 months from the priority date (or later in some Offices). However, in respect of some other Offices, the time limit of 30 months (or later) may nevertheless apply. See the Annex to Form PCT/IB/301 and, for details about the applicable time limits, Office by Office, see the *PCT Applicant's Guide*, Volume II, National Chapters and the WIPO Internet site.

- ☐ (if applicable) This notification confirms the information given by telephone, facsimile transmission or in person on:

4. Only where paragraph 3 applies, a copy of this notification has been sent to the International Bureau.

Name and mailing address of the IPEA/

Mail Stop PCT, Commissioner for Patents
P.O. Box 1450, Alexandria, VA 22313-1450

Facsimile No. 703-305-3230

Authorized officer

Sonya D. Barnes

Telephone No. 703-305-9140 EX 129

From the INTERNATIONAL BUREAU

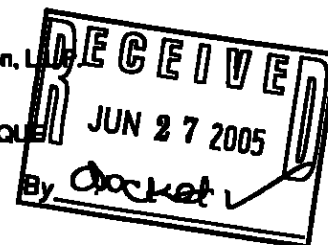
196

PCT

SECOND AND SUPPLEMENTARY NOTICE
INFORMING THE APPLICANT OF THE
COMMUNICATION OF THE INTERNATIONAL
APPLICATION (TO DESIGNATED OFFICES
WHICH APPLY THE 30 MONTH TIME
LIMIT UNDER ARTICLE 22(1))

(PCT Rule 47.1(c))

To:

CAHOON, Colin, P.
Carstens, Yee & Cahoon, LLP
P.O. Box 802334
Dallas, TX 75380
ETATS-UNIS D'AMERIQUE

Date of mailing (day/month/year) 23 June 2005 (23.06.2005)		IMPORTANT NOTICE	
Applicant's or agent's file reference CFLAY.00178P			
International application No. PCT/US2004/003375	International filing date (day/month/year) 06 February 2004 (06.02.2004)	Priority date (day/month/year) 21 February 2003 (21.02.2003)	
Applicant FRITO-LAY NORTH AMERICA, INC. formerly known as RECOT, INC. et al			

1. **ATTENTION:** For any designated Office(s), for which the time limit under Article 22(1), as in force from 1 April 2002 (30 months from the priority date), does not apply, please see Form PCT/IB/308(First Notice) issued previously.
2. Notice is hereby given that the following designated Office(s), for which the time limit under Article 22(1), as in force from 1 April 2002, does apply, has/have requested that the communication of the international application, as provided for in Article 20, be effected under Rule 93bis.1. The International Bureau has effected that communication on the date indicated below:
10 September 2004 (10.09.2004)

AU, AZ, BY, CN, CO, DZ, EP, HU, KG, KP, KR, MD, MK, MZ, NA, RU, SY, TM, US

In accordance with Rule 47.1(c-bis)(i), those Offices will accept the present notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

3. The following designated Offices, for which the time limit under Article 22(1), as in force from 1 April 2002, does apply, have not requested, as at the time of mailing of the present notice, that the communication of the international application be effected under Rule 93bis.1:

AE, AG, AL, AM, AP, AT, BA, BB, BG, BR, BW, BZ, CA, CR, CU, CZ, DE, DK, DM, EA, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, ID, IL, IN, IS, JP, KE, KZ, LC, LK, LR, LS, LT, LV, MA, MG, MN, MW, MX, NI, NO, NZ, OA, OM, PG, PH, PL, PT, RO, SC, SD, SG, SK, SL, TJ, TN, TR, TT, UA, UZ, VC, VN, YU, ZA, ZW

In accordance with Rule 47.1(c-bis)(ii), those Offices accept the present notice as conclusive evidence that the Contracting State for which that Office acts as a designated Office does not require the furnishing, under Article 22, by the applicant of a copy of the international application.

4. **TIME LIMITS** for entry into the national phase

For the designated or elected Office(s) listed above, the applicable time limit for entering the national phase will, subject to what is said in the following paragraph, be 30 MONTHS from the priority date.

In practice, time limits other than the 30-month time limit will continue to apply, for various periods of time, in respect of certain of the designated or elected Office(s) listed above. For regular updates on the applicable time limits (30 or 31 months, or other time limit), Office by Office, refer to the *PCT Gazette*, the *PCT Newsletter* and the *PCT Applicant's Guide*, Volume II, National Chapters, all available from WIPO's Internet site, at <http://www.wipo.int/pct/en/index.html>.

It is the applicant's sole responsibility to monitor all these time limits.

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. +41 22 740 14 35	Authorized officer Ellen Moyse Facsimile No. +41 22 338 89 75
---	---

PATENT COOPERATION TREATY

197 #6
RECEIVED
 JUL 05 2005
 By *doctet* ✓
 CPC, C5W, CL6

From the
 INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:
 COLIN P. CAHOON
 CARSTENS & CAHOON, LLP
 P.O. BOX 802334
 DALLAS, TEXAS 75380

PCT

NOTIFICATION OF TRANSMITTAL OF
 INTERNATIONAL PRELIMINARY
 REPORT ON PATENTABILITY
 (Chapter II of the Patent Cooperation Treaty)

(PCT Rule 71.1)

Date of mailing
 (day/month/year) **01 JUL 2005**

Applicant's or agent's file reference

CFLAY.0017EP

IMPORTANT NOTIFICATION

International application No.

PCT/USD403375

International filing date (day/month/year)

06 February 2004 (06.02.2004)

Priority date (day/month/year)

21 February 2003 (21.02.2003)

Applicant

FRITO-LAY NORTH AMERICA, INC.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary report on patentability and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.
4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary report on patentability. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the *PCT Applicant's Guide*.

The applicant's attention is drawn to Article 33(5), which provides that the criteria of novelty, inventive step and industrial applicability described in Article 33(2) to (4) merely serve the purposes of international preliminary examination and that "any Contracting State may apply additional or different criteria for the purposes of deciding whether, in that State, the claimed invention is patentable or not" (see also Article 27(5)). Such additional criteria may relate, for example, to exemptions from patentability, requirements for enabling disclosure, clarity and support for the claims.

Name and mailing address of the IPEA/US
 Mail Stop PCT, Attn: IPEA/US
 Commissioner for Patents
 P.O. Box 1450
 Alexandria, Virginia 22313-1450
 Facsimile No. (703) 305-3230

Authorized officer

Arthur L. Corbin

Telephone No. (571) 272-1350

John Proctor

Patricia Spe

Form PCT/IPEA/416 (January 2004)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference CFLAY.00178P		FOR FURTHER ACTION		See Form PCT/IBA/416
International application No. PCT/US04/03375		International filing date (day/month/year) 06 February 2004 (06.02.2004)	Priority date (day/month/year) 21 February 2003 (21.02.2003)	
International Patent Classification (IPC) or national classification and IPC IPC(7): A 23L 1/217 and US CL: 426/321, 618, 637				
Applicant FRITO-LAY NORTH AMERICA, INC.				
1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36. 2. This REPORT consists of a total of <u>3</u> sheets, including this cover sheet. 3. This report is also accompanied by ANNEXES, comprising: a. ☐ (sent to the applicant and to the International Bureau) a total of ____ sheets, as follows: ☐ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions). ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box. b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions). 4. This report contains indications relating to the following items: ☒ Box No. I Basis of the report ☐ Box No. II Priority ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability ☐ Box No. IV Lack of unity of invention ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability, citations and explanations supporting such statement ☐ Box No. VI Certain documents cited ☐ Box No. VII Certain defects in the international application ☐ Box No. VIII Certain observations on the international application				
Date of submission of the demand 30 March 2005 (30.03.2005)		Date of completion of this report 10 June 2005 (10.06.2005)		
Name and mailing address of the IPEA/US Mail Stop PCT, Attn: IPEA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (703) 305-3230		Authorized officer Arthur L. Corbin Telephones No. (571) 272-1399 Jean Prochazka, Foreign Legal Specialist		

Form PCT/IBA/409 (cover sheet)(January 2004)

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/US04/03375

Box No. I Basis of the report

1. With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

- ☐ This report is based on translations from the original language into the following language _____, which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
 - ☐ publication of the international application (under Rule 12.4)
 - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the elements of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

- ☒ the international application as originally filed/furnished
- ☒ the description:
 - pages 1-21 as originally filed/furnished
 - pages* NONE received by this Authority on _____
 - pages* NONE received by this Authority on _____
- ☒ the claims:
 - pages 22-28 as originally filed/furnished
 - pages* NONE as amended (together with any statement) under Article 19
 - pages* NONE received by this Authority on _____
 - pages* NONE received by this Authority on _____
- ☒ the drawings:
 - pages 1-2 as originally filed/furnished
 - pages* NONE received by this Authority on _____
 - pages* NONE received by this Authority on _____
- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing.

3. ☒ The amendments have resulted in the cancellation of:

- ☒ the description, pages NONE
- ☒ the claims, Nos. NONE
- ☒ the drawings, sheets/figs NONE
- ☒ the sequence listing (*specify*): NONE
- ☒ any table(s) related to the sequence listing (*specify*): NONE

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing (*specify*): _____
- ☐ any table(s) related to the sequence listing (*specify*): _____

* If item 4 applies, some or all of those sheets may be marked "superseded."

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/US04/03375

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims 1-49	YES
	Claims NONE	NO
Inventive Step (IS)	Claims NONE	YES
	Claims 1-49	NO
Industrial Applicability (IA)	Claims 1-49	YES
	Claims NONE	NO

2. Citations and Explanations (Rule 70.7)

Claims 1-49 lack an inventive step under PCT Article 33(3) as being obvious over BECK. BECK discloses adding an amino acid, e.g. up to 0.5% cysteine, and calcium chloride to a potato or corn product before cooking thereof. It would have been obvious that the addition of amino acid will reduce the acrylamide level in the cooked food product since the amount of the amino acid in BECK is within applicant's claimed range.

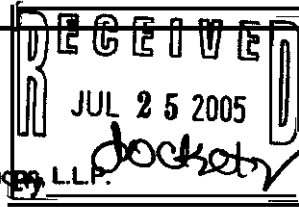
Claims 1-49 meet the criteria set out in PCT Article 33(4) since the claimed process is used to make an edible food product.

From the INTERNATIONAL BUREAU

PCTINFORMATION CONCERNING ELECTED
OFFICES NOTIFIED OF THEIR ELECTION

(PCT Article 31(7) and Rule 61.3)

To:

CAHOON, Colin, P.
Carstens, Yee & Cahoon, L.L.P.
P.O. Box 802334
Dallas, TX 75380
ETATS-UNIS D'AMERIQUE

Date of mailing (day/month/year) 14 July 2005 (14.07.2005)		IMPORTANT INFORMATION	
Applicant's or agent's file reference CFLAY.00178P			
International application No. PCT/US2004/003375	International filing date (day/month/year) 06 February 2004 (06.02.2004)	Priority date (day/month/year) 21 February 2003 (21.02.2003)	
Applicant FRITO-LAY NORTH AMERICA, INC. formerly known as RECOT, INC. et al			

1. The applicant is hereby informed that the International Bureau has, according to Article 31(7), notified each of the following Offices of its election:

EP: AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR
National: BG, CA, CN, CZ, DE, JP, KP, KR, MN, NO, PL, RO, RU, SK, US

2. The following Offices have waived the requirement for the notification of their election; the notification will be sent to them by the International Bureau only upon their request:

AP: BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW

EA: AM, AZ, BY, KG, KZ, MD, RU, TJ, TM

OA: BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG

National: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BR, BW, BY, BZ, CH, CO, CR, CU, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, KE, KG, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MW, MX, MZ, NA, NI, NZ, OM, PG, PH, PT, SC, SD, SE, SG, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW

3. Since the election(s) was (were) made after the expiration of 19 months from the priority date, the applicant is reminded that he must, subject to the following paragraph, enter the national phase within 20 months from the priority date (or later in some Offices) before some of the designated Offices in respect of which Article 22(1), as modified with effect of 1 April 2002, does not apply, by paying the national fee(s) and furnishing, if prescribed, a translation of the international application.

However, in respect of most other designated Offices, the time limit of 30 months (or later) may nevertheless apply. See the Annex to Form PCT/IB/301 and, for details about the applicable time limits, Office by Office, see the *PCT Applicant's Guide*, Volume II, National Chapters, the *PCT Newsletter* and the WIPO Internet site, updated regularly.

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Authorized officer

Ellen Moyse

Facsimile No. +41 22 740 14 35

Facsimile No. +41 22 338 89 75

Form PCT/IB/332 (January 2004)

Este recibo debe ser utilizado
Únicamente para tramites de
Mario Delgado Echeverry e Hijos Ltda.
Marca: PCT FRIJO LAY
Expediente: _____

738

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO

NIT : 800176089-2

RECIBO OFICIAL DE CAJA : 05 - 63,841
FECHA : AGOSTO 23 DE 2005

SUPERINTENDENCIA Y COMERCIO
Radicación : 05005-01-01 15r51:56 Folios: 209
Fecha (IMP): 2005-08-23 15r51:56
Trámite : 011 PCT-PATENTE 379 PASA NUL1 411 PRESENAC
Dependencia: 2820 DIVISION DE NUEVAS OPERACIONES

CONSIGNACION

DEPOSITANTE	TIPO PAGO	BANCO	CUENTA	No. PAGO	FECHA PGO	Vr. PAGO
MARIO DELGADO ECHEVERRY	CONSIGNACION	BANCO POPULAR	050-00110-6	14464947	23/08/2005	9,894,000.00

C O N C E P T O

CANT.	RENTISTICO	CONCEPTO	TOTAL CONCEPTO
1	50005-01-01	SOLICITUDES	
		1 TRAMITES DE SOL. DE PATENTE DE IN	443,000.
		TOTAL :	443,000.00

SOM: CUATROCIENTOS CUARENTA Y TRES MIL PESOS

RESPONSABLE : _____

RECIBO DE CAJA APLICADO AL EXPEDIENTE No. _____

Marcas - Patentes
Modelos - Diseños
Nombres Comerciales - Enseñas
Propiedad Intelectual
Registros en el Exterior
Registros Sanitarios INVIMA - ICA
Acciones Judiciales - Administrativas
Derecho Comercial - Industrial
Asesoría - Contratos - Otros
Correspondencia a Nivel Mundial



Bogotá D.C. - Colombia
Avda. 22 Park Way No. 37 - 31 Of. 202
Tels. (571) 2444098 - 3890824
Fax (571) 2442498 A.A. No. 8207
E-mail: mde@mdelaw.com

Marío Delgado Echeverry e Hijos Ltda.

Miembros ACPI - ASIP - AIPPI

Abogados Consultores - Marcas y Patentes

The Undersigned, Thomas P. Schur, citizen, adult, and living in Dallas, Texas, United States, in my position of legal Representative of the company Frito-Lay North America, Inc., with its headquarters located at 7701 Legacy Drive, Plano, Texas 75024-4099, US, which is incorporated in the State of Delaware, United States, grant ample and sufficient power of attorney to: JAIME EDUARDO DELGADO VILLEGAS and/or CLEMENCIA DELGADO VILLEGAS, attorneys, adults, residing in Bogotá (Colombia), so that on our behalf and representation, carry out before your office all types of errands an especial procedures for the registration and renewal of all kinds of Product and Service trademarks, deposits of name and commercial logotype, industrial models and drawings, invention patents, utility models, integrated circuits, name of domain, Copyrights, plant varieties, agricultural, veterinary and sanitary registries, capacity certificates, renewal, modification, transfer, assignment and expansions and to be responsible as general attorneys, for the supervision of all matters related to industrial and Intellectual property, being empowered to present and withdraw objections, to present appeals, to request testimonies, to receive documents, to pay legal fees, to approve exploitations, to agree on transactions on trademark agreements with third parties of legal entities, to abandon action, to substitute and to carry out all the necessary actions before any administrative authority of the aforementioned purposes in the event that such procedures shall be transferred unto a judicial field, the legal representatives are authorized to act as plaintiff or defendant before the competent authorities, having an ample power to settle, to submit to arbitration, to waive, to present appeals and all other necessary special faculties.

For that purpose, I kindly request to grant ample powers to our attorneys, who shall be able to exercise the functions independently or collectively.

The present power of attorney revokes and cancels any other previous powers of attorney given by the Company in the territory of the Colombian Republic.

Sincerely,

Frito-Lay North America, Inc.

By: Thomas P. Schur
Thomas P. Schur, Assistant Secretary

Notarial Certificate:

The undersigned Notary Public certifies that the preceding signature reading Thomas P. Schur is authentic; that signer is Assistant Secretary of Frito-Lay North America, Inc. of Plano, Texas, United States, and that he is empowered to grant this power, and that said Company exists and is duly organized in accordance with the laws of the State of Delaware, United States.

All the foregoing facts are known to the Notary due to his/her having examined the respective documents to which he/she, the Notary, attests.

Granted and signed at Plano, Texas, on July 20, 2004.

Cynthia L. Huddleston
Notary Public, State of Texas
My Commission Expires: 10-22-05

This Power of Attorney should be authenticated with the filed Notarial certificate and legalized by Apostille or by the Colombian Consulate.

Atentamente se dirige a Usted

ciudadano _____ mayor y vecino de _____ para manifestarle que en mi condición de Representante legal de la firma _____ domiciliada en _____ y constituida inicialmente en _____

conflero poder general, amplio y suficiente a los Dres. JAIME EDUARDO DELGADO VILLEGAS, y/o CLEMENCIA DELGADO VILLEGAS, Abogados, mayores y vecinos de Bogotá, D.C. (Colombia), para que en nuestro nombre y representación adelanten ante Ustedes toda clase de diligencias y procedimientos especiales para el Registro y Renovación en su Despacho, de toda clase de Marcas de Producto y Servicio, Depósitos de Nombre y Enseña Comercial, Diseños Industriales y Patentes de Invención, Patentes modelo de Utilidad, Esquemas de Circuitos integrados, Nombres de dominio, Derechos de Autor, Variedades vegetales, registros agrícolas, veterinarios y sanitarios, certificados de capacidad, renovación, modificación, traspaso y ampliación de los mismos y atiendan como Apoderados generales todo asunto referente a la Propiedad Industrial e Intelectual, quedando facultados para presentar y retirar Oposiciones, interponer recursos, solicitar testimonios, recibir documentos, cancelar costos legales, probar explotaciones, aceptar transacciones, llegar a acuerdos mercantiles con terceras personas o entidades jurídicas, desistir, sustituir y hacer cuanto fuere necesario ante cualquier autoridad administrativa para los fines arriba indicados; y en caso de que el procedimiento debiera pasar a conocimiento judicial, quedan facultados para actuar como demandantes o demandados ante los Jueces que sean competentes, con poder amplio, pudiendo transar, someter a árbitros, desistir, interponer recursos y con todas las demás facultades especiales que fueren necesarias.

Con éte objeto, ruego le confieran personería suficiente a nuestros Apoderados quienes podrán obrar en forma conjunta o independiente.

El presente poder revoca y cancela cuantos poderes se hubieren otorgado por la Compañía con anterioridad a esta fecha en el territorio de la República de Colombia.

Atentamente,

C.C.

Certificación Notarial:

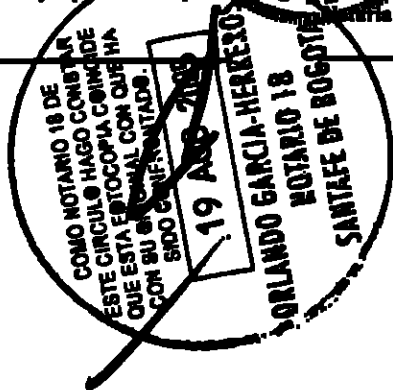
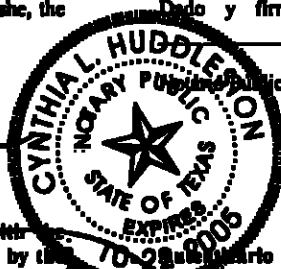
El infrascrito Notario Público certifica que la firma que antecede y dice _____ es auténtica: que el firmante es _____ de _____

que tiene facultad para otorgar este poder y que dicha compañía existe y está debidamente organizada de conformidad con las Leyes de _____

Todos los hechos anteriores le constan por haber examinado los documentos respectivos y de todo ello da fe.

Dado y firmado en _____ el _____ de _____ de 2004

Notario Público.





The State of Texas

Secretary of State

APOSTILLE

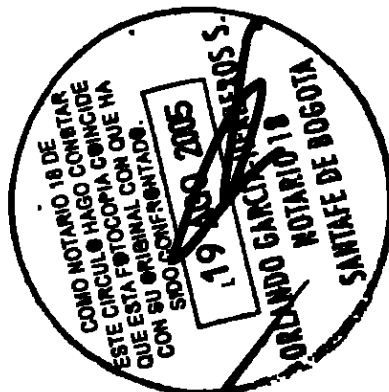
(Convention de La Haye du 5 Octobre 1961)

1. Country: United States of America
- This public document
2. has been signed by CYNTHIA L HUDDLESTON
3. acting in the capacity of Notary Public, State of Texas

4. and bears the seal/stamp of CYNTHIA L HUDDLESTON, Notary Public,
State of Texas, Commission Expires: 10-22-05

CERTIFIED

5. at Austin, Texas
6. on July 23, 2004
7. by the Secretary of State of Texas
8. Certificate No. N-417700
9. Seal
10. Signature:

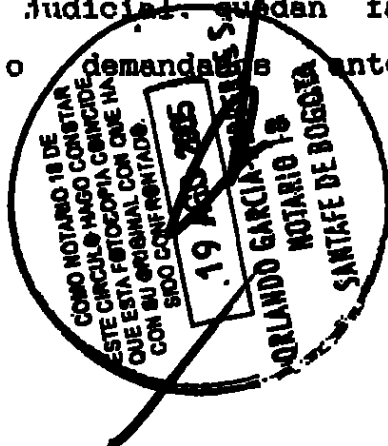


A handwritten signature in black ink, appearing to read "G. S. Connor".

Geoffrey S. Connor
Secretary of State
ST/wn

PODER

Atentamente se dirige a Usted Thomas P. Schur, ciudadano mayor y vecino de Dallas, Texas, Estados Unidos, para manifestarle que en mi condición de Representante legal de la firma Frito-Lay North America, Inc., domiciliada en 7701 Legacy Drive, Plano, Texas 75024-4099, Estados Unidos, confiero poder general, amplio y suficiente a los Doctores JAIME EDUARDO DELGADO VILLEGAS, y/o CLEMENCIA DELGADO VILLEGAS, Abogados, mayores y vecinos de Bogotá, D.C. (Colombia), para que en nuestro nombre y representación adelanten ante Ustedes toda clase de diligencias y procedimientos especiales para el Registro y Renovación en su Despacho, de toda clase de Marcas de Producto y Servicio, Depósitos de Nombre y Enseña Comercial, Diseños Industriales y Patentes de Invención, Patentes Modelo de Utilidad, Esquemas de Circuitos Integrados, Nombres de Dominio, Derechos de Autor, Variedades Vegetales, registros agrícolas, veterinarios y sanitarios, certificados de capacidad, renovación, modificación, traspaso y ampliación de los mismos y atiendan como apoderados generales todo asunto referente a la propiedad industrial e intelectual, quedando facultados para presentar y retirar Oposiciones, interponer recursos, solicitar testimonios, recibir documentos, cancelar costos legales, probar explotaciones, aceptar transacciones, llegar a acuerdos marcarios con terceras personas o entidades jurídicas, desistir, sustituir y hacer cuanto fuere necesario ante cualquier autoridad administrativa para los fines arriba indicados; y en caso de que el procedimiento debiera pasar a conocimiento judicial, quedan facultados para actuar como demandantes o demandados ante los Jueces que sean



GABRIEL FLORES CHADID
Traductor e Interpreté Oficial
Act. 2000 de 1992 del Min. de Justicia
Min. de Relaciones Exteriores

competentes, con poder amplio, pudiendo transar, someter a árbitros, desistir, interponer recursos y con todas las demás facultades especiales que fueren necesarias.

Con éste objeto, ruego le confieran personería suficiente a nuestros Apoderados quienes podrán obrar en forma conjunta o independiente.

El presente poder revoca y cancela cuantos poderes se hubieren otorgado por la Compañía con anterioridad a esta fecha en el territorio de la República de Colombia.

Atentamente, Firmado por: Thomas P. Schur
Secretario Adjunto de Frito-Lay North America, Inc.

Certificación Notarial:

El infrascrito Notario Público certifica que la firma que antecede y dice THOMAS P. SCHUR es auténtica: que el firmante es SECRETARIO ADJUNTO de FRITO-LAY NORTH AMERICA, INC., que tiene facultad para otorgar este poder y que dicha compañía existe y está debidamente organizada de conformidad con las Leyes del Estado de Delaware, Estados Unidos.

Todos los hechos anteriores le constan por haber examinado los documentos respectivos y de todo ello da fé.

Dado y firmado en Plano, Texas. a los 20 días del mes de Julio de 2004.

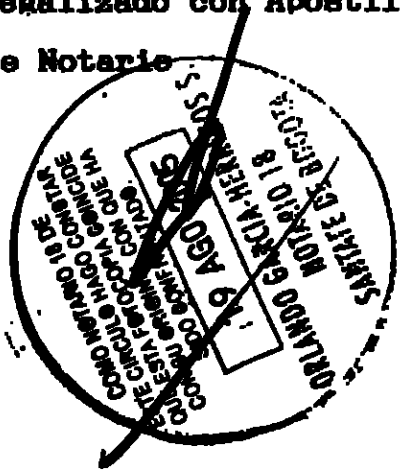
Firmado y Sellado por: Notario Público

Estado de Texas, Condado de Collin

CYNTHIA L. HUDDLESTON

Fecha de Vencimiento: 10-22-2005

Este poder debe ser legalizado con Apostille. Favor reducir a Escritura Pública ante Notario



GABRIEL RUEDA GUTIÉRREZ
Traductor e Interprete Oficial
Pase. 0000 de 1992 del Min. de Justicia
Min. de Relaciones Exteriores

207 206

ESTADO DE TEXAS

Secretario de Estado

APOSTILLE

(Convention de La Hays du 5 Octobre 1961)

1. País: Estados Unidos de América

El presente documento público...

2. ha sido firmado por CYNTHIA L. HUDDLESTON

3. en su condición de Notario Publico, Estado de Texas,

4. lleva el sello/estampilla de CYNTHIA L. HUDDLESTON,

Notario Publico, Estado de Texas. Fecha de Vencimiento de la
Comisión Notarial: 10-22-05.

SE CERTIFICA

5. en Austin, Texas

6. el día 23 de Julio del 2004

7. por el Secretario de Estado de Texas

8. Certificado No. N-417700

9. Sello

10. Firma:

Geoffrey S. Connor

Secretario de Estado

La anterior es Traducción Oficial de un documento presentado originalmente en inglés. Esta traducción fue realizada por GABRIEL RUEDA CHADID (Traductor Oficial). Resolución 5996 del MinJusticia, por lo cual estampo mi Sello y Firmo.

Bogotá D.C.



TRADUC. TÉCNICAS
DE COLOMBIA
NIT 17.124.146.A

MINISTERIO DE RELACIONES
EXTERIORES

Carretera del pueblo
55509

COYA FIRMA APARECE EN EL
DOCUMENTO DESEMPEÑA
LAS FUNCIONES INDICADAS

NO SE ASUME
RESPONSABILIDAD DEL TEXTO

2004 ABR 13 A 9 48

JEFE DE LEGALIZACIONES
SANTAFE DE BOGOTA D.C.



REQUISITOS NECESARIOS PARA PRESENTACION Y AGILIZACION DEL TRAMITE

	USUARIO	RADICADOR
PATENTE DE INVENCION ☒	()	()
- Indicación de que se solicita la concesión de una patente.	()	()
- Datos de identificación del solicitante o de la persona que se presenta la solicitud.	()	()
- Descripción de la invención.	()	()
- Dibujos de ser estos pertinentes.	()	()
- Comprobante de Pago de las tasas establecidas.	()	()

COMPLETA () **INCOMPLETA** ()

DISEÑO INDUSTRIAL ()

- Indicación de que se solicita el registro de Diseño Industrial	()	()
- Datos de identificación del solicitante o de la persona que presenta la solicitud.	()	()
- Representación gráfica o fotográfica del Diseño Industrial o muestra del Material que incorpora el diseño.	()	()
- Comprobante de pago de las tasas establecidas	()	()

COMPLETA () **INCOMPLETA** ()

ESQUEMA DE TRAZADO ()

- Indicación de que solicita el registro de un Esquema de trazado.	()	()
- Datos de identificación del solicitante o de la persona que presenta La solicitud.	()	()
- Representación gráfica del esquema de trazado	()	()
- Comprobante de pago de las tasas establecidas.	()	()

COMPLETA () **INCOMPLETA** ()

Firma Responsable:

Fecha:

Folio _____

2020
Bogotá DC

Doctor
JAIME EDUARDO DELGADO VILLEGAS
Apoderado
FRITO – LAY NORTH AMERICA. INC. RECOT, INC.

REFERENCIA:	Radicación No.	05-91265
	Solicitud Internacional	PCT/US2004/03375
	Fecha inicio fase nacional	21-09-2005
	Trámite	011
	Evento	379
	Actuación	416
	Oficio No.	799
	Folios	001

Teniendo en cuenta que la solicitud de privilegio de patente que se tramita bajo el expediente indicado en la referencia, reúne los requisitos de forma establecidos en la Decisión 486 de la Comisión de la Comunidad Andina, el Tratado de Cooperación en Materia de Patentes (PCT), el Reglamento y la Circular Única de la Superintendencia de Industria y Comercio, se envía el extracto de la solicitud a la Oficina de Comunicaciones para efecto de su publicación en la Gaceta de Propiedad Industrial.

Cúmplase
Dado en Bogotá DC

21 OCT. 2005



ALIX CARMENZA CÉSPEDES DE VERGEL
Jefe de la División de Nuevas Creaciones

202030