

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO



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Doctor

José Luis Salazar

Director de Nuevas Creaciones (E)

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO

E. _____ S. _____ D. _____

Referencia: Expediente No. **06.066.897**

Solicitud de Patente de Invención titulada: "Método para hacer un sustrato alimenticio con doble textura que tenga pedazos grandes condimentados"

Solicitante: Frito-Lay North America, Inc.

RESPUESTA AL AUTO NOTIFICADO POR FIJACIÓN EN LISTA NO. 309

DEL 3 DE SEPTIEMBRE DE 2010, OFICIO NO. 11282 (EXAMEN DE FONDO)

ÁLVARO CORREA ORDÓÑEZ, mayor de edad y vecino de Bogotá D.C., identificado tal como aparece al pie de mi firma, en mi carácter de apoderado de la sociedad en referencia, doy respuesta al auto emanado por ese Despacho dentro del término de prórroga solicitado mediante memorial 06.066.897 00006-0000 de fecha 11 de octubre de 2010:

1. Objeciones del Examinador

1.1 De la solicitud de patente

1.1.1. Descripción

Dice su Despacho que la traducción de la solicitud resulta muy literal y que por lo tanto es muy difícil de leer. Sugiere una revisión.

Se mencionan como ejemplo las expresiones “toppings” que se debería traducir como “ingrediente” o “cubierta”.

Menciona, además, que la expresión “transición al vidrio” no existe y que la expresión correcta es “transición vítrea”.

Anota, también, que la expresión equivalente de destrosa” realmente debe ser “equivalente de dextrosa”.

Finalmente observa que la palabra “hidroscópico” no existe, pero si la palabra “higroscópico”.

También se objetan las expresiones: “Ácido nucléico Aw fresco”, “actividad de agua fresca”, “carbohidrato comestible que se somete a cambio de transición a vidrio”, “a una temperatura de adhesivo”, “en donde dicho segundo recubrimiento por lo menos un humectante”, “comprende un análogo a queso”, “tiene un espacio vacío”, etc.

1.1.2. Reivindicaciones

Dice su Despacho que la traducción de la solicitud resulta muy literal y que por lo tanto es muy difícil de leer. Sugiere una revisión.

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Su Despacho también anota que: el solicitante utiliza la expresión “adhesivo seco” para referirse a jarabe de maíz u otros como dextrosa, dextrina o maltodextrosa. Considera su Despacho que dichos compuestos no pueden catalogarse como adhesivos *per se* dado que tienen múltiples usos en la industria de alimentos. Sugiere por lo tanto eliminar la expresión “adhesivo seco” de las reivindicaciones.

Considera, además, su despacho que frases y palabras ambiguas como “sustancialmente” y “cerca de” no deben utilizarse en las reivindicaciones.

Considera incorrecta la expresión “actividad de agua fresca”.

También considera que la expresión “actividad de agua en caliente” es ambigua.

Su despacho opina que el solicitante coloca como sinónimas las expresiones “cocción” y “horneado” siendo procesos diferentes. Por lo tanto sugiere la revisión del término especialmente en la reivindicación 4.

Se considera que la expresión “pendientes de sorción” no están enmarcadas dentro de un contexto y no son expresiones de uso explícito sino que están asociadas a diversas variables y por lo tanto sugiere modificar dicha expresión por alguna otra que se relacione en la descripción y que exprese que a una misma temperatura y a determinada actividad de agua un alimento absorbe más agua que otro.

Sugiere corregir la expresión “queso análogo” por “análogo del queso”.

Finalmente considera que tal como se encuentra redactado el capítulo, el producto de la reivindicación 26 no necesariamente se produce con el proceso de las primeras reivindicaciones. Se considera que si bien coinciden algunas variables no es necesario que dicho producto pase por el proceso relacionado inicialmente. Se sugiere, por lo tanto, hacer

dependiente la reivindicación 26 de la 1.

2. Argumentos a favor de la patentabilidad de la solicitud

2.1 De la solicitud de patente

De acuerdo con las observaciones planteadas por su Despacho en cuanto a algunos defectos de la traducción, se ha procedido a hacer una detallada revisión de los textos de la descripción y reivindicaciones los cuales se allegan corregidos de acuerdo con su solicitud.

A pesar de lo anterior, el solicitante desea hacer algunos comentarios a las observaciones planteadas:

En relación con la observación a la expresión “adhesivo seco”, el solicitante desea manifestar que no es claro el por qué de la misma. El solicitante desea, además, mencionar que la descripción es clara cuando se establece que el uso de jarabes de maíz u otros carbohidratos aceptables da como resultado preferiblemente la aplicación como adhesivo seco. De tal forma que varios adhesivos secos similares a los descritos son, también, aceptables como tales.

Por favor note patentes Estadounidenses como la 7.074.446 y la 5.298.268 en donde se utiliza tal expresión en el mismo sentido y nunca se recibió una observación como la presente. La aplicación que se reivindica para tales sustancias en la presente invención es claramente como adhesivo seco. Además la expresión adhesivo seco y los potenciales compuestos que se pueden utilizar se describen con suficiencia en la descripción. Un experto en la técnica no tendrá ninguna dificultad en entender el término “adhesivo seco” a la luz de la explicación y mención que se hace en la descripción presentada por el solicitante. Su Despacho la considera ambigua, sin embargo, el solicitante ha descrito de manera muy clara la invención, lo mismo que cómo y cuales tipos de compuestos se pueden utilizar como adhesivos secos. No obstante la anterior explicación y sólo con el objeto de hacer más expedito el trámite de la presente solicitud, el solicitante ha decidido modificar la expresión adhesivo seco por: “uno o mas de sólidos de jarabe de maíz, dextrina, maltodextrina, sacarosa y polidextrina”, tal y como se define en la descripción.

En cuanto a la observación relacionada con el hecho de que las expresiones “cocción” y “horneado” no son sinónimos, el solicitante desea manifestar a su Despacho que su apreciación es incorrecta.

Con el fin de demostrar su error el solicitante allega copia del significado del verbo “cocer” que presenta el diccionario de la Real Academia de la Lengua en donde en la segunda acepción establece:

2. tr. Somenter pan, cerámica, piedra caliza, etc., a la acción del calor en un horno, para que pierdan humedad y adquieran determinadas propiedades. (resaltado fuera de texto)

Por su parte en la definición de hornear el mismo diccionario dice:

1. tr. enhornar

Y en enhornar dice:

1. tr. Meter algo en el horno para asarlo o cocerlo. (resaltado fuera de texto)

De otro lado, el diccionario de sinónimos Signum en el sitio web: <http://www.diclib.com/hornear/show/en/signum/H/961/720/12/13/25442> establece como sinónimo del verbo “hornear”: asar, tostar, cocer, calentar, pasar, preparar. (resaltado fuera de texto).

De acuerdo con la anterior explicación resulta claro el error de su Despacho y solicita que se de cómo superada la objeción.

En relación con el término “pendiente de sorción” el solicitante considera que tal como se explica en toda la solicitud cuando se refiere a los problemas resueltos por la invención y sus beneficios:

"Los ingredientes alimenticios están típicamente incluidos en un paquete de alimentos herméticamente sellado y así un equilibrio aproximado con la humedad relativa con el interior del paquete. Se ha comprobado la dificultad de lograr un alimento de pasaboca con doble textura o con múltiple textura, en razón a que el ingrediente del alimento que tiene un contenido de humedad inferior y por lo tanto una textura crocante, típicamente absorbe la humedad evaporada proveniente del ingrediente de alimento que tiene un contenido de humedad mayor y de esta manera una textura más suave.

En la medida en que el ingrediente alimenticio con contenido de humedad inferior absorbe agua éste se vuelve menos crocante. En la medida en que el ingrediente alimenticio con contenido de humedad mayor pierde agua éste se endurece. Debido a esta migración de humedad es difícil lograr una vida de almacenamiento larga de los productos de pasabocas con doble textura."

...

"Este problema se empeora en productos alimenticios con cubierta de textura múltiple que requieren un adhesivo. Los sistemas adhesivos basados en agua utilizados sobre sustrato alimenticio impactan negativamente la textura en razón a que la hidratación y el subsecuente secado térmico destruyen las estructuras internas. Más aún, un adhesivo basado en agua deteriora el carácter crocante del fragmento, especialmente si se aplica en un estado acuoso, en razón a la migración de la humedad proveniente del adhesivo hacia el sustrato alimenticio."

...

"Una isoterma de sorción de humedad es una representación grafica de la relación entre el contenido de humedad de un ingrediente comestible que absorbe humedad y el A_w de ese ingrediente comestible a una temperatura particular constante. El eje X representa el A_w y el eje Y representa el porcentaje de humedad de los componentes comestibles principales. Un ejemplo de una isoterma de sorción de humedad del fragmento 202 y una isoterma de sorción del adhesivo 204 se han ilustrado en la **figura 2**. Una isoterma de desorción es una representación gráfica de la relación entre el contenido de humedad de un ingrediente alimenticio que pierde humedad y el A_w de ese ingrediente alimenticio a una temperatura particular constante. Una isoterma de desorción de humedad del análogo del queso estable al almacenamiento 206 se ha ilustrado en la **figura 2**. Como se ha usado aquí, la pendiente de sorción se define como la pendiente de la curva de sorción

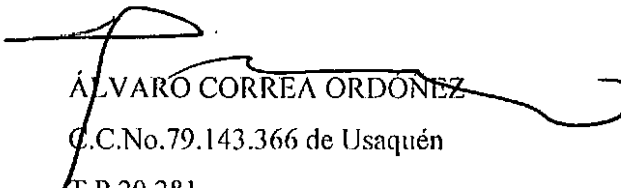
o desorción de un valor de actividad de agua particular. Entre más empinada la pendiente de sorción, mayor es la inclinación a absorber agua. De manera opuesta, entre más a nivel esté la pendiente, menor es la propensión de un ingrediente alimenticio a absorber agua."

Teniendo en cuenta la anterior explicación que aparece en la solicitud, se considera que un experto en la técnica entendería las reivindicaciones tal como se citaron. La presente invención mejora con los métodos luego de adherir trozos grandes saborizantes en partícula en un sustrato de alimento, mientras se le da una vida de almacenamiento larga al minimizar la migración de humedad. A pesar de la anterior explicación, se han hecho algunas modificaciones a la redacción de las reivindicaciones en donde dichas pendientes de sorción ya no se mencionan.

Finalmente la reivindicación 26 se ha hecho dependiente de la reivindicación 1 de acuerdo con lo solicitado.

En virtud de lo anterior, solicito que se acepten las razones expuestas en el presente documento y en consecuencia, se otorgue el privilegio de patente de invención para el invento que se tramita en este expediente.

Atentamente,



ÁLVARO CORREA ORDÓÑEZ
C.C.No.79.143.366 de Usaquén
T.P.20.281

- Anexos:
1. Capítulos Descriptivo y Reivindicatorio modificados
 2. Definiciones de los verbos "cocer", "hornear" y "enhornar" encontrados el Diccionario de la Real Academia
 3. Copia del resultado encontrado en el diccionario de sinónimos *Signum* en relación con el verbo "hornear".
 4. Copia de las Patentes US 7,074,446 y US 5,298,268

Anexo 1

Capítulos Descriptivo y Reivindicatorio modificados

MÉTODO PARA HACER UN SUSTRATO ALIMENTICIO CON
DOBLE TEXTURA QUE TENGA TROZOS GRANDES CONDIMENTANTES

ANTECEDENTES DE LA INVENCION

1. Referencia Cruzada a Solicitud Relacionada

Esta solicitud es una continuación en parte de la solicitud de patente U.S. Serie No. 10/696,970, presentada en octubre 30, 2003, cuya descripción técnica se incorpora aquí como referencia.

2. Campo Técnico

La presente invención se relaciona con un método para adherir pedazos, fragmentos, porciones o bocados tridimensionales a un sustrato y más particularmente, a un método para adherir pedazos de alimentos grandes tridimensionales a un sustrato de alimento de pasaboca por medio del cual los pedazos grandes se adhieren sustancialmente al sustrato. Más específicamente, la presente invención se relaciona con un método para elaborar un alimento de pasaboca con cubierta de doble textura.

3. Descripción de la Técnica Relacionada

Las partículas alimenticias se agregan a menudo a los alimentos, especialmente a los alimentos de pasabocas. Los fragmentos de tortilla, pretzels, crackers, palomitas de maíz, y

numerosos otros alimentos tienen a menudo condimentos aplicados a ellos durante el procesamiento. Los condimentos utilizados, usualmente en forma de polvo, han incluido la sal, el queso, el chile, el ajo, la especia Cajún, condimento ranchero, crema agria y cebolla, entre otros. Sin embargo, existe a menudo una acumulación indeseable de condimentos en las paredes laterales y el fondo de la bolsa de alimentos de pasabocas con el resultado de que el consumidor tiene menos que el complemento deseado de recubrimiento sobre este. La separación ocurre por la suficiente adhesión del condimento al fragmento. El problema de la separación se incrementa con el tamaño y peso de las partículas individuales.

Una manera en que se ha hecho una aproximación a este problema en el pasado fue al utilizar aceite como un adhesivo para adherir los condimentos en partículas a una base o sustrato. Por ejemplo, la Patente U.S. No.6,534,102 B2, de Kasemzadeh, describe un pedazo de condimento que, luego de la extrusión y cocido es inmerso en un aceite y suspensión de condimento a una temperatura elevada. El producto es luego recubierto en seco con condimentos o rociado con aceites y grasas en caliente o a temperatura ambiente que llevan los condimentos o los condimentos se aplican como polvo sobre la superficie mientras el aceite y las grasas se utilizan para adherir el condimento a la superficie. Un inconveniente de utilizar solamente aceite, sin embargo, es que la resistencia del adhesivo de las mezclas de aceite tradicionales no son suficiente fuertes para adherir los

pedazos tridimensionales grandes a una superficie de sustrato. En ciertas aplicaciones, pedazos tridimensionales grandes son deseables porque ellos le posibilitan a los fragmentos de pasabocas empacados emular otro producto de cubierta que incluye, pero no está limitado a pizza con ingredientes, un fragmento de nacho, o una tostada.

Otra composición de la técnica anterior utilizada para adherir partículas a productos alimenticios es la Patente No. 3,689,290 de *Blackenstock et al* que describe el uso de un agente de recubrimiento comprendido de sólidos de jarabe de maíz seco para adherir tamaños de partícula pequeños de cubiertas de alimento a un sustrato. La Patente de *Blackenstock* describe un tamaño de partícula de la cubierta del alimento como de malla 12-100, que corresponde a un rango de tamaño de partícula de 0.150 a 1.68 milímetros (0.0059 a 0.0661 pulgadas). De nuevo, estos son tamaños de partícula relativamente pequeños que se adhieren a un sustrato. El adhesivo no es lo suficientemente fuerte para adherir una cantidad substancial de partículas tridimensionales mayores a fragmentos.

La solicitud de Patente U.S. 2002/0187220 A1 describe un adhesivo en partícula comestible que comprende maltodextrina, un tensoactivo comestible, un disolvente, un polisacárido, y un almidón modificado. La invención, sin embargo, está claramente destinada a la adición de partículas muy pequeñas. La invención indica que el tamaño de partícula preferido es de menos de 650

micrómetros. Como otras invenciones de la técnica anterior, esta invención tampoco hace referencia a la adhesión de pedazos relativamente más grandes a fragmentos.

Otra composición de la técnica anteriormente utilizada para adherir saborizantes a un alimento se ilustra en la Patente Europea EP 815 741 A2 que describe una composición fundida en caliente que comprende un almidón, tal como jarabe de maíz, maltodextrina, o un almidón tratado con amilasa, y un plastificador tal como poliol o ácido poliacético. Como las otras invenciones, esta invención también fue diseñada para adherir aditivos en partículas tipo polvo a los alimentos tales como sal, azúcar, queso en polvo, y condimentos de aderezo con mayonesa. Como otras invenciones de la técnica anterior, esta tampoco muestra la adherencia de pedazos relativamente más grandes a fragmentos. Otra aproximación de la técnica anterior para adherir saborizantes y especias grandes de comida fue poner el saborizante sobre una galleta no horneada. Así, los saborizantes de queso y otras especias fueron entonces horneados dentro de la masa. Esta aproximación, sin embargo, no puede ser utilizada cuando es deseable adherir partículas a una pieza de pasabocas substancialmente horneada, tal como un fragmento de tortilla, inmediatamente antes de la adición del condimento.

Consecuentemente subsiste la necesidad de un método para adherir trozos, fragmentos, pedazos o pedacitos de condimento en partículas grandes a un sustrato de alimento. El método debe

permitirle a un alimento de pasaboca demostrar la apariencia, textura y sabor característico de un producto alimenticio que emule una cubierta que sea aún altamente resistente a la separación. El método debe ser adaptable a una línea de producto en donde la adición de las partículas grandes ocurra en una etapa posterior al cocimiento sustancial del sustrato alimenticio subyacente. Los ingredientes alimenticios están típicamente incluidos en un paquete de alimentos herméticamente sellado y así un equilibrio aproximado con la humedad relativa con el interior del paquete. Se ha comprobado la dificultad de lograr un alimento de pasaboca con doble textura o con múltiple textura, en razón a que el ingrediente del alimento que tiene un contenido de humedad inferior y por lo tanto una textura crocante, típicamente absorbe la humedad evaporada proveniente del ingrediente de alimento que tiene un contenido de humedad mayor y de esta manera una textura más suave.

En la medida en que el ingrediente alimenticio con contenido de humedad inferior absorbe agua éste se vuelve menos crocante. En la medida en que el ingrediente alimenticio con contenido de humedad mayor pierde agua éste se endurece. Debido a esta migración de humedad es difícil lograr una vida de almacenamiento larga de los productos de pasabocas con doble textura.

El contenido de agua de un ingrediente alimenticio se mide típicamente mediante su nivel de actividad de agua ("Aw"). La Aw se define por medio de la siguiente ecuación:

$$A_w = P/P_o$$

donde P = presión de vapor de agua en el alimento

P_o = presión de vapor de agua pura bajo las mismas condiciones

El A_w es una medida cuantitativa de agua libre no unida en un sistema que está disponible para apoyar reacciones biológicas y químicas. Dos diferentes ingredientes alimenticios con el mismo contenido de agua pueden variar significativamente en su nivel A_w dependiendo de cuánta agua libre se encuentre en el sistema. Si el contenido de agua es mayor, el ingrediente con textura suave tiene un ingrediente que excede la humedad relativa de su ambiente, entonces el agua tiende a evaporarse del ingrediente alimenticio originando que el ingrediente se endurezca. De manera similar, si existe un contenido de humedad inferior, la textura crocante tiene un A_w que es menor que la humedad relativa de su ambiente, entonces este tiende a absorber agua, originando que el ingrediente se suavice. Por ejemplo, considere una pieza de queso suave, que tenga un A_w de 0.92 ubicado sobre una galleta crocante que tenga una A_w de 0.10 en un recipiente sellado inicialmente al 50% de humedad relativa. Con el paso del tiempo la textura del queso suave se endurece y esta pierde agua y se aproxima al equilibrio con la atmósfera del recipiente. La textura de la galleta rizada, sin embargo, se suaviza en la medida en que ésta

absorbe esta humedad evaporada para aproximarse al equilibrio con la atmósfera del recipiente. Como resultado, ambos ingredientes alimenticios pierden su textura deseada. Más aún, además de los cambios de textura, los cambios en la humedad pueden conducir a otros efectos indeseables que incluyen crecimiento microbiano, reacciones de degradación, y cambios organolépticos.

Este problema se empeora en productos alimenticios con cubierta de textura múltiple que requieren un adhesivo. Los sistemas adhesivos basados en agua utilizados sobre sustrato alimenticio impactan negativamente la textura en razón a que la hidratación y el subsecuente secado térmico destruyen las estructuras internas. Más aún, un adhesivo basado en agua deteriora el carácter crocante del fragmento, especialmente si se aplica en un estado acuoso, en razón a la migración de la humedad proveniente del adhesivo hacia el sustrato alimenticio. Además, existe pérdida de sabor que da como resultado la sequedad de un sustrato alimenticio humedecido. Como se discutió previamente, los adhesivos basados en aceite no adhieren trozos de saborizante en partículas grandes a un sustrato alimenticio. Como resultado, ha sido difícil para los fabricantes de producto alimenticio empacar productos alimenticios con textura múltiple para almacenamiento con una duración de almacenamiento prolongada. En la técnica anterior se ilustran numerosos intentos de preservar características de doble textura de productos alimenticios.

La Patente U.S. No. 4,401,681 describe un método para prevenir la migración de la humedad proveniente de una fase de humedad alta a una fase de humedad baja. Por ejemplo, la patente describe combinar sólidos de jarabe de maíz que tengan un equivalente de dextrosa de 22 a 24 y alta metoxil pectina con una salsa de pizza para evitar que la humedad proveniente de la salsa emigre hacia la pasta de la pizza dura durante la vida de almacenamiento. Esta descripción, sin embargo, no enseña un método que minimice la transmisión de la humedad desde una textura más suave a una textura más crocante a través de un área que tenga un volumen dejado en la parte superior. Por el contrario la descripción está limitada a suministrar una capa de barrera directa entre dos ingredientes con contenidos de humedad con diferencial alto.

La Patente U.S. No. 4,853,236 describe un producto alimenticio de doble textura, estable al almacenamiento que tiene una primer textura dura que comprende una composición de fruta sobre una porción de concha, y una segunda porción de núcleo texturizado variable que comprende una emulsión de aceite en agua. Esta descripción no enseña ni una textura masticable exterior ni una textura crocante exterior de un producto alimenticio con cubierta.

La Patente U.S. 4,961,942, describe una composición de masa que tiene una pluralidad de texturas estables en almacenamiento. La patente describe, además, una masa de galleta de relleno

masticable, suave y una masa con recubrimiento exterior más firme en donde la masa de recubrimiento comprende un contenido de azúcar alto. Esta no describe una masa que pueda ser utilizada en pasabocas sabrosos.

La Patente No. 4,913,919, cedida al mismo cesionario de la presente solicitud, describe una composición de recubrimiento que comprende una suspensión acuosa con alto contenido de sólidos, que tiene un contenido de sólidos de al menos 40% de peso. La superficie exterior de un alimento de pasaboca se recubre con la solución acuosa. El recubrimiento se seca para suministrar una textura exterior crocante y una textura interior masticable. Esta descripción no enseña una textura masticable exterior.

La patente U.S. No. 5,405,625, describe un producto de pasaboca lleno con queso que tiene un recubrimiento exterior tostado que comprende hojuelas de papa y harina de arroz pre-gelatinizada. En una modalidad, el relleno es húmedo y el producto alimenticio de pasaboca se puede hornear u hornear en microondas sin el relleno de queso sobreexpandiéndose o chorreando. La descripción no enseña una textura crocante exterior.

La patente U.S. No. 6,500,474 describe utilizar un recubrimiento líquido calentado para recubrir adicionalmente un producto alimenticio prerecubierto y subsecuentemente poner en contacto la pieza alimenticia prerecubierta, cubierta con líquido

con un material en particular corto y grueso para formar un producto alimenticio adornado con un recubrimiento sustancialmente continuo corto y grueso. Esta descripción no enseña una textura crocante exterior.

De acuerdo con esto, subsiste la necesidad de un método para elaborar un producto alimenticio de pasaboca con cubierta, de doble textura, estable al almacenamiento que comprenda un sustrato alimenticio crocante y una cubierta masticable. El método debe utilizar un adhesivo no basado en agua y no basado en aceite que pueda adherir trozos de saborizante en partículas grandes a un sustrato alimenticio crocante sustancialmente cocido. El método debe minimizar la actividad de agua en los ingredientes del producto alimenticio y debe minimizar la migración de la humedad proveniente de la cubierta masticable al sustrato alimenticio crocante.

RESUMEN DE LA INVENCION

La invención propuesta utiliza una combinación de adhesivos en polvo seco mezclados sobre trozos y ubicados sobre un sustrato alimenticio y en donde, además, el adhesivo sufra una transición vítrea y fluya hacia abajo de trozo en trozo y punto de contacto del sustrato alimenticio. Subsecuentemente, las condiciones del proceso cambian, y el adhesivo sufre otra transición vítrea de regreso a un sólido amorfo que endurece el adhesivo y se adhiere al trozo de la superficie de sustrato de alimento.

De esta manera, la invención produce un método por medio del cual grandes pedazos de saborizantes se adhieren a un sustrato alimenticio de pasaboca para lograr la apariencia, textura, y sabor de un producto alimenticio que emula una cubierta. Además, el presente método suministra un recubrimiento que es altamente resistente a la separación. Además, el método se puede implementar luego de la cocción del sustrato alimenticio subyacente.

La invención suministra, además, un método que minimiza la migración de la humedad proveniente desde una cubierta con textura más suave hacia un sustrato alimenticio más crocante. Las propiedades del ingrediente del producto alimenticio se optimizan al suministrar al menos dos texturas distintas. Las propiedades del ingrediente del producto alimenticio optimizadas pueden ser el contenido de humedad, las actividades del agua, y las pendientes de sorción.

BREVE DESCRIPCIÓN DE LOS DIBUJOS

Las características novedosas que se consideran características de la invención se establecen en las reivindicaciones finales. La invención misma, sin embargo, así como también el modo preferido de uso, los objetivos adicionales y las ventajas de esta, se entenderán mejor con referencia a la siguiente descripción detallada de las modalidades ilustrativas

cuando se lean en conjunto con los dibujos que la acompañan, en donde:

La **figura 1** es una representación esquemática de una modalidad del nuevo proceso.

La **figura 2** es una representación gráfica que describe las isotermas de sorción de humedad para los ingredientes principales en una modalidad de la invención.

DESCRIPCIÓN DETALLADA

Una modalidad innovadora de la invención se describirá ahora con referencia a la **figura 1**. Los trozos condimentantes, saborizantes o ilustrativos **12** y un adhesivo **14** se mezclan en un mezclador o tambor de 30 pulgadas de diámetro **10**. Como se utilizan aquí, los trozos condimentantes grandes **12** son condimentos grado alimento en donde al menos el 5% en peso de los trozos, tienen un diámetro que excede 1.7 milímetros y están sustancialmente entre 1.7 y 17.0 milímetros de diámetro. En una modalidad preferida, el aceite vegetal **16**, preferiblemente a una temperatura de aproximadamente 23 a 32°C (74 a 90°F), es rociada en el tambor **10** para recubrir los trozos condimentantes **12** para funcionar como un adhesivo líquido temporal **16** y promover la unión entre el adhesivo seco **14** y los trozos condimentantes **12**. En una modalidad alternativa, el adhesivo líquido temporal **16** es calentado a una temperatura de aproximadamente 43 a 60°C (109 a

140°F) antes de ser rociado en el tambor 10. El adhesivo temporal 16 utilizado puede ser cualquier aceite adhesivo de la técnica anterior que incluye, pero no está limitado a, olestra®, aceite de maíz, aceite de soya, aceite de semilla de maíz, o aceite de palma. Alternativamente, un sustituto del aceite se puede utilizar como un adhesivo líquido temporal 16. El objetivo es recubrir los trozos condimentantes 12 para promover la unión con el adhesivo seco 14 durante la mezcla y hasta que el adhesivo seco 14 sufra una fase de transición vítrea. Se puede utilizar cualquier adhesivo líquido temporal 16 que cumpla este objetivo. Ejemplos de un sustituto del aceite que se podían utilizar como un adhesivo temporal incluyen, pero no están limitados a glicerol, propilenglicol, alcohol, y mezclas de estos. Un adhesivo líquido temporal 16 puede no ser necesario si el tamaño particular del adhesivo seco 14 es suficientemente pequeño, y/o los trozos individuales 12 son suficientemente porosos, y/o el trozo tiene un exterior higroscópico o aceitoso húmedo.

El tambor 10 es un dispositivo cilíndrico que rota y se utiliza típicamente para agregar condimentos a la circunferencia total del sustrato. En esta invención, sin embargo, el tambor se utiliza para mezclar el adhesivo 14 con el trozo condimentante 12. Así, aunque el tambor 10 se describe en esta modalidad, cualquier dispositivo equivalente que incluya pero no esté limitado a, un mezclador, un tambor que incluye un tambor de tanda, o un tambor continuo, o un mezclador tal como un mezclador de tanda, un mezclador continuo, o un mezclador de cinta se

pueden utilizar para mezclar el adhesivo **14** con el trozo de condimento. Como se utilizan en esta invención, un sustrato es sustancialmente cocido y puede ser un fragmento de alimento de pasaboca freído u horneado hecho de una masa, tal como masa de maíz u otra masa a base de almidón. Como se utiliza en esta invención los términos sustrato y fragmento se utiliza intercambiabilmente y se refieren a una amplia variedad de ítems de alimentos de pasaboca que son o que están comercializados comúnmente disponibles que incluyen, pero no están limitados a, papa a la francesa, galletas, fragmentos multigrano, fragmentos de maíz, y fragmentos de tortilla. En una modalidad de la presente invención, el sustrato comprende una primera textura que es crocante.

Los trozos condimentantes **12** que comprenden proteína vegetal texturizada, trozos vegetales saborizados, o trozos coloreados se encuentran comercialmente disponibles. Por ejemplo, Bac'n Pieces™ Bacon Flavored Bits se pueden comprar de McCormick® de Sparks, MD en muchas tiendas de abarrotes locales. Los trozos también pueden comprender harina de maíz o harina trigo, independientemente o en combinación. De esta manera, los trozos pueden consistir de proteína vegetal texturizada, harina de maíz, harina de trigo, y combinaciones de estos. En una modalidad, los trozos tienen un contenido de humedad preferiblemente de menos del 5%.

Luego de mezclar en el tambor 10, los trozos condimentantes 12 y el adhesivo 14 son entonces transferidos 22 a una primera unidad para cubierta 20. Se puede utilizar la unidad para cubiertas 20 elaborada por Raque, de Louisville, KY. Los Sólidos de Jarabe de Maíz se definen por la FDA como jarabes de glucosa seca en los cuales el contenido de azúcar reductor es equivalente a dextrosa 20 o mayor. En una modalidad, el adhesivo seco 14 utilizado comprende preferiblemente Sólidos de Jarabe de Maíz con un Equivalente de Dextrosa de más de 20 y más preferiblemente entre aproximadamente 20 y 50. Este rango de dextrosa equivalente puede dar como resultado una masticabilidad, brillo y endulzamiento reducido. Se pueden utilizar los Equivalentes de Dextrosa superiores a 50, pero dan como resultado mayor dulce, opuesto a un sabor salado. Otros numerosos adhesivos de carbohidrato también se pueden utilizar incluyendo, pero no estando limitados a dextrosa, dextrina, maltodextrosa, sacarosa, polidextrosa, y combinaciones de estos. Estos carbohidratos se pueden comprar de varios abastecedores que incluyen National Starch y Chemical Company of Bridgewater, New Jersey, Danisco Cultor of New Century, Kansas, y Tate & Lyle PLC localizado en Londres, Inglaterra. En una modalidad alternativa, se puede utilizar la maltodextrina, definida por la FDA como un jarabe de glucosa seca en la cual el contenido de azúcar reductor es menor de 20 Equivalentes de Dextrosa. El uso de maltodextrina, sin embargo, puede requerir el uso de vapor para activar el adhesivo. Al utilizar sólidos de jarabe de maíz en lugar de un adhesivo basado en agua o que requiera vapor, la textura del fragmento

crocante se preserva en razón a la hidratación y el subsecuente secado térmico se reduce grandemente. Así, el uso de sólidos de jarabe de maíz y otros carbohidratos aceptables da como resultado una aplicación adhesiva seca.

De nuevo, aunque esta invención se describe con referencia a un fragmento de tortilla frita, se puede utilizar cualquier sustrato de alimento que influya, pero no este limitado a, un fragmento, una galleta, un fragmento horneado, un pasaboca extruido, o un pasaboca hinchado. Antes de que el fragmento entre a la freidora 30, se hace la masa por medio numerosos métodos estándar bien conocidos en la técnica. Sin embargo, se puede hacer una combinación novedosa y única de modificaciones a la masa de la técnica anterior y/o a los ingredientes de masa para mejorar la tostabilidad del sustrato de cubierta subyacente. Por ejemplo, en una modalidad de fragmento de tortilla, se puede utilizar un molido mas grueso de maíz, preferiblemente hecho en el molino de maíz que tenga un espacio entre 0.0020 y aproximadamente 0.0030 milímetros, y más preferiblemente que tenga una espacio entre aproximadamente 0.0023 y aproximadamente 0.0026 milímetros. Un molido más grueso requiere menos corte cuando el maíz es molido y vuelto masa, disminuyendo la cantidad de gelatinización del almidón e incrementando la cantidad de partículas de maíz con molido mas grande en la masa de maíz. Las partículas mas grandes hacen que la textura del fragmento permanezca más gruesa lo que implica un fragmento más completo, más crujiente, y más crocante. Menos gelatinización aporta una

formación de película de superficie más delgada durante el freído. Además, tamaños de partícula de maíz mayores originan más alteraciones, aún más en una película de superficie más delgada. Cuando la masa se fríe, el agua de la masa puede escapar más fácilmente a través de estas alteraciones como vapor, dando como resultado un fragmento con un contenido de humedad inferior. El fragmento de contenido de humedad inferior da como resultado una textura más crocante. Además, el producto contendrá menos vapor generado dentro del fragmento durante el freído, lo cual a su vez reduce la cantidad y el tamaño de las vejigas superficiales producidas, resultando de esta manera en una textura más crocante. El almidón, preferiblemente entre aproximadamente 2% y aproximadamente 10% en peso de la masa, se puede agregar a la masa para absorber más agua durante la producción de masa de maíz. En una modalidad, se utiliza almidón de maíz ceroso. De nuevo, cuando esta agua es subsecuente liberada durante el freído, se crean más pequeñas y más numerosas vejigas dando como resultado una textura más crocante. Una harina baja en gluten, preferiblemente entre aproximadamente 2% y aproximadamente 35% en peso de la masa, se puede utilizar en la masa para las propiedades organolépticas. En una modalidad, se utiliza harina trigo.

Típicamente, un producto de masa es comprimido entre un par de rodillos laminadores contra rotatorios que están localizados cercanamente, suministrando de esta manera un punto de apretamiento a través del cual la masa se conforma en láminas. La

masa puede ser entonces cortada por, por ejemplo, un rodillo cortador para formar o para dar la forma del producto deseado. Alternativamente, la masa o masa de maíz es extruida y cortada en una forma de fragmento deseada. Después de que la masa o masa de maíz es cortada, los fragmentos son transportados hacia y a través de un horno tostador. Los fragmentos se deben tostar para lograr un contenido de humedad de pre-cocción entre aproximadamente 22% y aproximadamente 30%. Para esto, los fragmentos son depositados sobre una correa transportadora. Después del tostado, los fragmentos conformados tienen una rigidez mayor para la inserción en el freidor 30. En una modalidad, los fragmentos tostados, antes de ser freídos son pasados a través de una etapa de prueba donde los fragmentos son expuestos al aire ambiente durante una cantidad específica de tiempo para equilibrar la humedad. Después de la prueba, los fragmentos son transferidos al freidor 30. Para transportar los fragmentos hacia un freidor 30, los fragmentos son removidos de la correa o el transportador tostador y ubicados en un transportador freidor 32. En razón a que el sustrato plano facilita la aplicación homogénea de los trozos condimentantes 12, en la modalidad preferida, un freidor monocapa 30 se utiliza para ayudar a asegurar un sustrato plano y minimizar el rizamiento del fragmento. El freidor monocapa 30 tiene dos correas; una correa superior y una correa inferior. El sustrato se ubica entre dos correas en la medida en que este se mueve a través del freidor 30. El sistema de dos correas minimiza el rizado del fragmento y mantiene el fragmento plano en la medida en que este se mueve a

través del freidor. El fragmento, en el ejemplo del fragmento de tortilla, esta en el freidor monocapa durante un tiempo de cocción de cerca de 52 a 56 segundos a una temperatura entre 170-207°C (338 - 404°F). Una freidora monocapa también suministra un freído más uniforme y por lo tanto permite que los fragmentos produzcan ampollas consistentes y un contenido de humedad final más uniforme y más bajo. Como se usa aquí, un contenido de humedad de salida es el contenido de humedad luego del cocido del sustrato alimenticio. En una modalidad, el contenido de humedad de salida de un fragmento freído en una monocapa es preferiblemente entre cerca de 0.5 a cerca de 1.0%. El freído en tanda, por otro lado, resulta en un contenido variable de humedad, formación de ampollas y contenidos de aceite de terminado. Más aún, los contenidos de humedad de salida del estado de la técnica típicamente exceden 1.0%. Un contenido de humedad de salida más bajo resulta en un fragmento más crocante. Adicionalmente, un fragmento con contenido de humedad más bajo, más seco, comprende mas aceite superficial que aceite interior. Este aceite superficial ayuda a proteger los fragmentos de la absorción de exceso de humedad durante el proceso de formación de cubierta (discutido más adelante). En una modalidad alternativa, se puede utilizar cualquier freidor **30** conocido en la técnica. Después de salir del freidor **30**, el sustrato continúa a lo largo de una cinta transportadora de malla abierta **42** y se enfría a aproximada 100°F a 150°F. Debido a que esta temperatura todavía está por encima del ambiente, la migración de humedad sobre el sustrato del fragmento se retarda. Aunque se describen numerosas

modificaciones para ilustrar una modalidad preferida, la esencia de la invención puede lograrse con menos de todos los ingredientes de la masa y las modificaciones de procesamiento descritas, en la medida que aquellos versados en la técnica es probable que lo reconozcan. Después de que el fragmento se ha freído, los trozos condimentantes **12** y adhesivo **14** son entonces aplicados **24** al fragmento por medio de una unidad para cubierta **20** u otros medios para cubierta.

El fragmento es entonces enviado a un primer horno **40**. Un horno de choque tal como el modelo MDJ-45AS-1, fabricado por Heat and Control, Inc., de Hayward, CA puede ser usado como el primer horno. El fragmento es transportado por el primer horno **40** sobre una cinta transportadora de malla abierta durante aproximadamente 17 segundos. La temperatura elevada del horno, preferiblemente cerca de 190 a 232 ° C (374 a 450 ° F), sirve para disparar la fase de transición vítrea del adhesivo seco **14** sobre el sustrato. En una modalidad, el vapor **44** entre 6.9 y 34.5 kPa (1 y 5 psi) se inyecta en el primer horno **40** para acelerar la activación del adhesivo seco **14** al disminuir la temperatura de transición vítrea del adhesivo por medio de la adición del vapor de agua. En esta modalidad, el trozo entonces sale del primer horno **40** a lo largo de la cinta transportadora de malla abierta **52** hacia un segundo horno **50** para retirar la humedad agregada en el primer horno como vapor. En el segundo horno **50**, el fragmento continúa sobre una cinta transportadora de malla abierta durante aproximadamente 17 segundos a una temperatura elevada que varía entre cerca de 190 a

232°C (374 a 450°F). El segundo horno 50 puede ser un modelo idéntico al del primer horno 40.

En una modalidad alternativa, solamente un horno, sin vapor, se usa para disparar la fase de transición vítrea del adhesivo seco. En tal modalidad, la temperatura del horno permanece igual alrededor de 190 a 232°C (374 a 450°F). Adicionalmente, el tiempo total de permanencia también permanece igual cerca de 34 segundos. En modalidades alternativas, se podrían utilizar tiempos de permanencia más largos o más cortos y temperaturas más altas o más bajas. El tiempo de permanencia y la temperatura requieren solo ser suficientes para promover un cambio de transición vítrea en el adhesivo seco 14. Un horno de choque AirForce®, fabricado por Heat & Control, Inc. De Hayward, CA, puede ser usado como una modalidad de horno único. Como se ha usado aquí, un medio de adherencia para adherir un trozo condimentante a un sustrato se entiende que incluye cualquier mezcla de carbohidrato comestible que se somete a un cambio de transición vítrea a una temperatura del adhesivo (opuesta al horno) entre 40 y 60°C cuando el adhesivo tiene un contenido de humedad que está entre 4 a 8%. Como lo saben aquellos versados en la técnica, el rango de la temperatura de transición vítrea del adhesivo seco 14 cambia en relación con el contenido de humedad. Entre más alto el contenido de humedad, más bajo es el rango de temperatura de transición vítrea. De manera opuesta, entra más bajo sea el contenido de humedad, mayor es el rango de temperatura de transición vítrea. Así, si el contenido de la

humedad del adhesivo es elevado por encima o por debajo de 4 a 8% entonces el rango de temperatura de transición vítrea correspondiente cambiará también. Sin embargo, tales cambios deben ser considerados como dentro del espíritu y alcance de la invención reivindicada.

El fragmento entonces sale del segundo horno **50** sobre la cinta transportadora de malla abierta **72** en donde comienza a enfriarse. En una modalidad, el fragmento se enfría durante aproximadamente 30 segundos. El adhesivo seco **14** se endurece al enfriarse para influir en un pegado fuerte entre los trozos condimentantes **12**, la cubierta y el sustrato.

En una modalidad, las etapas de agregar y calentar los trozos condimentantes **12** por encima de la temperatura de transición vítrea del adhesivo seco **14** y luego permitir que los trozos condimentantes **12**, el adhesivo **14**, y el sustrato de enfrien por debajo de la temperatura de transición vítrea **14** del adhesivo se podría repetir para formar un fragmento multicapa. Al repetir estas etapas, dos o más capas de porciones condimentantes **12** se podrían agregar a un único sustrato o fragmento.

En una modalidad preferida de la invención, un segundo ingrediente, preferiblemente, pero no necesariamente en la forma de trizas de queso, hubo un ingrediente similar a queso, o un ingrediente de queso es entonces aplicado al sustrato cubierto con los trozos por medio de una segunda unidad para cubierta **60**.

A diferencia de la primera cubierta que comprende los trozos, la segunda cubierta tiene una temperatura de fusión más baja que los trozos condimentantes **12** de la primera cubierta y no se requiere adhesivo adicional para adherir la segunda cubierta al sustrato. En una modalidad, la segunda cubierta tiene una segunda textura que comprende una textura más suave que la primera textura del sustrato crocante. Un análogo del queso estable al almacenamiento descrito en la solicitud de patente estadounidense serie número 10/649,825 y cedida a Kerry Specialty Ingredients de Beloit, WI se puede usar como la segunda cubierta.

La figura 2 es una representación gráfica que ilustra las isotermas de sorción y desorción de humedad para los ingredientes principales en una modalidad de la invención. Una isoterma de sorción de humedad es una representación grafica de la relación entre el contenido de humedad de un ingrediente comestible que absorbe humedad y el A_w de ese ingrediente comestible a una temperatura particular constante. El eje X representa el A_w y el eje Y representa el porcentaje de humedad de los componentes comestibles principales. Un ejemplo de una isoterma de sorción de humedad del fragmento **202** y una isoterma de sorción del adhesivo **204** se han ilustrado en la **figura 2**. Una isoterma de desorción es una representación gráfica de la relación entre el contenido de humedad de un ingrediente alimenticio que pierde humedad y el A_w de ese ingrediente alimenticio a una temperatura particular constante. Una isoterma de desorción de humedad del análogo del queso estable al almacenamiento **206** se ha ilustrado en la **figura**

2. Como se ha usado aquí, la pendiente de sorción se define como la pendiente de la curva de sorción o desorción de un valor de actividad de agua particular. Entre más empinada la pendiente de sorción, mayor es la inclinación a absorber agua. De manera opuesta, entre más a nivel esté la pendiente, menor es la propensión de un ingrediente alimenticio a absorber agua. Así, es ventajoso para los ingredientes alimenticios de textura más suave y masticable que tengan una pendiente de sorción más empinada que los ingredientes alimenticios crocantes para controlar la migración de humedad. Por ejemplo, en una modalidad, la pendiente de sorción de adhesivo **204** es más empinada que la pendiente de sorción del fragmento **202**. En razón de la pendiente de sorción más empinada del adhesivo **204**, el adhesivo ayuda a amortiguar la toma de humedad por el sustrato. Por lo tanto, en una modalidad, la pendiente de sorción **206** del sustrato de fragmento crocante es siempre menos empinada que la pendiente de sorción del queso **202** y frecuentemente menos empinada que la pendiente de sorción del adhesivo **204**.

La segunda cubierta del análogo del queso comprende un Aw fresco entre 0.40 y cerca de 0.50 y un Aw calentado entre 0.30 a 0.40 y comprende una pendiente de desorción más empinada que la pendiente de sorción de la base crocante como se ilustró por la **figura 2**. El Aw fresco es el Aw del queso antes de que el queso se funda. El Aw calentado es el Aw del queso después de que el queso se ha sido fundido sobre el sustrato crocante (discutido más abajo). Más aún, se puede usar por lo menos un humectante en

la segunda cubierta para inhibir adicionalmente la migración de humedad desde la segunda cubierta suave. Un humectante es un ingrediente que promueve la absorción y retención de humedad. Los humectantes que pueden ser usados incluyen, pero no se limitan a, glicerina, propilenglicol, lactato de sodio y acetato de sodio. Además, otros sistemas de ligado de agua tales como la celulosa pueden ser usados también en la segunda cubierta. La segunda cubierta puede comprender, por lo menos, un humectante entre cerca de 10% a cerca de 40%, celulosa entre cerca de 1% a cerca de 5%, o combinaciones de estos con base en el peso de la segunda cubierta.

Haciendo de nuevo referencia a la Figura 1, la segunda unidad para cubierta 60 puede ser un modelo igual y del mismo tipo al de la primera unidad para cubierta 20. Luego de la aplicación de la segunda cubierta, el fragmento es entonces enrutado a un tercer horno 70. El tercer horno 70 es preferiblemente un Raymax 1525 infrarrojo, fabricado por Watlow Electric Manufacturing Company de San Luis, MO. El fragmento es enrutado hacia el tercer horno 70 sobre una cinta transportadora de malla abierta 72. El fragmento continúa por el tercer horno 70 durante un tiempo de permanencia de aproximadamente 60 segundos con una temperatura de horno de alrededor de 82 a 138°C (180 a 280°F). En una modalidad alternativa, se podrían usar los tiempos de permanencia más cortos o más largos y las temperaturas más altas o más bajas. El tiempo de permanencia y la temperatura requiere solamente ser suficiente para fundir el segundo conjunto

de cubierta. El fragmento entonces sale del tercer horno 70 sobre una cinta transportadora de malla abierta 92 en donde es rociada con un aceite atomizado u otros líquidos adhesivos tanto en la parte superior como la parte inferior. A diferencia del adhesivo temporal 16, el objetivo con este líquido adhesivo es suministrar un adhesivo más permanente para ligar un condimento con el fragmento y la cubierta. Se puede utilizar un aplicador por rociado de aceite 80 fabricado por GOE-Avins de Amherst, NY, modelo #=SM-5000-BP-3065. Aunque muchos tipos de adhesivos líquidos incluyen manteca de cerdo, se pueden utilizar otros aceites de base animal, y aceites de base vegetal como el rociado atomizado, una modalidad preferida usa aceite de maíz o de soya. El líquido adhesivo o aceite debe ser rociado a una temperatura elevada, preferiblemente cerca de 43 a 60°C (109 a 140°F). Luego de la atomización del aceite, el fragmento pasa por un aplicador de condimento 90 en donde un condimento de sabor particular 94 es aplicado a ambos lados del fragmento. El aplicador de condimento 90 aplica primero el condimento 94 sobre la parte superior del fragmento que va en una cinta transportadora de malla abierta. El fragmento es entonces volteado sobre otra cinta transportadora de malla abierta y el otro lado es entonces condimentado. Se puede usar un aplicador de condimento fabricado por ARBO de Toronto, Ontario, Canadá modelo número KDC-VV 12" x 20" x 45". El fragmento puede entonces luego ser enfriado y enviado para ser empacado 96.

Aunque la invención ha sido mostrada y descrita particularmente con referencia a una modalidad preferida, podrá entenderse por aquellos versados en la técnica que diversos cambios en forma y detalle pueden ser hechos aquí sin salirse del espíritu y alcance de la invención.

REIVINDICACIONES:

Lo que se reivindica es:

1. Un método para adherir trozos de condimento grandes sobre un sustrato alimenticio, dicho método comprende las etapas de:
 - a) mezclar uno o mas de sólidos de jarabe de maíz, dextrosa, dextrina, maltodextrosa, sacarosa y polidextrosa con una pluralidad de trozos condimentantes tridimensionales para formar una mezcla de uno o mas de sólidos de jarabe de maíz, dextrosa, dextrina, maltodextrosa, sacarosa y polidextrosa-trozos en donde dichos trozos tienen un diámetro entre 1,7 a 17 mm;
 - b) cocer un sustrato alimenticio que tiene una superficie para aplicar dichos trozos y en donde dicho sustrato alimenticio comprende una primera textura;
 - c) aplicar dicha mezcla de uno o mas de sólidos de jarabe de maíz, dextrosa, dextrina, maltodextrosa, sacarosa y polidextrosa-trozo a dicho sustrato alimenticio;

- d) calentar dicha mezcla de uno o mas de sólidos de jarabe de maíz, dextrosa, dextrina, maltodextrosa, sacarosa y polidextrosa-trozo a una temperatura por encima de la temperatura de transición vítrea de dicho uno o mas de sólidos de jarabe de maíz, dextrosa, dextrina, maltodextrosa, sacarosa y polidextrosa en donde dicha temperatura de transición vítrea esta entre 40°C a 60°C y adicionalmente en donde dicho uno o mas de sólidos de jarabe de maíz, dextrosa, dextrina, maltodextrosa, sacarosa y polidextrosa comprende un contenido de humedad de entre 4% a 8%; y
- e) enfriar dicha mezcla de uno o mas de sólidos de jarabe de maíz, dextrosa, dextrina, maltodextrosa, sacarosa y polidextrosa-trozos a una temperatura por debajo de la temperatura de transición vítrea de dicho uno o mas de sólidos de jarabe de maíz, dextrosa, dextrina, maltodextrosa, sacarosa y polidextrosa de modo que dicho uno o mas de sólidos de jarabe de maíz, dextrosa, dextrina, maltodextrosa, sacarosa y polidextrosa se endurece y adhiere dichos trozos a dicho sustrato alimenticio.
- f) Aplicar una segunda cubierta que tiene una segunda textura a dicho sustrato alimenticio; y

- g) Fundir dicha segunda cubierta sobre dicho sustrato alimenticio.
2. El método de la reivindicación 1 que comprende las etapas de:
- h) aplicar un rociado de adhesivo líquido a dicho sustrato alimenticio; y
 - i) aplicar un polvo condimentado a dicho sustrato alimenticio.
3. El método de la reivindicación 1 en donde dicha cocción de dicho sustrato alimenticio en la etapa b) ocurre por medio de freído en una freidora monocapa.
4. El método de la reivindicación 1 en donde dicha cocción de dicho sustrato alimenticio en la etapa b) ocurre por medio de horneado.
5. El método de la reivindicación 1 en donde dicha segunda cubierta de la etapa f) comprende una actividad de agua entre 0.40 a 0.50.
6. El método de la reivindicación 1 en donde dicha segunda cubierta comprende una actividad de agua entre 0.30 a 0.40.

7. El método de la reivindicación 1 en donde dicho segundo cubierta comprende por lo menos un humectante entre 10% a 40% en peso de dicha segunda cubierta.
8. El método de la reivindicación 7 en donde dicho humectante seleccionado del grupo que consiste de glicerina, propilenglicol, lactato de sodio, y acetato de sodio.
9. El método de la reivindicación 1 en donde dicha segunda cubierta comprende 1% a 5% de celulosa.
10. El método de la reivindicación 1 en donde a una temperatura particular constante, dicha segunda cubierta comprende una mayor propensión a absorber agua que dicho sustrato de alimento.
11. El método de la reivindicación 10 en donde a una temperatura particular constante, dicho uno o mas de sólidos de jarabe de maíz, dextrosa, dextrina, maltodextrosa, sacarosa y polidextrosa comprende una mayor propensión a absorber agua que dicho sustrato de alimento.

12. El método de la reivindicación 1 en donde dicha segunda cubierta comprende adicionalmente un análogo del queso estable al almacenamiento.
13. El método de la reivindicación 1 en donde dicho uno o mas de sólidos de jarabe de maíz, dextrosa, dextrina, maltodextrosa, sacarosa y polidextrosa comprende sólidos de jarabe de maíz con un equivalente de dextrosa entre 20 a 50.
14. El método de la reivindicación 1 en donde dicho sustrato alimenticio está hecho de una masa que comprende un molido grueso en donde dicho molido grueso está hecho de un molido de maíz que tiene un espacio entre 0.0020 y 0.0030 milímetros.
15. El método de la reivindicación 1 en donde dicho sustrato alimenticio está hecho de una masa que comprende un almidón agregado entre 2% a 10% en peso de la masa.
16. El método de la reivindicación 15 en donde dicho almidón comprende almidón de maíz ceroso.
17. El método de la reivindicación 1 en donde dicho sustrato alimenticio está hecho de una masa que comprende una harina baja en gluten entre 2% a 35% en peso de la masa.

18. El método de la reivindicación 17 en donde dicha harina baja en gluten comprende harina de trigo.
19. El método de la reivindicación 1 en donde dicho sustrato alimenticio comprende un contenido de humedad pre-cocido entre 22% a 30%.
20. El método de la reivindicación 1 en donde dichos trozos comprenden un contenido de humedad de menos de 5% en peso.
21. El método de la reivindicación 1 en donde un ingrediente de dichos trozos es seleccionado del grupo que consiste de proteína vegetal texturizada, harina de maíz, harina de trigo, y mezclas de ellos.
22. El método de la reivindicación 1 en donde dichos trozos tienen una tercera textura y en donde dicha segunda textura es más suave que dicha tercer textura.
23. El método de la reivindicación 1 en donde dicho sustrato alimenticio comprende una humedad de salida de 0.5% a 1.0% después de la etapa b).
24. El método de la reivindicación 1 en donde dicho sustrato alimenticio comprende un contenido de humedad entre 0.5% a 2.0% después de la etapa g).

25. Un producto alimenticio de pasabocas hecho por el método de la reivindicación 1.

26. Un producto alimenticio de pasabocas estable al almacenamiento preparado mediante el método de la reivindicación 1 que comprende:

un sustrato alimenticio cocido que tiene una primera textura en donde dicho sustrato alimenticio comprende adicionalmente una geometría plana que tiene un lado superior;

una primera cubierta sobre dicho sustrato alimenticio que comprende una mezcla de uno o mas de sólidos de jarabe de maíz, dextrosa, dextrina, maltodextrosa, sacarosa y polidextrosa; y

una pluralidad de trozos condimentantes tridimensionales en donde por lo menos 5% de dichos trozos, en peso, tienen un diámetro entre 1.7 y 17 milímetros;

una segunda cubierta no particulada sobre dicho lado superior de dicho sustrato alimenticio que tiene una segunda textura en donde dicha segunda textura es más suave que dicha primera textura.

27. El producto alimenticio de pasabocas estable al almacenamiento de la reivindicación 26 en donde dicho sustrato alimenticio cocido comprende un sustrato alimenticio frito.
28. El producto alimenticio de pasabocas estable al almacenamiento de la reivindicación 27 en donde sustrato alimenticio frito es cocido en un freidor monocapa.
29. El producto alimenticio de pasabocas estable al almacenamiento de la reivindicación 26 comprende adicionalmente un polvo condimentado.
30. El producto alimenticio de pasabocas estable al almacenamiento de la reivindicación 26 en donde dicho sustrato alimenticio cocido comprende un sustrato alimenticio horneado.
31. El producto alimenticio de pasabocas estable al almacenamiento de la reivindicación 26 en donde dicha segunda cubierta comprende una actividad de agua entre 0.40 a 0.50, luego de la etapa de f) de la reivindicación 1.
32. El producto alimenticio de pasabocas estable al almacenamiento de la reivindicación 26 en donde dicha segunda cubierta comprende una actividad de agua entre

0.30 a 0.40, luego de la etapa de fundición g) de la reivindicación 1.

33. El producto alimenticio de pasabocas estable al almacenamiento de la reivindicación 26 en donde dicha segunda cubierta comprende, por lo menos, un humectante entre 10% y 40% en peso de dicha segunda cubierta.
34. El producto alimenticio de pasabocas estable al almacenamiento de la reivindicación 33 en donde dicho humectante es seleccionado del grupo que consiste de glicerina, propilenglicol, lactato de sodio, y acetato de sodio.
35. El producto alimenticio de pasabocas estable al almacenamiento de la reivindicación 26 en donde dicha segunda cubierta comprende entre 1% y 5% de celulosa.
36. El producto alimenticio de pasabocas estable al almacenamiento de la reivindicación 26 en donde a una temperatura particular constante, dicho uno o mas de sólidos de jarabe de maíz, dextrosa, dextrina, maltodextrosa, sacarosa y polidextrosa comprende una mayor propensión a absorber agua que dicho sustrato de alimento.

37. El producto alimenticio de pasabocas estable al almacenamiento de la reivindicación 36 en donde a una temperatura particular constante, dicho uno o mas de sólidos de jarabe de maíz, dextrosa, dextrina, maltodextrosa, sacarosa y polidextrosa comprende una mayor propensión a absorber agua que dicho sustrato de alimento.
38. El producto alimenticio de pasabocas estable al almacenamiento de la reivindicación 26 en donde dicha segunda cubierta comprende un análogo del queso estable al almacenamiento.
39. El producto alimenticio de pasabocas estable al almacenamiento de la reivindicación 26 en donde dicho uno o mas de sólidos de jarabe de maíz, dextrosa, dextrina, maltodextrosa, sacarosa y polidextrosa comprende, adicionalmente, una pluralidad de sólidos de jarabe de maíz que tienen un equivalente de dextrosa entre 20 y 50.
40. El producto alimenticio de pasabocas estable al almacenamiento de la reivindicación 26 en donde dicho sustrato alimenticio está hecho de una masa que comprende un molido grueso en donde dicho molido grueso está hecho de molido de maíz que tiene un espacio vacío entre 0.0020 y 0.0030 milímetros.

41. El producto alimenticio de pasabocas estable al almacenamiento de la reivindicación 26 en donde dicho sustrato alimenticio de pasabocas está hecho de una masa que comprende un almidón agregado entre 2% y 10% en peso de la masa.
42. El producto alimenticio de pasabocas estable al almacenamiento de la reivindicación 41 en donde dicho almidón comprende almidón de maíz ceroso.
43. El producto alimenticio de pasabocas estable al almacenamiento de la reivindicación 26 en donde dicho sustrato alimenticio está hecho de una masa que comprende una harina baja en gluten entre 2% y 35% en peso de la masa.
44. El producto alimenticio de pasabocas estable al almacenamiento de la reivindicación 43 en donde dicha harina baja en gluten comprende harina de trigo.
45. El producto alimenticio de pasabocas estable al almacenamiento de la reivindicación 26 en donde dichos trozos comprenden un contenido de humedad pre-cocido de entre 22% y 30% en peso.
46. El producto alimenticio de pasabocas estable al almacenamiento de la reivindicación 26 en donde dichos

trozos comprenden un contenido de humedad de menos de 5% en peso.

47. El producto alimenticio de pasabocas estable al almacenamiento de la reivindicación 26 en donde un ingrediente de dichos trozos es seleccionado del grupo que consiste de una proteína vegetal texturizada, harina de maíz, harina de trigo y mezclas de ellos.
48. El producto alimenticio de pasabocas estable al almacenamiento de la reivindicación 26 en donde dichos trozos condimentantes tienen una tercera textura y en donde dicha segunda textura es más suave que dicha tercera textura.
49. El producto alimenticio de pasabocas estable al almacenamiento de la reivindicación 26 en donde dicho sustrato alimenticio comprende un contenido de humedad de salida entre 0.5% y 1.0%.
50. El producto alimenticio de pasabocas estable al almacenamiento de la reivindicación 26 en donde dicho alimenticio comprende un contenido de humedad entre 0.5% y 2.0%.

MÉTODO PARA HACER UN SUSTRATO ALIMENTICIO CON
DOBLE TEXTURA QUE TENGA TROZOS GRANDES CONDIMENTANTES

RESUMEN DE LA DESCRIPCIÓN

El método para hacer un sustrato alimenticio doblemente texturizado que tenga trozos grandes condimentados en donde los trozos son adheridos sustancialmente al sustrato alimenticio, o fragmento. Una primera cubierta comprende trozos condimentantes grandes y uno o mas de sólidos de jarabe de maíz, dextrosa, dextrina, maltodextrosa, sacarosa y polidextrosa es aplicado a un fragmento cocido que tiene una primera textura. El fragmento cocido y con cubierta es entonces calentado a una temperatura de modo que el adhesivo es sometido a transición vítrea y fluye alrededor de los trozos y del punto de contacto con el sustrato alimenticio. El fragmento cocido y con cubierta es entonces sometido a condiciones de proceso cambiantes, tales como enfriamiento, endurecimiento del uno o mas de sólidos de jarabe de maíz, dextrosa, dextrina, maltodextrosa, sacarosa y polidextrosa, y se forma una unión entre la hojuela y los trozos condimentantes. Una segunda cubierta que tiene una segunda textura es entonces colocado y fundida sobre el fragmento. Las propiedades del ingrediente alimenticio son optimizadas para suministrar un producto alimenticio doblemente texturizado estable al almacenamiento.

Anexo 2

Definiciones de los verbos "cocer", "hornear" y
"enhornar" encontrados el Diccionario de la Real
Academia

**cocer.**

(Del lat. *coquĕre*).

1. tr. Hacer comestible un alimento crudo sometiéndolo a ebullición o a la acción del vapor.
2. tr. Someter pan, cerámica, piedra caliza, etc., a la acción del calor en un horno, para que pierdan humedad y adquieran determinadas propiedades.
3. tr. Someter algo a la acción del fuego en un líquido para que comunique a este ciertas cualidades.
4. tr. Preparar o tramar algo con sigilo. U. t. c. prnl. *Algo se cuece en esa reunión.*
5. tr. coloq. Digerir la comida o los alimentos en el estómago.
6. tr. *Med.* madurar (|| activar la supuración).
7. intr. Dicho de un líquido: hervir. *El agua está cociendo.* U. t. c. tr.
8. intr. Dicho de algunos líquidos, como el vino: fermentar.
9. intr. enriar.
10. prnl. Padecer intensamente y por largo tiempo un dolor o incomodidad.
11. prnl. coloq. asarse.
12. prnl. coloq. emborracharse (|| beber hasta trastornarse los sentidos).

¶

MORF. conjug. c. mover.

duro de ~ y peor de comer.

1. expr. U. para dar a entender que las cosas que por su naturaleza son aviesas y malignas, dificultosamente las reduce a razón el tiempo y la disciplina.

vieja fue y no se coció.

1. expr. coloq. U. para notar o reprender la excusa vana que se da por haber dejado de hacer algo.

 hornear.

(De *horno*).

1. tr. enhornar.

2. intr. Ejercer el oficio de hornero.

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enhornar.

1. tr. Meter algo en el horno para asarlo o cocerlo.

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Anexo 3

Copia del resultado encontrado en el diccionario de sinónimos *Signum* en relación con el verbo "hornear"

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hornear

Sinónimos

verbo

asar: [asar](#), [tostar](#), [cocer](#), [calentar](#), [pasar](#), [preparar](#)

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Anexo 4

Copia de las Patentes US 7,074,446 y US 5,298,268



US007074446B2

(12) **United States Patent**
Heywood et al.

(10) Patent No.: **US 7,074,446 B2**
(45) Date of Patent: ***Jul. 11, 2006**

- (54) **METHOD FOR MAKING A
DUAL-TEXTURED FOOD SUBSTRATE
HAVING LARGE SEASONING BITS**
- (75) Inventors: **Adrianna Ashley Heywood**, Plano, TX
(US); **K. Michael King**, Dallas, TX
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TX (US); **Heather Ann Longo**,
Richardson, TX (US)

- (73) Assignee: **Frito-Lay North America, Inc.**, Plano,
TX (US)

- (*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 52 days.

This patent is subject to a terminal dis-
claimer.

- (21) Appl. No.: **10/755,577**

- (22) Filed: **Jan. 12, 2004**

- (65) **Prior Publication Data**

US 2005/0095321 A1 May 5, 2005

Related U.S. Application Data

- (63) Continuation-in-part of application No. 10/696,970,
filed on Oct. 30, 2003.

- (51) Int. Cl.
A23P 1/08 (2006.01)

- (52) U.S. Cl. **426/292; 426/289**

- (58) Field of Classification Search **426/289-296,
426/285**

See application file for complete search history.

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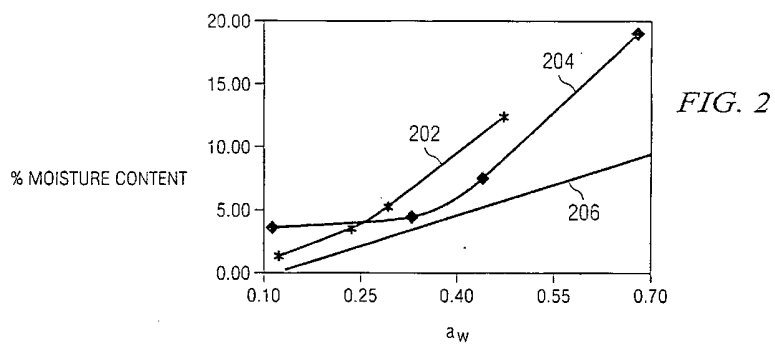
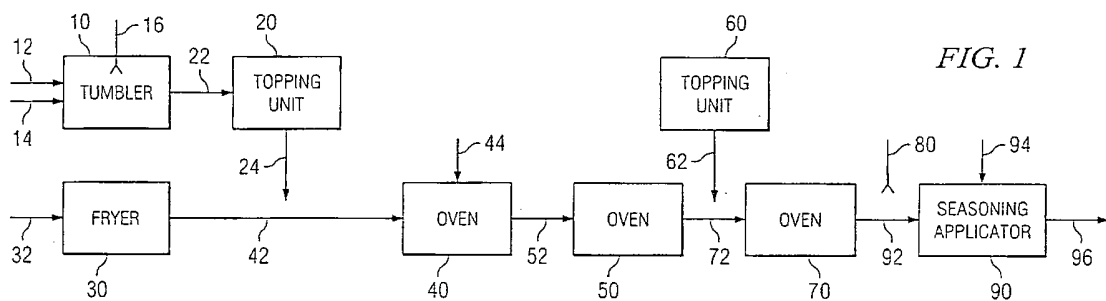
Primary Examiner—Carolyn Paden

(74) *Attorney, Agent, or Firm*—Colin P. Calhoun; Carstens &
Cahoon, LLP

- (57) **ABSTRACT**

Method for making a dual-textured food substrate having large seasoning bits whereby the bits are substantially adhered to the food substrate, or chip. A first topping comprising large seasoning bits and a dry adhesive is applied to a cooked chip having a first texture. The topped, cooked chip is then heated to a temperature such that the dry adhesive undergoes a glass transition and flows down around the bit to the bit and food substrate contact point. The topped, cooked chip is then subjected to changed process conditions, such as cooling, the adhesive hardens, and a bond is formed between the chip and the seasoning bits. A second topping having a second texture is then placed and melted onto the chip. The food ingredient properties are optimized to provide a shelf-stable dual-textured food product.

24 Claims, 1 Drawing Sheet



1
METHOD FOR MAKING A
DUAL-TEXTURED FOOD SUBSTRATE
HAVING LARGE SEASONING BITS

CROSS-REFERENCE TO RELATED
APPLICATION

This application is a continuation-in-part of U.S. patent application Ser. No. 10/696,970, filed on Oct. 30, 2003, the technical disclosure of which is hereby incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Technical Field

The present invention relates to a method for adhering three-dimensional bits, fragments, chunks, or morsels to a substrate and more particularly, to a method for adhering large three dimensional food bits to a snack food substrate whereby the large bits are substantially adhered to the substrate. More specifically, the present invention relates to a method for making a dual-textured, topped snack food.

2. Description of Related Art

Food particulates are often added to foods, especially snack foods. Tortilla chips, pretzels, crackers, popcorn, and numerous other foodstuffs often have seasonings applied to them during processing. Seasonings used, usually in a powdered form, have included salt, cheese, chili, garlic, Cajun spice, ranch, sour cream and onion, among many others. However, there is often an undesirable accumulation of seasoning on the sidewalls and bottom of the snack food bag with the result that the consumer has less than the desired complement of topping thereon. The separation occurs because of insufficient adhesion of the seasoning to the chip. The problem of separation increases with the size and weight of the individual particles.

One way this problem has been approached in the past was by using oil as an adhesive to adhere particulate seasonings to a base or substrate. For example U.S. Pat. No. 6,534,102 B2, issued to Kazemzadeh, discloses a seasoning bit that, following extrusion and cooking is immersed into an oil and seasoning slurry at an elevated temperature. The product is then dry-coated with seasonings or sprayed with hot or room temperature oils and fats either carrying seasonings or the seasonings are applied as dusting on the surface while the oil and fats are used to adhere the seasoning to the surface. One drawback to using only oil, however, is that the adhesive strength of traditional oil mixes are not strong enough to adhere large three-dimensional bits to a substrate surface. In certain applications, large three-dimensional bits are desirable because they enable packaged snack chips to emulate another topped product including, but not limited to a pizza with toppings, a nacho chip, or a tostada.

Another prior art composition used to adhere particulate to a food product is U.S. Pat. No. 3,689,290 issued to Blackenstock et al which discloses using a coating agent comprised of dry corn syrup solids to adhere small particle sizes of food toppings to a substrate. The Blackenstock Patent discloses a particle size of the food topping as being 12-100 mesh, which corresponds to a particle size range of 0.150 to 1.68 millimeters (0.0059 to 0.0661 inches). Again, these are relatively small particle sizes that are being adhered to a substrate. The adhesive is not strong enough to adhere a substantial amount of larger three-dimensional particles to the chip.

U.S. Patent Application 2002/0187220 A1 discloses an edible particulate adhesive comprising maltodextrin, an

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edible surfactant, a solvent, a polysaccharide, and a modified starch. The invention, however, is clearly aimed at very small particulate adhesion. The invention indicates the preferred particle size is less than 650 micrometers. Thus, this invention also fails to adhere relatively large bits to a chip.

Another prior art composition used to adhere flavorings to a foodstuff is illustrated by European Patent EP 0 815 741 A2 which discloses a hot melt composition comprising a starch, such as corn syrup, maltodextrin, or an amylase-treated starch, and a plasticizer, such as a polyol or a polyacetic acid. Like the other inventions, this invention was also designed to adhere powdery-type particulate additives to foodstuffs such as salt, sugar, cheese powder, and ranch seasonings. Like other inventions in the prior art, it also fails to adhere relatively large bits to chips.

Another prior art approach to adhere large food flavorings and spices was to put the flavorings on an unbaked cracker. Thus, cheese flavorings and other spices were then baked into the dough. This approach, however, cannot be used when it is desirable to adhere particles to a substantially cooked snack piece, such as a tortilla chip, immediately prior to the addition of seasoning.

Consequently a need exists for a method to adhere large particulate flavoring bits, fragments, chunks, or morsels to a food substrate. The method should allow a snack food to demonstrate the characteristic look, texture, and taste of an emulated topped food product, yet be highly resistant to separation. The method should be adaptable to a product line wherein the addition of the large particles occurs at a step after substantial cooking of the underlying food substrate.

Food ingredients are typically enclosed in a hermetically sealed food package and thus approach equilibrium with the relative humidity of the inside of the package. It has proven difficult to achieve a dual-textured or multi-textured snack food, because the food ingredient having a lower moisture content and thereby crispy texture, typically absorbs evaporated moisture from a food ingredient having a higher moisture content and thereby softer texture.

As the lower moisture content food ingredient absorbs water it becomes less crispy. As the higher moisture content food ingredient loses water, it hardens. Because of this moisture migration it is difficult to achieve a long shelf-life on dual textured snack products.

The water content of a food ingredient is typically measured by its water activity level ("Aw"). The Aw is defined by the following equation:

$$Aw=P/P_0$$

where P=vapor pressure of water in the food

P₀=vapor pressure of pure water under the same conditions.

The Aw is a quantitative measure of unbound free water in a system that is available to support biological and chemical reactions. Two different food ingredients with the same water content can vary significantly in their Aw level depending on how much free water is in the system. If a higher moisture content, soft texture ingredient has an Aw that exceeds the relative humidity of its environment, then water tends to evaporate from the food ingredient causing the ingredient to harden. Similarly, if a lower moisture content, crispy texture has an Aw that is less than the relative humidity of its environment, then it tends to absorb water, causing the ingredient to soften. For example, consider a piece of soft cheese, having an Aw of 0.92 placed on a crispy cracker having an Aw of 0.10 in a sealed container initially at 50% relative humidity. Over time the texture of the soft cheese hardens as it loses water and approaches equilibrium

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with the container atmosphere. The texture of the crispy cracker, however, softens as it absorbs this evaporated moisture to approach equilibrium with the container atmosphere. As a result, both food ingredients lose their desired texture. Moreover, besides texture changes, changes in moisture can lead to other undesirable effects including microbial growth, degradation reactions, and organoleptical changes.

The problem is compounded in multi-textured, topped food products that require an adhesive. Water-based adhesive systems utilized on a food substrate negatively impact texture as hydration and subsequent thermal drying destroy internal structures. Moreover, a water-based adhesive deteriorates chip crispness, especially if applied in an aqueous state, because of moisture migration from the adhesive into the food substrate. In addition, there is flavor loss that results from drying a moistened food substrate. As discussed previously, oil-based adhesives fail to adhere large bit particulate flavoring bits to a food substrate. As a result, it has long been difficult for food product manufacturers to package multi-textured food products for extended shelf life storage. Numerous attempts to preserve dual-textured features of food products are illustrated in the prior art.

U.S. Pat. No. 4,401,681 discloses a method for preventing moisture migration from a high-moisture phase to a low-moisture phase. For example, the patent discloses combining corn syrup solids having a Dextrose Equivalent of 22 to 24 and a high methoxyl pectin with a pizza sauce to prevent moisture from the sauce from migrating into the pizza crust during shelf life. This disclosure, however, fails to teach a method that minimizes moisture transmission from a softer texture to a crisper texture through an area having a headspace. Rather the disclosure is limited to providing a direct barrier layer between two ingredients with high differential moisture contents.

U.S. Pat. No. 4,853,236 discloses a shelf-stable dual-textured food product having a first, hard texture comprising a fruit composition on a shell portion, and a second, variably textured core portion comprising an oil-in-water emulsion. This disclosure fails to teach both an outer chewy and an outer crispy texture of a topped food product.

U.S. Pat. No. 4,961,942, discloses a dough composition having a plurality of shelf-stable textures. The patent further discloses a soft, chewy filler cookie dough and a firmer outer casing dough wherein the casing dough comprises a high sugar content. It fails to disclose a dough that can be used in savory snacks.

U.S. Pat. No. 4,913,919, assigned to the same assignee of the present application, discloses a coating composition comprising a high solids content aqueous suspension, having a solids content of at least 40% by weight. The outside surface of a snack food is coated with the aqueous solution. The coating is dried to provide a crisp outer texture and chewy inner texture. This disclosure fails to teach an outer chewy texture.

U.S. Pat. No. 5,405,625, discloses a cheese filled snack product having a crisp outer casing comprising potato flakes and pre-gelatinized rice flour. In one embodiment, the filling is moist and the snack food product can be baked or microwaved without the cheese filling over expanding or leaking. This disclosure fails to teach an outer chewy texture.

U.S. Pat. No. 6,500,474 discloses using a heated liquid coating to further coat a pre-coated food product and subsequently contacting the liquid-coated pre-coated food piece with a chunky particulate matter to form a food product

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enrobed with a substantially continuous chunky coating. This disclosure fails to teach an outer crispy texture.

Accordingly, a need exists for a method for making a shelf-stable dual-textured, topped snack food product comprising a crisp food substrate and a chewy topping. The method should utilize a non-water based and non-oil based adhesive that can adhere large particulate flavoring bits to a substantially cooked, crisp food substrate. The method should minimize the water activity in food product ingredients and should minimize moisture migration from the chewy topping to the crisp food substrate.

SUMMARY OF THE INVENTION

The proposed invention uses a combination of dry-powdered adhesives admixed onto bits and placed on a food substrate and wherein further the adhesive undergoes a glass transition and flows down around the bit to the bit and food substrate contact point. Subsequently, process conditions change, and the adhesive undergoes another glass transition back to an amorphous solid which hardens the adhesive and adheres the bit to the food substrate surface.

Hence, this invention produces a method whereby large flavoring bits are adhered to a snack food substrate to achieve the look, texture, and taste of an emulated topped food product. In addition, the instant method provides a topping that is highly resistant to separation. Furthermore, the method can be implemented following the cooking of the underlying food substrate.

The invention further provides a method that minimizes moisture migration from a softer textured topping to a crispier food substrate. Food product ingredient properties are optimized to provide at least two distinct textures. Optimized food product ingredient properties can be moisture content, water activities, and sorption slopes.

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:

FIG. 1 is a schematic representation of one embodiment of the new process.

FIG. 2 is a graph representation depicting moisture sorption isotherms for the major ingredients in one embodiment of the invention.

DETAILED DESCRIPTION

An embodiment of the innovative invention will now be described with reference to FIG. 1. Seasoning, flavoring or illustrative bits 12 and an adhesive 14 are mixed together in a 30-inch diameter mixer or tumbler 10. As used herein, large seasoning bits 12 are food grade seasonings wherein at least 5% of the bits, by weight, have a diameter exceeding 1.7 millimeters and are substantially between 1.7 and 17.0 millimeters diameter. In a preferred embodiment, vegetable oil 16, preferably at a temperature of about 23 to 32° C. (74 to 90° F.), is sprayed into the tumbler 10 to coat the seasoning bits 12 to function as a temporary liquid adhesive 16 and promote bonding between the dry adhesive 14 and the seasoning bits 12. In an alternative embodiment, the temporary liquid adhesive 16 is heated to a temperature of

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about 43 to 60° C. (109 to 140° F.) prior to being sprayed in the tumbler 10. The temporary adhesive 16 used can be any prior art adhesive oil including, but not limited to, olestra®, corn oil, soybean oil, cottonseed oil, or palm oil. Alternatively, an oil substitute can be used as a temporary liquid adhesive 16. The objective is to coat the seasoning bits 12 to promote bonding with the dry adhesive 14 during mixing and until the dry adhesive 14 undergoes a glass transition phase. Any temporary liquid adhesive 16 that meets this objective can be used. Examples of an oil substitute that could be used as a temporary adhesive includes, but is not limited to glycerol, propylene glycol, alcohol, and mixtures thereof. A temporary liquid adhesive 16 may not be needed if the particle size of the dry adhesive 14 is small enough, and/or the individual bits 12 are porous enough, and/or the bit has a moist hydroscopic or oily exterior.

The tumbler 10 is a cylindrical device that rotates and is typically used to add seasoning to a substrate's total circumference. In this invention, however, the tumbler is used to admix adhesive 14 to the seasoning bit 12. Thus, although a tumbler 10 is described in this embodiment, any equivalent device including but not limited to, a mixer, a tumbler including a batch tumbler or a continuous tumbler, or a blender such as a batch blender, continuous blender, or ribbon blender may be used to admix the adhesive 14 to the seasoning bit. As used in this invention, a substrate is substantially cooked and can be a fried or baked snack food chip made from a dough, such as masa or other starch based dough. As used in this invention the terms substrate and chip are used interchangeably and refer to any wide variety of snack food items that are commonly commercially available including, but not limited to, potato chips, crackers, multi-grain chips, corn chips, and tortilla chips. In one embodiment of the present invention, the substrate comprises a first texture that is crispy.

Seasoning bits 12 comprising Textured Vegetable Protein, flavored vegetable bits, or colored bits are commercially available. For example, Bac'n Pieces™ Bacon Flavored Bits can be purchased from McCormick® of Sparks, Md. in many local grocery stores. The bits can also comprise corn flour or wheat flour, independently or in combination. Hence, the bits can consist of textured vegetable protein, corn flour, wheat flour, and combinations thereof. In one embodiment, the bits have a moisture content preferably less than about 5%.

Following admixing in the tumbler 10, the seasoning bits 12 and adhesive 14 are then transferred 22 to a first topping unit 20. A topping unit 20 manufactured by Raque, of Louisville, Ky. can be used. Corn Syrup Solids are defined by the FDA as dried glucose syrups in which the reducing sugar content is 20 Dextrose Equivalent or higher. In one embodiment, the dry adhesive 14 used preferably comprises corn syrup solids with a Dextrose Equivalent more than 20 and most preferably between about 20 and 50. This Dextrose Equivalent range can result in reduced chewiness, sliminess, and sweetness. Dextrose Equivalents higher than about 50 can be used, but result in a sweeter, as opposed to savory flavor. Numerous other carbohydrate adhesives can also be used including, but not limited to dextrose, dextrin, maltodextrin, sucrose, polydextrose, and combinations thereof. These carbohydrates can be purchased from various suppliers including National Starch and Chemical Company of Bridgewater, N.J., Danisco Cullor of New Century, Kans., and Tate & Lyle PLC located in London, England. In an alternative embodiment, maltodextrin, defined by the FDA as dried glucose syrups in which the reducing sugar content is less than 20 Dextrose Equivalent can be used. Use of

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maltodextrin, however, can require the use of steam to activate the adhesive. By using corn syrup solids instead of a water-based or steam requiring adhesive, a crisp chip texture is preserved because hydration and subsequent thermal drying is greatly reduced. Thus, use of corn syrup solids or other acceptable carbohydrate results in a preferable dry adhesive application.

Again, although this invention is described with reference to a fried tortilla chip, any food substrate including, but not limited to, a chip, a cracker, a baked chip, an extruded snack, or a pulled snack, can be used. Prior to the chip entering the fryer 30, the dough is made by any one of a number of standard methods well known in the art. A novel and unique combination of modifications, however, can be made to the prior art dough and/or the dough ingredients to enhance the crispiness of the underlying topped substrate. For example, in a tortilla chip embodiment, a coarser corn grind, preferably made from the corn mill having a gap between about 0.0020 and about 0.0030 millimeters, and more preferably having a gap between about 0.0023 and about 0.0026 millimeters can be used. A coarser grind requires less shear when corn is ground into masa, decreasing the amount of starch gelatinization and increasing the amount of larger ground corn particles in the masa. Larger particles cause the chip texture to remain more coarse which conveys a heartier, crunchier, and crispier chip. Less gelatinization provides thinner surface film formation during frying. In addition, larger ground corn particle sizes cause more disruptions, even more so in a thinner surface film. When the dough is fried, water within the dough can more easily escape through these disruptions as steam, resulting in a chip with a lower moisture content. A lower moisture content chip results in a crispier texture. Further, the product will contain less steam build-up within the chip during frying, which in turn reduces the amount and size of surface blisters produced, further resulting in a crispier texture. Starch, preferably between about 2% and about 10% by weight of the dough, can be added to the dough to absorb more water during masa production. In one embodiment, waxy corn starch is used. Again, when this water is subsequently released during frying, smaller and more numerous surface blisters are created resulting in a crispier texture. A low gluten flour, preferably between about 2% and about 35% by weight of the dough, can be used in the dough for organoleptic properties. In one embodiment, wheat flour is used.

Typically, a dough product is compressed between a pair of counter rotating sheeter rollers that are located closely together, thereby providing a pinch point through which the dough is formed into sheets. The dough can then be cut by, for example, a cutting roller to form the shape of the product desired. Alternatively, the dough or masa is extruded and cut into a desired chip shape. After the dough or masa is cut, the chips are transported towards and through a toast oven. The chips should be toasted to achieve a pre-cook moisture content between about 22% and about 30%. For this, the chips are deposited onto a moving belt. After toasting, the shaped chips have increased stiffness for insertion into a fryer 30. In one embodiment, the toasted chips, prior to being fried, are passed through a proofing stage where the chips are exposed to ambient air for a specified amount of time to equilibrate moisture. After proofing, chips are transferred to a fryer 30. To convey the chips into the fryer 30, the chips are removed from the toasting belt or conveyor and placed onto the fryer conveyor 32. Because flat substrate facilitates even application of the seasoning bits 12, in the preferred embodiment, a monolayer fryer 30 is utilized to help ensure a flat substrate and minimize chip curl. The

monolayer fryer 30 has two belts; an upper belt and a lower belt. The substrate is positioned between the two belts as it moves through the fryer 30. The two-belt system minimizes chip curl and keeps the chip flat as it moves through the fryer. The chip, in the example of a tortilla chip, is in the monolayer fryer for a dwell time of about 52 to 56 seconds at a temperature of about 170–207° C. (338–404° F.). A monolayer fryer also provides for more uniform frying and thus allows the chips to produce consistent blisters and a more uniform, lower exit moisture content. As used herein, an exit moisture content is the moisture content following the cooking of the food substrate. In one embodiment, the exit moisture content of a chip fried in a monolayer is preferably between about 0.5 and about 1.0%. Batch frying, on the other hand, results in variable moisture content, blister formation and finished oil contents. Moreover, prior art exit moisture contents typically exceed 1.0%. A lower exit moisture content results in a crispier chip. In addition, a drier, lower moisture content chip comprises more surface oil than interior oil. This surface oil helps to protect the chips from absorbing excess moisture during the topping process (discussed below). In an alternative embodiment, any fryer 30 known in the art can be used. After exiting the fryer 30, the substrate proceeds along an open mesh conveyor belt 42 and cools to approximately 100° F. to 150° F. Because this temperature is still above ambient, moisture migration onto the chip substrate is retarded. Although numerous modifications are disclosed to illustrate a preferred embodiment, the essence of the invention can be achieved with fewer than all of the dough ingredient and processing modifications disclosed, as those skilled in the art are likely to recognize. After the chip has been fried, the seasoning bits 12 and adhesive 14 are then applied 24 to the chip via a topping unit 20 or other topping means.

The chip is then sent to a first oven 40. An impingement oven such as model IMDJ-45AS-1, manufactured by Heat and Control, Inc., of Hayward, Calif. can be used as the first oven. The chip is transported through the first oven 40 on an open mesh conveyor belt for approximately 17 seconds. The elevated oven temperature, preferably about 190 to 232° C. (374 to 450° F.), serves to trigger the glass transition phase of the dry adhesive 14 onto the substrate. In one embodiment, steam 44 between 6.9 and 34.5 kPa (1 and 5 psi) is injected into the first oven 40 to expedite activation of the dry adhesive 14 by lowering the glass transition temperature of the adhesive via the addition of water vapor. In this embodiment, the chip then proceeds out of the first oven 40 along the open mesh conveyor belt 52 into a second oven 50 to drive off the moisture added in the first oven as steam. In the second oven 50, the chip proceeds on an open mesh conveyor belt for approximately 17 seconds at an elevated temperature range of about 190 to 232° C. (374 to 450° F.). The second oven 50 can be a make and model identical to the first oven 40.

In an alternative embodiment, only one oven, without steam, is used to trigger the glass transition phase of the dry adhesive. In such an embodiment, the oven temperature remains the same about 190 to 232° C. (374 to 450° F.). In addition, the total dwell time also remains the same at about 34 seconds. In alternative embodiments, longer or shorter dwell times and higher or lower temperatures could be used. The dwell time and temperature need only be sufficient to promote a glass transition change in the dry adhesive 14. An AirForce® impingement oven, manufactured by Heat & Control, Inc. of Hayward, Calif. can be used as in the single-oven embodiment. As used herein, an adhering means for adhering a seasoning bit to a substrate is meant to include

any edible carbohydrate blend that undergoes a glass transition change at an adhesive (as opposed to oven) temperature between 40 and 60° C. when the adhesive has a moisture content of between about 4 to 8%. As those skilled in the art are aware, the glass transition temperature range of the dry adhesive 14 changes relative to the moisture content. The higher the moisture content, the lower the glass transition temperature range. Conversely, the lower the moisture content, the higher the glass transition temperature range. Thus, if the moisture content of the adhesive is raised above or below 4 to 8%, then the corresponding glass transition temperature range will change as well. However, such changes should be construed to be within the spirit and scope of the claimed invention.

The chip then proceeds out of the second oven 50 along the open mesh conveyor belt 72 where it begins to cool. In one embodiment, the chip cools for approximately 30 seconds. The dry adhesive 14 hardens on cooling to affect a strong bond between the seasoning bits 12 topping and the substrate.

In one embodiment, the steps of adding and heating the seasoning bits 12 above the glass transition temperature of the dry adhesive 14 and then allowing the seasoning bit 12, adhesive 14, and substrate to cool below the adhesive's 14 glass transition temperature could be repeated to form a multi-layered chip. By repeating these steps, two or more layers of seasoning bits 12 could be added to a single substrate or chip.

In a preferred embodiment of the invention, a second topping, preferably, but not necessarily, in the form of cheese shreds, a cheese-like topping, or a cheese topping is then applied to the bit-topped substrate via a second topping unit 60. Unlike the first topping comprising the bits, the second topping has a lower melting temperature than the seasoning bits 12 of the first topping and no additional adhesive is required to adhere the second topping to the substrate. In one embodiment, the second topping having a second texture comprises a softer texture than the first texture of the crispy substrate. A shelf-stable cheese analog as disclosed in U.S. patent application Ser. No. 10/649,825 and assigned to Kerry Specialty Ingredients of Beloit, Wis. can be used as the second topping.

FIG. 2 is a graph representation depicting the moisture sorption or desorption isotherms for the major ingredients in one embodiment of the invention. A moisture sorption isotherm is a graphical representation of the relationship between the moisture content of a food ingredient that absorbs moisture and the *A_w* of that food ingredient at a particular, constant temperature. The x-axis represents the *A_w* and the y-axis represents the moisture percentage of the main food components. An example of a chip moisture sorption isotherm 202 and adhesive sorption isotherm 204 is depicted in FIG. 2. A desorption isotherm is a graphical representation of the relationship between the moisture content of a food ingredient that loses moisture and the *A_w* of that food ingredient at a particular, constant temperature. A shelf-stable cheese analog moisture desorption isotherm 206 is depicted in FIG. 2. As used herein, sorption slope is defined as the slope of the sorption or desorption curve of a particular water activity value. The steeper the sorption slope, the higher the propensity to absorb water. Conversely, the more level the slope, the lower the propensity of a food ingredient to absorb water. Thus, it is advantageous for the chewy, softer texture food ingredients to comprise a steeper sorption slope than the crispy food ingredients to control moisture migration. For example, in one embodiment, the adhesive sorption slope 204 is steeper than the chip sorption

slope 202. Because of the adhesive's steeper sorption slope 204, the adhesive helps buffer moisture uptake by the substrate. Hence, in one embodiment, the crispy chip substrate sorption slope 206 is always less steep than the cheese sorption slope 202 and often less steep than the adhesive sorption slope 204.

The second topping cheese analog comprises a fresh Aw between about 0.40 and about 0.50 and a heated Aw between about 0.30 and about 0.40 and comprises a desorption slope steeper than the sorption slope of the crispy base as illustrated by FIG. 2. A fresh Aw is the Aw of the cheese prior to the cheese being melted. The heated Aw is the Aw of the cheese after the cheese has been melted on the crispy substrate (discussed below). Moreover, at least one humectant can be used in the second topping to further inhibit moisture migration from the second, soft topping. A humectant is an ingredient that promotes the absorption and retention of moisture. Humectants that can be used include, but are not limited to, glycerin, propylene glycol, sodium lactate and sodium acetate. In addition, other water binding systems such as cellulose can also be used in the second topping. The second topping can comprise at least one humectant between about 10 percent to about 40 percent, cellulose between about 1 percent to about 5 percent, or combinations thereof based on the weight of the second topping.

Referring back to FIG. 1, the second topping unit 60 can be the same model and type as first topping unit 20. Following application of the second topping, the chip is then routed to a third oven 70. The third oven 70 is preferably an infrared Raymax 1525, manufactured by Watlow Electric Manufacturing Company, of St. Louis, Mo. The chip is routed to a third oven 70 on an open mesh conveyor belt 72. The chip proceeds through the third oven 70 for a dwell time of approximately 60 seconds with an oven temperature about 82 to 138° C. (180 to 280° F.). In alternative embodiments, shorter or longer dwell times and higher or lower temperatures could be used. The dwell time and temperature need only be sufficient to melt the second set of toppings. The chip then proceeds out of the third oven 70 on an open mesh conveyor belt 92 where it is sprayed with an atomized oil or other liquid adhesive from both the top and the bottom. Unlike the temporary adhesive 16, the objective with this liquid adhesive is to provide a more permanent adhesive to bind a seasoning with the chip and the toppings. An oil spray applicator 80 manufactured by GOB-Avins of Amherst, N.Y., model #OSM-5000-BP-3065 can be used. Although many types of liquid adhesives including lard, other animal-based oils, and vegetable-based oils can be used as the atomized spray, a preferred embodiment uses corn or soybean oil. The liquid adhesive or oil should be sprayed at an elevated temperature, preferably about 43 to 60° C. (109 to 140° F.). Following oil atomization, the chip passes through a seasoning applicator 90 where a particulate flavored seasoning 94 is applied to both sides of the chip. The seasoning applicator 90 first applies seasoning 94 to the topside of the chip on an open mesh conveyor belt. The chip is then flipped onto another open mesh conveyor belt and the other side is then seasoned. A seasoning applicator manufactured by ARBO of Toronto, Ontario, Canada model number KDC-VV 12"x20"x45" can be used. The chip may then be further cooled and sent to be packaged 96.

While this invention has been particularly shown and described with reference to a preferred embodiment, it will be understood by those skilled in the art that various changes in form and detail may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. A method of adhering large seasoning bits on a food substrate, said method comprising the steps of:

- a) mixing a dry adhesive with a plurality of three-dimensional seasoning bits to form an adhesive-bit mix wherein said bits are substantially between about 1.7 to about 17 mm in diameter;
 - b) cooking a food substrate having a surface to apply said bits and wherein said food substrate comprises a first texture;
 - c) applying said adhesive-bit mix to said food substrate;
 - d) heating said adhesive-bit mix to a temperature above a glass transition temperature of said dry adhesive wherein said glass transition temperature is between about 40° C. to about 60° C. and further wherein said dry adhesive comprises a moisture content of about 4% to about 8%; and
 - e) cooling said adhesive-bit mix to a temperature below the glass transition temperature of said dry adhesive such that said dry adhesive hardens and adheres said bits to said food substrate.
- f) applying a second topping having a second texture to said food substrate; and
- g) melting said second topping on said food substrate.
2. The method of claim 1 further comprising the steps of:
- h) applying a liquid adhesive spray to said food substrate; and
 - i) applying a seasoning powder to said food substrate.

3. The method of claim 1 wherein said cooking of said food substrate in step b) occurs by frying in a monolayer fryer.

4. The method of claim 1 wherein said cooking of said food substrate in step b) occurs by baking.

5. The method of claim 1 wherein said second topping comprises a fresh water activity between about 0.40 and about 0.50.

6. The method of claim 1 wherein said second topping comprises a heated water activity between about 0.30 and about 0.40.

7. The method of claim 1 wherein said second topping further comprises about 1 percent to about 5 percent cellulose.

8. The method of claim 1 wherein said food substrate comprises a first sorption slope and wherein said second topping comprises a second sorption and wherein said second sorption slope is steeper than said first sorption slope.

9. The method of claim 8 wherein said adhesive comprises a third moisture sorption slope and wherein said third moisture sorption slope is steeper than said first moisture sorption slope.

10. The method of claim 1 wherein said second topping further comprises a shelf stable cheese analog.

11. The method of claim 1 wherein said dry adhesive comprises corn syrup solids with a Dextrose Equivalent between about 20 and about 50.

12. The method of claim 1 wherein said food substrate is made from a dough comprising a coarse grind wherein said coarse grind is made from a corn mill having a gap between about 0.0020 and about 0.0030 millimeters.

13. The method of claim 1 wherein said food substrate is made from a dough comprising an added starch between about 2 percent and about 10 percent by weight of the dough.

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14. The method of claim 13 wherein said starch comprises waxy corn starch.

15. The method of claim 1 wherein said food substrate is made from a dough comprising a low gluten flour between about 2 percent and about 35 percent by weight of the dough.

16. The method of claim 15 wherein said low gluten flour comprises wheat flour.

17. The method of claim 1 wherein said food substrate comprises a pre-cook moisture content between about 22 percent and about 30 percent.

18. The method of claim 1 wherein said bits comprise a moisture content of less than about 5 percent by weight.

19. The method of claim 1 wherein an ingredient of said bits is selected from the group consisting of textured vegetable protein, corn flour, wheat flour, and mixtures thereof.

20. The method of claim 1 wherein said bits have a third texture and wherein said second texture is softer than said third texture.

21. The method of claim 1 wherein said food substrate comprises an exit moisture of between about 0.5 percent and about 1.0 percent after step b).

22. The method of claim 1 wherein said food substrate comprises a moisture content between about 0.5 percent and about 2.0 percent after step g).

23. A method of adhering large seasoning bits on a food substrate, said method comprising the steps of:

a) mixing a dry adhesive with a plurality of three-dimensional seasoning bits to form an adhesive-bit mix

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wherein said bits are substantially between about 1.7 to about 17 mm in diameter;

b) cooking a food substrate having a surface to apply said bits and wherein said food substrate comprises a first texture;

c) applying said adhesive-bit mix to said food substrate;

d) heating said adhesive-bit mix to a temperature above a glass transition temperature of said dry adhesive wherein said glass transition temperature is between about 40° C. to about 60° C. and further wherein said dry adhesive comprises a moisture content of about 4% to about 8%; and

e) cooling said adhesive-bit mix to a temperature below the glass transition temperature of said dry adhesive such that said dry adhesive hardens and adheres said bits to said food substrate.

f) applying a second topping having a second texture to said food substrate, wherein said second topping comprises at least one humectant between about 10 percent and about 40 percent by weight of said second topping; and

g) melting said second topping on said food substrate.

24. The method of claim 23 wherein said humectant is selected from the group consisting of glycerin, propylene glycol, sodium lactate, sodium acetate, and mixtures thereof.

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United States Patent [19]
Maegli

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[45] Date of Patent: Mar. 29, 1994

- [54] SEASONED SNACK FOODS AND METHODS FOR PRODUCTION THEREOF
- [75] Inventor: Jack W. Maegli, Deloit, Wis.
- [73] Assignee: Beatreme Foods Inc., Deloit, Wis.
- [21] Appl. No.: 933,236
- [22] Filed: Aug. 21, 1992
- [51] Int. Cl.⁵ A23G 3/00; A23L 1/09
- [52] U.S. Cl. 426/93; 426/98; 426/103; 426/233; 426/272; 426/292; 426/293; 426/302; 426/309
- [58] Field of Search 426/93, 98, 96, 103, 426/272, 292, 302, 309, 658, 660
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[57] ABSTRACT
A low fat content, seasoned, cereal-based snack food having a low moisture content is produced. An adhesive for the seasoning is an at least partially amorphous form of a mixture of at least one monosaccharide, preferably glucose, and at least one polyhydric, aliphatic, saturated alcohol having 3 to 6 carbon atoms, preferably glycerol. The adhesive is applied to the snack food by direct spraying on the snack food or by encapsulating the adhesive in a fat and blending the encapsulated adhesive with the snack food.

37 Claims, No Drawings

SEASONED SNACK FOODS AND METHODS FOR PRODUCTION THEREOF

The present invention relates to a seasoned cereal-based snack food, and more particularly to such a snack food having a low fat and low moisture content edible adhesive on the surfaces thereof for adhering dry solids seasoning to the surfaces of the snack food.

BACKGROUND OF THE INVENTION

Cereal-based snack foods are quite popular and may take a variety of specific forms, such as seasoned corn curls, taco chips, tortilla chips, crackers, etc., all of which, usually, require some seasoning at least on the surfaces thereof. That seasoning must be adhered to those surfaces by an edible adhesive, and in the past, that adhesive has most usually been an oil or fat. For example, when a potato chip is produced (potatoes being considered cereal for the purposes of this invention), sliced potatoes are deep fat fried. After removal from the fryer, the potato chips have considerable oil or fat on the surfaces thereof, and when dusted with a seasoning, e.g. salt, the salt adheres to the surfaces of the potato chips by way of a residual fat functioning as an adhesive. Corn chips, such as taco chips and tamale chips, may be likewise produced, but here the seasoning will be a mixture of flavors and, usually, salt. As another example, corn curls and crackers are often flavored with cheese powder. Corn curls, for example, after puffing from dough, may be sprayed with an oil, and then the cheese powder adhered to the surfaces thereof by way of the oil functioning as an edible adhesive. Crackers are usually leavened and baked, and likewise require oil sprayed on the surfaces to function as an adhesive, e.g. an adhesive for seasonings, including cheese powders.

However, for dietary purposes, it is often important to reduce the fat intake, and snack foods, as described above, have been produced with reduced fat contents, the reduction in fat content being both in regard to the fat in the formulations of doughs for forming the snack food and in the fat used in the adhesive for the seasoning. For example, a cracker may be baked with a relatively low fat content, but with that low fat content, sufficient residual fat does not remain on the cracker for adequately adhering seasonings to the surfaces of the cracker. If additional fat is placed on the crackers for adhesive purposes, that additional fat would defeat, to a large measure, the purpose of providing a low fat dough for producing the cracker.

As a result, the art has sought low fat adhesives for snack foods of the nature described above. Various substitutes for the traditional fat adhesives have been proposed in the art. Many of these proposals involve water solutions of various edible ingredients which, when applied and dried on the snack food, provide a tacky adhesive for adhering the seasonings. These approaches, however, suffer from a common difficulty. Since such snack foods are intended to be shelf stable, the moisture content of the snack food (or at least the water activity of the snack food) must be at a low level in order to prevent staling and bacterial growth on the snack food during shipping, handling and storing. It is difficult when applying water solutions of such tackifying adhesives to ensure that the water used for application of the adhesive is sufficiently evaporated to reduce the moisture content of the adhesive (and also the snack

food) to a safe level of water activity and one that will not induce staling of the substrate, i.e. snack food. This is particularly true when the adhesive material itself is hygroscopic, which is often the case with edible sugars and alcohols. In addition, such hygroscopic adhesives will absorb moisture, particularly when the snack food package is opened, and the snack food may become sticky or tacky and may allow staling and/or bacterial growth.

While not directed to cereal-based snack foods, the problem discussed above has been a considerable problem in other snack food arts, such as in the art of coating nuts. For example, U.S. Pat. No. 3,477,858 discloses that adhesives, such as starch-based adhesives or gums, tend to flake off and produce unsightly fines. Also, it is disclosed that non-oily adhesives, such as sorbitol and mannitol, have difficulty in that, especially, sorbitol remains tacky for long periods of time, e.g. at least 18 hours, after cooling to room temperature, and the nuts tend to adhere to each other. In addition, sorbitol is hygroscopic and the nuts tend to be sticky after exposure to high humidity. On the other hand, mannitol becomes hard and brittle, immediately after removing the nuts from a molten bath thereof, with poor drainage of the mannitol, agglomeration of the nuts, and difficulties in obtaining an adequately seasoned product. That patent goes on to propose a mixture of mannitol and sorbitol for somewhat mitigating these difficulties.

Somewhat similarly, U.S. Pat. No. 3,671,266 proposes coating nuts with a hexitol, e.g. mannitol, sorbitol and mixtures thereof, wherein at least 10% sorbitol is used.

U.S. Pat. No. 4,161,545 recognizes the above-discussed U.S. Pat. No. 3,671,266, but points out that the approach of that patent produces dark-colored nuts, and instead proposes a mixture of honey and water followed by enrobing with a dry mixture of sugar and starch.

However, U.S. Pat. No. 4,692,342 recognizes the above-described U.S. Pat. No. 4,161,545, but states that improved adhesion of seasoning can be achieved when the nuts are coated with a dry adhesive film-forming material and then with an aqueous mixture of honey and an adhesive film-forming material. Adhesive materials such as vegetable gums, dextrin, modified starches, albuminoids, and the like are suggested.

Somewhat similar problems are also encountered in producing ready-to-eat food bars, e.g. commonly referred to as "granola bars", and in those bars the binders are usually sugar syrups, shortening or the like. However, glycerine had also been proposed as the binder, but as U.S. Pat. No. 4,605,561 points out, in order to keep such food products from spoiling, the water activity (A_w), in general, must be less than about 0.9, and hygroscopic materials can cause difficulties in this regard, especially polyhydric alcohols, such as sorbitol and glycerol. That patent then goes on to propose a fondant of sucrose, corn syrup, fat and water as the binder.

U.S. Pat. No. 4,451,488 points out that the polyhydric alcohols may be used, in such food bars, but used in combination with a binder system that includes sugars, shortening and a combination of sorbitol and glycerol.

Cereal grains involve something of a similar problem, and U.S. Pat. No. 3,806,613, directed to a fortifying coating on cereal grain products, states that adhesive films of gums, shellac and the like have been used in the past for such purposes, but points out that edible fatty

acid esters of glycerol or sorbitol provide better results, especially for iron-fortified cereals.

Something of the same problem is also found in connection with dried fruits. For example, U.S. Pat. No. 4,363,825 relates to dried and shredded coconut and points out that glycols, such as propylene glycol, butylene glycol or glycerol, function as humectants for such products, which allow easy rehydration of the shredded coconut. To achieve low moisture content, the patent goes on to propose a coating of glycerol monostearate, glycerol, propylene glycol, maltodextrin, creamed coconut and salt.

As can be, therefore, easily appreciated, the art has recognized a number of difficulties in connection with adhesive coatings and binders for various foods. The specific problems vary, considerably, with the particular food involved, as briefly discussed above, but the common denominator of these difficulties is that of finding adequate materials to function in lieu of the traditional fats, for binding and adhesive purposes, for the particular food involved.

It would, therefore, be of substantial benefit in the art to provide an adhesive for a snack food which has both low fat content, for dietary purposes, and low moisture content, for storage-stable purposes, and which adhesive can adequately adhere seasoning to the surface of a cereal-based snack food, which snack food and the surfaces thereof present their own set of difficulties, especially that of absorption of the adhesive into the snack food itself. At the same time, it would be important to the art to provide such adhesives which are not brittle, such as aqueous applied and dried monosaccharides, i.e. sugars, but on the other hand, are not humectants which can increase water activity on storage, such as polyhydric alcohols. It would be a further advantage to the art to provide such adhesives which will firmly adhere the seasonings, but which will not become tacky and adhere the seasoned pieces of snack food together during handling, storage and use.

BRIEF DESCRIPTION OF THE INVENTION

The invention is based on several primary discoveries and several subsidiary discoveries. First of all, as a primary discovery, it was found that an aqueous applied adhesive could be rendered into a low water activity adhesive, with low moisture content or low water activities, when the adhesive is in the at least partially amorphous state, as opposed to the more generally non-amorphous state of aqueous applied sugar adhesive solutions.

As a second major discovery, it was found that the amorphous state of such aqueous applied adhesives could be achieved by including in the aqueous solution for application to the snack food a compound which would otherwise function as a humectant, i.e. a polyhydric alcohol.

Thirdly, as a major discovery, it was found that such an at least partially amorphous adhesive could be made from a mixture of at least one monosaccharide and at least one polyhydric, aliphatic, saturated alcohol having 3 to 6 carbon atoms.

As a subsidiary discovery, it was found that certain monosaccharides, i.e. glucose, mannose, galactose and fructose, are particularly useful in such an at least partially amorphous adhesive. Further, in such an at least partially amorphous adhesive, it was found that certain polyhydric alcohols, i.e. glycerol, sorbitol and mannitol, are particularly useful in forming such an at least

partially amorphous adhesive, in combination with the monosaccharides.

As another subsidiary discovery, it was found that glucose and glycerol form a very effective amorphous adhesive, particularly when used in ratios of between about 0.5:1 and 8:1.

As a further subsidiary discovery, particularly when the adhesive is applied directly from a water solution, it was found that salts, e.g. sodium and calcium salts, improve the adherence of the amorphous adhesive to the snack food and decrease hygroscopicity, and that, particularly, calcium chloride is most effective in this regard.

As a further subsidiary discovery, it was found that with the use of such at least partially amorphous adhesives, problems could be experienced in coating the adhesive on the snack food, in that the adhesive and snack food could adhere to the walls of the container in which the adhesive is applied to the snack food, e.g. a tumbler, but that this problem could be overcome by placing in the adhesive a small amount of an anti-stick agent, such as a small amount of fat.

It was also found that specific methods must be provided for adequately applying the at least partially amorphous adhesive to the snack food, and these methods include, among others, particular steps and temperatures for such application.

Thus, very briefly stated, the present invention provides a low fat content, seasoned, cereal-based snack food having a low fat and low moisture content (low water activity) edible adhesive on surfaces thereof and edible dry solids seasoning adhered to the surfaces by the adhesive. The improvement provided by the present invention is where the adhesive comprises an at least partially amorphous form of a mixture of at least one monosaccharide and at least one polyhydric, aliphatic, saturated alcohol having 3 to 6 carbon atoms.

In a method for producing the snack food, a mixture is formed of the at least one monosaccharide and at least one polyhydric alcohol and a co-solvent therefore. The mixture is heated to at least the amorphous causing temperature (usually above the melting point of the monosaccharide and alcohol) and for a time sufficient to cause the mixture to become an at least partially amorphous mixture. The amorphous mixture is cooled to a lower temperature where the viscosity and surface tension of the amorphous mixture substantially prevents absorption of the amorphous mixture into the snack food. The amorphous mixture is sprayed onto the snack food to coat the snack food with the amorphous mixture. The seasoning is then applied to the so-coated snack food, and the seasoned snack food is cooled to a temperature where the amorphous mixture is no longer substantially tacky. Thus, the seasoning is substantially firmly adhered to the snack food.

In another form of the process, a mixture is formed of the at least one monosaccharide, the at least one polyhydric alcohol, an edible fat having a melting point between 100° F. and 165° F., and an emulsifier for the fat. That mixture is stirred and heated to at least the amorphous-causing temperature for a time sufficient to cause the mixture to become amorphous and to form a solvent-in-oil emulsion. The emulsion is atomized, e.g. spray chilled, to encapsulate the amorphous mixture in the fat and provide small particles thereof. The particles are blended with the snack food and the seasoning to form a blend thereof, and the blend is heated to a melt temperature sufficient to cause the fat to melt and dis-

tribute the amorphous mixture over the snack food and to adhere the seasoning to the snack food. The seasoned snack food is then cooled to a temperature where the amorphous mixture is no longer substantially tacky. Thus, the seasoning is substantially firmly adhered to the snack food.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS OF THE INVENTION

As noted above, the invention is directed to a low fat content, seasoned, cereal-based snack food having a low fat and low moisture content (low water activity) edible adhesive on surfaces thereof. Typically, the snack food of the present invention will have less than about one third of the fat of usual oil adhesive snack foods. For example, in a snack food cracker, when the seasoning is adhered with oil, the total oil content of the cracker is about 11%. With that same cracker, but when the seasoning is adhered with the present amorphous-form adhesive, the fat content will typically be about 1 1/2%. Thus, the present invention, truly, provides a low fat content snack food. On a broader plane, the fat content of the present adhesive will be from zero up to about 10%, which should be contrasted with oil-base adhesives which are, typically, nearly 100% fat.

The moisture content of the present snack food will be low, and, including the moisture content of the adhesive, will typically have a water activity less than about 0.60. In addition, due to the amorphous nature of the adhesive, the water activity of the adhesive is exceptionally low, e.g. typically a water activity of about 0.80 or less.

The adhesive can be applied to any cereal-based snack food (potatoes being included in the present definition of cereal for purposes of the present specification and claims) and, typically, the snack foods are made of corn, barley, oats, wheat, rice and the like. The snack food may be puffed, partially puffed, or substantially unpuffed, e.g. a corn curl, a cracker or a chip. However, in order to keep a low fat content of the snack food, the snack food will be normally baked, although some small amount of deep fat frying may be used, particularly after a baking step.

The seasoning may be any conventional edible seasoning, e.g. salt, sugar, tomato powders, onion and garlic powders, sour cream powders, cheese powders, spices, peppers, etc., and the particular seasoning may be chosen as desired; it is not critical to the invention.

The adhesive will be disposed on surfaces of the snack food. Usually, a relatively uniform disposition of the adhesive on substantially all of the surfaces of the snack food will be required, although for certain applications of seasoning, it may not be necessary for such substantial covering of the surfaces with the adhesives, e.g. where localized seasoning is intended.

The adhesive must be in an at least a partially amorphous form, preferably substantially amorphous, but, at least, with small amounts of crystallization, e.g. no more than 40% of the adhesive may be in a crystalline form, more preferably no more than 30%, and usually less than 10%, and conversely the adhesive is at least 60% amorphous, etc.

Normally, the adhesive, as a consequence of being amorphous, will also be supersaturated with respect to at least one of the polyhydric alcohol and the monosaccharide, and often with respect to both. With such mixtures of the polyhydric alcohol and monosaccharide,

the amorphous-caused supersaturation with respect to at least one of the alcohol or monosaccharide will so form the adhesive to reduce water activity and elevate surface tension (to prevent the adhesive from being imbibed by the snack substrate), at least when in a form having the low crystallizations described by the above. Of course, the need for the amorphous-caused supersaturation at all, to achieve the desired state of the adhesive, will strongly depend on the particular alcohol and monosaccharide used, as well as the proportion thereof. With some alcohols and monosaccharides, only one of these need be in the amorphous-caused supersaturated form, while with others both should be, and while with others the amorphous-caused supersaturation is not required, in order to reach the low levels of crystallization of the amorphous form, as described above. This can easily be determined, however, by empirically determining the correct amorphous form, with the low levels of crystallization, for any particular combination and proportions of alcohol and monosaccharide.

The particular monosaccharide or monosaccharides are not critical, so long as the monosaccharides will form an amorphous form, and the monosaccharides may be selected from aldopentoses, aldohexoses, and ketohexoses, and mixtures thereof. However, preferably, the monosaccharides are glucose, mannose, galactose and fructose, or mixtures thereof, and the most preferred monosaccharide is glucose.

Likewise, the polyhydric alcohol is not particularly critical, again, so long as in combination with the monosaccharide, the required amorphous form of the adhesive will be formed. However, glycerol, sorbitol and mannitol, and mixtures thereof, have been found to be particularly useful for this purpose, and are preferred. The most preferred polyhydric alcohol is glycerol, and, hence, the most preferred combination of monosaccharide and polyhydric alcohol is that of glucose and glycerol.

The weight ratio of the monosaccharide to alcohol, and particularly in regard to the preferred combination of glucose and glycerol, is between about 0.5:1 and 8:1. This will form the amorphous adhesive, but for a better balance of properties, it is preferred that that ratio be between 1:1 and 4:1.

Especially when the adhesive is applied directly from a water solution, the adhesive may contain at least one edible salt, especially sodium and calcium salts or mixtures thereof, and more preferably sodium or calcium chloride or mixtures thereof. The preferred form is where the salts are both sodium chloride and calcium chloride. Calcium chloride (hydrated) will form a gel with most water soluble proteins in the seasoning (many seasonings contain water soluble protein), especially when the seasoning protein content is at least about 20% or greater. This gel will deter hygroscopicity which might be otherwise associated with some of the present ingredients, e.g. glycerol, sorbitol and glucose, having humectant properties. For example, many seasonings will have protein contents, such as 20% or more of sodium caseinate, e.g. cheese powders and the like, and the gel formed with the salt, particularly calcium chloride, is very useful in lowering the hygroscopicity of the adhesive. If the seasonings do not contain such protein, for reduced hygroscopicity, low levels of such protein, e.g. sodium caseinate, may be added to the seasoning prior to application to the snack food. For this purpose, at least about 20% protein and up to about 50% protein may be added to the seasoning.

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As briefly noted above, with the present low fat or no fat adhesive, it is possible that some of the adhesive or seasoning may adhered to the walls of the apparatus in which the adhesive/seasoning is applied to the snack food. This is normally not a problem with conventional oil adhesives, since the oil functions as an anti-stick agent in such circumstances. With particular apparatus, e.g. anti-stick coated apparatus, e.g. Teflon-coated apparatus, such sticking may not be a difficulty, but to prevent sticking, a small amount of fat/oil may be used in the adhesive, typically from 1% up to 15%, more usually less than 10%, and very typically about 5% or less. Any edible fat/oil may be used in this regard, but preferably an oil is used, since this provides better anti-stick properties. More preferably, for dietary purposes, the oil is a vegetable oil, e.g. soybean oil. However, irrespective of the particular fat and/or oil, good anti-stick properties can be achieved, generally, when the weight ratio of the monosaccharide to the fat and/or oil is between about 20:1 and 6:1.

Of course, the adhesive will have residual amounts of the co-solvent for the monosaccharide and polyhydric alcohol. While a variety of co-solvents may be used, e.g. ethyl alcohol, since the monosaccharides are water soluble and the present polyhydric alcohols may be chosen so as to be water soluble, water is the preferred co-solvent.

Finally, the adhesive may contain flavors, if desired, and in certain cases, the adhesive may also contain seasoning. For example, where a peppery taste is to be imparted to the snack food, pepper oils may be included in the adhesive, to give a pepper background flavor to the snack food.

Snack food, with the above-described adhesive, can be prepared by direct application of the adhesive to the snack food, or it can be applied by an indirect application of the adhesive to the snack food. In the direct application method, the adhesive is prepared and sprayed directly on the snack food. In the indirect method, the adhesive is prepared in an encapsulated form, and the encapsulated form is applied to the snack food (mostly in a blend with the desired seasoning).

In the direct application form, a mixture is formed of the at least one monosaccharide and the at least one polyhydric alcohol and a co-solvent therefore, e.g. typically water, the preferred co-solvent. The mixture is then heated to at least the amorphous-causing temperature. The amorphous-causing temperature will, of course, vary with the particular monosaccharide, the particular polyhydric alcohol, and the ratios thereof, as well as the amount of water in which the monosaccharide and alcohol are dissolved. However, generally speaking, the amorphous-causing temperature is generally above the melting point of the highest melting point component of the adhesive, but generally will be at least 150° F., and more usually at least 200° F., and up to about 350° to 400° F. The particular amorphous-causing temperature must be imperically determined for any combination of monosaccharide, alcohol and water. The mixture is allowed to dwell at that temperature for a time sufficient to cause the mixture to become at least partially amorphous, as defined above. Here again, that time will vary considerably with the particular monosaccharide, alcohol and amount of water, but, generally speaking, the mixture will become amorphous in a relatively short time, e.g. about one minute or in about five minutes, and usually less than in about thirty minutes.

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After the mixture has become at least partially amorphous, the amorphous mixture is cooled to a lower temperature where the viscosity and surface tension increases to such a point that the amorphous mixture is substantially prevented from being absorbed into the snack food. The lower temperature will, of course, not only depend upon the particular monosaccharide, alcohol and amount of water, but also on the surface of the snack food to which the adhesive is being applied. It is important, however, that the viscosity and surface tension of the amorphous mixture be such that the adhesive is not substantially absorbed into the snack food, but substantially remains on the surface thereof. This viscosity and surface tension, and hence the lower temperature, must be determined imperically for any particular snack food and any particular amorphous adhesive. In any event, the lower temperature to which the adhesive is cooled must be sufficient that the viscosity and surface tension of the adhesive is high enough that when the adhesive is sprayed onto the snack food, the adhesive remains, largely, on the surface of the snack food, and is not substantially absorbed thereinto, e.g. no more than 30%, preferably no more than 10%, is absorbed into the snack food. While this lower temperature must be determined imperically, in most cases, that lower temperature will be at least below 175° F., and usually at least below 160° F., e.g. somewhere between about 120° F. and 160° F.

The cooled amorphous mixture is then applied, e.g. sprayed, onto the snack food to coat surfaces of the snack food with the amorphous mixture. Any conventional spraying device may be used in this regard, but preferably a conventional atomizing spraying device is used (e.g. an air atomizing nozzle), since such conventional devices will produce small droplets of the adhesive and more uniformly coat the snack food.

After applying the adhesive, the seasoning is applied to the so-coated snack food. Here again, the particular means of applying the seasoning is not critical, and the seasoning may be applied in a conventional snack food tumbler, or fluidizing chamber, or the like. Indeed, the adhesive may be sprayed onto the snack food to coat the surfaces thereof in the same apparatus in which the seasoning is applied to the snack food, and, this is a preferred embodiment.

It is also preferable that both the adhesive and the snack food be heated during application of the adhesive. Again, the particular temperature will depend upon the particular adhesive and the particular snack food, but, generally speaking, the snack food and/or the adhesive will be heated to temperatures between about at least 120° and 170° F., e.g. 125° to 175° F., in order to assure even coating of the adhesive and even adherence of the seasoning to the adhesive.

Thereafter the seasoned snack food is cooled to a temperature where the amorphous mixture is no longer substantially tacky. This, again, will depend upon the particular adhesive and the particular snack food, but, generally speaking, the so-seasoned snack food will be cooled to a temperature below about 120° F., especially about 115° F., and more preferably below 100° F., in order to cause the amorphous adhesive to reach very high viscosities and, accordingly, substantially reduce any tackiness.

Thus, the seasoning, by this method, is substantially firmly adhered to the snack food.

In another form of the method for preparing the snack food, a mixture of the at least one monosaccha-

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ride, the at least one polyhydric alcohol, an edible fat having a melting point between 100° F. and 165° F., and an emulsifier for that fat is prepared with the co-solvent, e.g. usually water. That mixture is stirred and heated to at least the amorphous-causing temperature, and for a time sufficient to cause the mixture to become amorphous and to form a solvent-in-oil emulsion such that the fat encapsulates the amorphous adhesive. Here again, the required temperature will vary with the particular adhesive and snack foods, and imperial tests must be used to ensure that the adhesive is at least partially amorphous, as defined above. The amorphous-causing temperature, however, can be at least approximately determined in this method, as well as the above-described method, when the mixture becomes substantially translucent. However, with stirring so as to form the solvent-in-oil emulsion, that translucent mixture will again become somewhat opaque, as the emulsion is formed. Thus, by following the light transmission characteristics of the mixture, at least an approximate amorphous-causing temperature can be determined by the translucency of the mixture, and the proper emulsion can be determined when that translucency becomes more opaque.

The edible fat may be any edible fat having the melting points described above. However, conventional fats, such as hydrogenated soybean oil, safflower oil, peanut oil, corn oil, and the like, are quite acceptable.

Likewise, the emulsifier is not critical and may be chosen from a wide range of emulsifiers, such as monoglycerides, sodium stearate, etc., and it is only necessary that the emulsifier be capable of emulsifying the mixture to a solvent-in-oil emulsion, with relatively small emulsion particle sizes, e.g. less than 50 microns.

The stirring and heating to cause the emulsion of the mixture, which has been heated to at least the amorphous-causing temperature, need only be sufficient to cause that solvent-in-oil emulsion so as to fat encapsulate the adhesive, and conventional stirrers are satisfactory in this regard. However, for better dispersal of the encapsulated adhesive onto the snack food, it is preferred that the particle size of the emulsion, and hence the encapsulated adhesive, be quite small, e.g. less than 10 microns or so. To achieve that very small particle size, it is preferred that the stirring is actually by homogenization, in a conventional dairy homogenizer.

Again, the amorphous-causing temperatures will be as described above in connection with the first form of the process, but in this second form of the process, if a lower amorphous-causing temperature is used, that temperature must be sufficient to also melt the fat so that the fat may be emulsified. Since most amorphous-causing temperatures will be about 150° F. or higher, e.g. at least 160° F., usual fats will have a melt temperature less than those amorphous-causing temperatures, particularly when the melting point of the fat is between about 110° F. and 165° F., especially between about 140° F. and 150° F.

The emulsion is atomized, e.g. spray chilled, and this encapsulates the amorphous mixture in the fat in small particles thereof. The spray atomizing may be in any conventional apparatus, i.e. a box dryer or a tower dryer, with the entering air temperatures somewhere between about 40° F. and 100° F., although temperatures outside of this range may be used, for particular adhesives.

The encapsulated particles are then blended with the seasoning and then with the snack food. This blending

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will be dependent upon the particular snack food. For example, in a corn curl, the corn curls and the adhesive/seasoning mixture are tumbled together or blended in a fluidized bed. On the other hand, when the snack food is a cracker or chip, that mixture of adhesive and seasoning may be simply dusted onto the cracker or chip. In any event, the blending of the encapsulated particles with the snack food and the seasoning is sufficient to cause the required mixture thereof.

Thereafter, the blend is heated to a melt temperature sufficient to cause the fat to melt, distribute the amorphous adhesive mixture over the snack food and to adhere the seasoning to the snack food, i.e. to provide the seasoned snack food. That melt temperature will, of course, simply be the melting point of the fat (or higher) used in producing the encapsulated adhesive, as discussed above.

Alternatively, the snack food may be heated to a higher temperature above the melt point of the fat and then a blend of adhesive/seasoning is added. A combination of this higher temperature and specific heat of the heated snack food must be sufficient to fully melt the encapsulating fat.

Thereafter, the seasoned snack food is cooled to a temperature where the amorphous mixture is no longer substantially tacky, as described above. Here again, therefore, this form of the process provides that the seasoning is substantially firmly adhered to the snack food.

Depending on the particular snack food, the particle size of the encapsulated adhesive can vary considerably. If the snack food has a very small pore size of a porous surface, then, correspondingly, the particle size of the encapsulated adhesive should be small, but on the other hand, where the pore size of the snack food surface is large, the particle size may be large. However, generally speaking, when the average particle size of the encapsulated particles is between about 1 and 500 microns, those particle sizes will be acceptable for almost any snack food.

Since this form of the product will have some fat therein, it is also important that the fat not oil out during transportation and storage. Since transportation and storage temperature can reach 100° F., it is, therefore, preferred that the melt temperature of the fat be at least 100° F., and more preferably, for safety purposes, at least 125° F., e.g. a fat having a melting point between 110° F. and 165° F.

In regard to either the direct spray application method or the indirect encapsulation method, the adhesive may also contain flavors or seasonings. This is not generally preferred, since the high temperatures to which the adhesive have been subjected for causing the amorphous form can cause undesired flavor changes in such flavors and seasonings. However, the more stable flavors and seasonings may be incorporated into the adhesive simply by incorporating those flavors or seasonings into the co-solvent from which the adhesive is made, as described above.

As can be appreciated from the above descriptions of the processes, the monosaccharide/alcohol/water mixture (water being the preferred co-solvent) when heated to the amorphous-causing temperature will cause the crystals of the monosaccharide to dissolve or melt and, in combination with the alcohol, form the amorphous, or glass state, adhesive. In this state, the adhesive resists crystallization when cooled. It is necessary to achieve that amorphous state in order to establish a fluidity of

the adhesive for ease of application and to provide a tacky surface to which the seasoning will adhere or bond. However, after prolonged contact with the snack food and seasoning, the moisture in the adhesive will tend to migrate from the adhesive, driving crystallization of the monosaccharide which will form an irreversible bond of the adhesive to the snack food and the seasoning. At that point, of course, the adhesive will, nonetheless, be at least in a partially amorphous form, as described above. Therefore, the moisture content plays a useful role in the adhesive, but on the other hand, the moisture content must not be high enough to induce spalling of the adhesive or wetting of the seasoning or the snack food. The alcohol of the adhesive prevents substantial crystallization of the monosaccharide and, thus, maintains the adhesive at least in the partially-amorphous form. This at least partially amorphous form is important to the adhesive, since the adhesive in that form will preserve the integrity and elasticity of the adhesive for both the snack food and the seasoning. This prevents the seasoning from being displaced from the snack food during handling, storage and the like.

As noted above, the adhesive may contain salts, and certain salts, especially sodium chloride, will reduce the natural sweet flavor of many monosaccharides and alcohols. The added salt will also reduce microbial growth during storage and prior to use of the snack food. Of course, microbial growth is strongly influenced by the water activity. While the present adhesive has moisture, as described above, that moisture serves to form the at least partially amorphous form and to reduce viscosity for ease of spray atomization in disposition on the snack food. That water, however, is involved in hydrogen bonding with solutes, and the water activity thereof is substantially reduced, as opposed to free or bulk phase water. However, the amount of water in the adhesive should never be more than that which will produce a water activity greater than 0.9, in combination with any salt added to the adhesive.

In regard to the encapsulation form of the invention, as described above, when the fat, e.g. 145° F. soybean oil stearin, microencapsulates the adhesive, e.g. 5 to 30 micron spheres, this precludes the adhesive from reacting with the seasoning until the melt temperature has been reached, as described above, and the encapsulating fat melts. With such small spheres, the adhesive/seasoning can be most uniformly disposed on the snack food, and by a very convenient method, e.g. simply tumbling or air blending. Once those small capsules are uniformly distributed, by raising the snack food to the melt temperature of the fat, the adhesive will be very uniformly dispersed on the snack food.

To achieve that encapsulation, as described above, an emulsifier is used. The emulsifier stabilizes the water-in-oil emulsion from which the encapsulated particles are formed. In addition, it may also be used to keep the fat in the adhesive in a well-dispersed state, while reaching the temperature which causes the amorphous state. The amount of the emulsifier for this latter purpose is not critical, so long as that function is obtained, but the fat should be at a level low enough so as to allow the phases to separate during the subsequent heating step when the melt temperature is reached. To keep the emulsifier at such low levels, it is preferred to use relatively high shear during the emulsification step, since the high shear will allow the proper emulsification without larger amounts of emulsifier. While this amount of emulsifier may vary considerably, depending on the

particular emulsifier, generally speaking, from 0.5 to 3% of emulsifier, based on the total weight of the mixture, is satisfactory.

In regard to either the direct spray application method or the indirect encapsulated particles application method, the temperature to which the mixture is heated to achieve the amorphous state (substantially non-crystalline state) must be determined imperically. However, basically, the heating is to allow anomerization, e.g. to the alpha and to the beta isomers, e.g. glucose. Anomerization will assist the amorphous-caused supersaturation of the monosaccharide, as described above, especially during subsequent cooling, but without significant crystallization.

The alcohols, as noted above, deter crystallization of the monosaccharide. This is apparently by disrupting the hydrogen bonding during ordinary crystal formation. The alcohols also lower the viscosity of the at least partially amorphous adhesive, and, of course, it is necessary for the viscosity to be low enough that the adhesive is able to flow and bond with the seasoning and the snack food.

With some monosaccharides, the heating step to cause the amorphous state does not actually result in true solutions of the monosaccharide. However, the product can be considered a supersaturated solution at ambient temperatures, with good microbial stability. Even if a true solution is not reached, the heating can be conducted such that the amorphous state will, nonetheless, be achieved.

In regard to the form of the process using the encapsulated adhesive, when the snack food, with the encapsulated particles and seasoning thereon, is heated to above the melting point of the encapsulating fat, the phases, of course, separate. The amorphous monosaccharide/alcohol adhesive is imbibed by both the seasoning and the snack food, forming a continuous structure. Upon cooling, some of the monosaccharide will crystallize, usually, forming an irreversible bond of the seasoning and snack food. As noted above, this bond is important, but on the other hand, it is equally important that some of the adhesive remain in the amorphous state, since that state provides good bonding with flexibility so that with normal agitation encountered during the life of the product, the seasoning will not flake off.

From the foregoing, it can be appreciated that wide ranges of the ingredients of the adhesive may be used. However, typically the ranges of the ingredients will be as follows.

Monosaccharide will be about 5 to 70%, with a preferred range of about 20 to 70% for the direct application method, and 5 to 40% being the preferred range for the encapsulation method.

The alcohol will be from about 10 to 50%, with the preferred range for the direct application method being from about 20 to 40%, and the preferred range for the encapsulation method being about 5 to 40%.

The solvent, e.g. water, will usually be from about 1 to 25%, with up to about 25% in the direct application method and up to about 20% in the encapsulation method being preferred.

The salt, at least preferably used in the direct application method, will be up to about 15%.

The fat used in the direct application method, for providing an anti-stick to the apparatus, when used, will be up to about 15%.

The use of other salts for providing the protein gel, as described above, when used, especially in the direct

application method, will be in amounts of about 0.5 to 8%.

Flavoring, when used, will be up to about 10%.

The fat used for encapsulation will range from about 35 to 85%, with about 60% being quite sufficient.

A typical and preferred formulation for the direct application method is as follows:

Glycerol	30%
Glucose	45%
Water	10%
Sodium Chloride	7%
Soybean Oil (70-130° F. Melt)	4%
Calcium Chloride	2%
Flavor	2%

A typical and preferred formulation for the encapsulation form is as follows:

Partially hydrogenated Soybean Oil (melt point 110-160° F.)	60%
Emulsifier (Sodium Stearate)	1%
Glucose	24%
Glycerol	10%
Water	5%

The invention will now be illustrated in regard to the following examples. In the examples, as well as in the foregoing disclosure and following claims, all percentages, ratios and parts are by weight, unless otherwise indicated. However, it will be apparent that the invention is not limited to the specific examples, but extends to the breadth of the foregoing disclosure.

EXAMPLE 1

Into a 1500 milliliter beaker was placed 30% glycerol, 45% glucose, 10% water, 7% sodium chloride, 4% partially hydrogenated soybean oil (125° F. melting point), 2% calcium chloride (in a 30% solution in water), and 2% fried fat flavor, with the total ingredients weighing 1000 grams. The beaker was placed on a hot plate with a magnetic stirrer, and the water, calcium chloride solution and salt, as described above, were added thereto with stirring. This mixture was heated to 180° F. with continued stirring. To the mixture was added the glycerol, glucose, oil and flavor, and, with stirring, the resulting mixture was heated to 250° F. At this temperature, the solution became somewhat translucent, and it was therefore determined that the amorphous-causing temperature had been reached.

The amorphous adhesive was cooled to ambient temperature (approximately 70° F.), and the adhesive had a consistency of viscous syrup.

To 130 grams of air-popped popcorn, was added 46 grams of cheese powder (Beatreme CT 113), 4 grams of sodium chloride, and 16 grams of the above-described adhesive. This addition was achieved by blending the cheese powder and salt together, and the popcorn was placed in a three gallon polyethylene bag. The adhesive was warmed on a hot plate to a temperature between 110° F. and 130° F., atomized into the bag with a conventional spray gun (Binks Model 62 with a No. 67 nozzle and a No. 367 needle). The pressure of the gun was 30 psi.

When the adhesive was being sprayed into the bag, containing the popcorn, the air flow from the spray nozzle agitated the popcorn in the bag and allowed even coating of the adhesive. The blend of cheese powder and salt were then tumbled in the bag for about 5 to

10 seconds and produced an even coating on the snack food, i.e. the popcorn.

EXAMPLE 2

An adhesive was prepared by mixing 60% partially hydrogenated soybean oil (melt range 110°-160° F.) and 1% sodium stearate emulsifier and heating the mixture to about 225° F., on a conventional hot plate. 24% of glucose, 10% of glycerol and 5% of water, all contained in a beaker, were heated on a hot plate to about 225° F. The heated combination of oil and emulsifier was then added thereto. This mixture was homogenized in a conventional laboratory homogenizer to form a water-in-oil emulsion thereof.

That emulsion was spray atomized in a conventional laboratory spray box with an entering air temperature of about 70° F. to produce fat microencapsulated adhesive.

7.5 grams of cheese powder (Beatreme CT 113) was mixed with 2.5 grams of the encapsulated adhesive. Conventional baked saltine crackers were placed in an oven at about 275° F. until they had equilibrated (about 45 seconds) and then removed from the oven. The encapsulated adhesive mixed with the cheese powder was dusted onto the hot crackers, and the hot crackers were allowed to cool. The cooled crackers had the cheese powder firmly adhered thereto.

As an alternate to this last step, the cheese powder and/or the adhesive can be dusted onto the crackers before heating, but this results in somewhat of a loss of the cheese flavor. Also, alternatively, the adhesive may be placed on the hot crackers separately from the cheese powder.

Having described the invention, it will be apparent to those skilled in the art that the invention admits to many modifications and variations. It is, therefore, the intention that such modifications and variations be within the described invention, as set forth by the scope of the annexed claims.

What is claimed is:

1. In a low fat content, seasoned, cereal-based snack food having a low fat and low moisture content edible adhesive on surfaces thereof and edible dry solids seasoning adhered to the surfaces by the adhesive, the improvement wherein the adhesive comprises an at least partially amorphous form of a mixture of at least one monosaccharide and at least one polyhydric, aliphatic, saturated alcohol having 3 to 6 carbon atoms.

2. The snack food of claim 1 wherein the monosaccharide is selected from the group consisting of aldopentoses, aldohexoses and ketohexoses and mixtures thereof.

3. The snack food of claim 2 wherein the monosaccharide is selected from the group consisting of glucose, mannose, galactose and fructose and mixtures thereof.

4. The snack food of claim 3 wherein the monosaccharide is glucose.

5. The snack food of claim 1 wherein the alcohol is selected from the group consisting of glycerol, sorbitol and mannitol and mixtures thereof.

6. The snack food of claim 5 wherein the adhesive is an at least partially amorphous form of a mixture of glucose and glycerol.

7. The snack food of claim 6 wherein the weight ratio of glucose to glycerol is between 0.5:1 to 8:1.

8. The snack food of claim 7 wherein the ratio is between 1:1 to 4:1.

9. The snack food of claim 1 wherein the adhesive also contains at least one edible salt.

10. The snack food of claim 9 wherein the salt is selected from the group consisting of sodium and calcium salts and mixtures thereof.

11. The snack food of claim 10 wherein the salt is selected from the group consisting of sodium and calcium chloride and mixtures thereof.

12. The snack food of claim 11 wherein the salts are both sodium chloride and calcium chloride.

13. The snack food of claim 1 wherein the adhesive also contains an edible fat.

14. The snack food of claim 13 wherein the fat is an oil.

15. The snack food of claim 14 wherein the oil is a vegetable oil.

16. The snack food of claim 15 wherein the vegetable oil is soybean oil.

17. The snack food of claim 13 wherein the weight ratio of the monosaccharide to fat is between 20:1 and 6:1.

18. A method for producing the snack food of claim 1, comprising:

(A) forming a mixture of the at least one monosaccharide and the at least one alcohol in a co-solvent therefor;

(B) heating the mixture to at least the amorphous-causing temperature and for a time sufficient to cause the mixture to become an at least partially amorphous mixture;

(C) cooling the amorphous mixture to a lower temperature where the viscosity and surface tension of the amorphous mixture substantially prevents absorption of the amorphous mixture into the snack food;

(D) spraying the amorphous mixture onto the snack food to coat surfaces of the snack food with the amorphous mixture;

(E) applying the seasoning to the so-coated snack food; and

(F) cooling the seasoned snack food to a temperature where the amorphous mixture is no longer substantially tacky; and wherein the seasoning is substantially firmly adhered to the snack food.

19. The method of claim 18 wherein the co-solvent is water.

20. The method of claim 18 wherein the amorphous-causing temperature is at least 150° F.

21. The method of claim 20 wherein the amorphous-causing temperature is at least 200° F.

22. The method of claim 18 wherein the lower temperature is at least below 175° F.

23. The method of claim 22 wherein the lower temperature is at least above 120° F.

24. The method of claim 18 wherein the amorphous mixture is atomized in a spray device for spraying onto the snack food.

25. The method of claim 18 wherein the adhesive also contains seasonings.

26. A method for producing the snack food of claim 1, comprising:

(A) forming a mixture of the at least one monosaccharide, the at least one polyhydric alcohol, an edible fat having a melting point between about 100° F. and 165° F., and an emulsifier for the fat;

(B) stirring and heating the mixture to at least the amorphous-causing temperature for a time sufficient to cause the mixture to become amorphous and to form a solvent-in-oil emulsion;

(C) atomizing the emulsion to encapsulate the amorphous mixture in the fat and provide small particles thereof;

(D) blending the particles with the snack food and the seasoning to form a blend thereof;

(E) heating the blend to a melt temperature sufficient to cause the fat to melt and distribute the amorphous mixture over the snack food and to adhere the seasoning to the snack food to provide seasoned snack food;

(F) cooling the seasoned snack food to a temperature where the amorphous mixture is no longer substantially tacky; and wherein the seasoning is substantially firmly adhered to the snack food.

27. The method of claim 26 wherein the co-solvent is water.

28. The method of claim 26 wherein the amorphous-causing temperature is at least 150° F.

29. The method of claim 28 wherein the amorphous-causing temperature is at least 200° F.

30. The method of claim 26 wherein the fat is a hydrogenated soybean oil.

31. The method of claim 26 wherein the emulsifier is a monoglyceride or sodium stearate.

32. The method of claim 30 wherein the fat has a melting point between 110° F. and 165° F.

33. The method of claim 26 wherein the stirring is by homogenization.

34. The method of claim 25 wherein the particles have an average particle size of between 1 and 500 microns.

35. The method of claim 26 wherein the melt temperature is at least 100° F.

36. The method of claim 26 wherein the melt temperature is at least 125° F.

37. The method of claim 26 wherein the adhesive also contains seasonings.

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