

Drigard & Castro
Abogados

Aparado 3602

Cra. 7 16-56
Bogotá - Colombia S.A.

Tel. Com. 3602200
Tel./Fax: (57.1) 2627076
(57.1) 3602700

E-Mail: drigard@drigardycastro.com.co

AS: 87.112

SUPERINTENDENCIA DE INDUSTRIA Y C
DIVISION DE NUEVAS CREACIONES
E. S. D.

RECEPCION DE DOCUMENTOS
Radicación: 2004-00-05 1614170 Folios: 2
Fecha: 05/08/2004
Trámite: 002 PRESENTA Y REGISTRA/ 534 PETICION
Dependencia: 2004 DIVISION DE NUEVAS CREACIONES

REF.: Expediente No. 02 003.266 solicitud de Patente
a nombre de **ROBERTO GONZALEZ BARRERA**

Titulada: **MÉTODO PARA LA PRODUCCIÓN DE HARINA DE MAÍZ
PRECOCIDA Y PELADA PARA AREPAS Y TORTILLAS**

RAMIRO CASTRO DUQUE, vecino de Bogotá, portador de la tarjeta Profesional No. 1003 del Consejo Superior de la Judicatura, obrando como apoderado de **ROBERTO GONZALEZ BARRERA**, según lo acredita el documento de poder presentado en la Secretaría General, de acuerdo con el Artículo 44 de la Decisión 486 de la Comisión de la Comunidad Andina, me permito solicitar que se examine si la invención contenida en la solicitud en referencia es patentable.

De acuerdo con lo anterior, me permito anexar el recibo oficial de caja No. 04-42,148 por valor de \$353.000.

Señor Superintendente,


RAMIRO CASTRO DUQUE
C.C. No. 170.322 de Bogotá
Código 340
T.P. No.1003 del C.S.J.
Cra 7 No. 16-56 Piso 9

Agosto 05, 2004
CHP/MEV/hr.

111
#14

SEPTIEMBRE 2004
Reduccion: De 603266 a 603266 Folios: 2
Fecha (Hr): 28/09-05 16:44:21
Transite : (02 PATENTES) 0 1 REGISTRO 530 CLASIFICACION
Dependencia: 2003 DIVISION DE REVENOS CRFACIEN

917 800176309-2

RECIBO OFICIAL DE CAJA : 04 - 12,548
FECHA : MAYO 27 DE 2004

CONSIGNACION

DEPOSITANTE	TIPO PAGO	CARACO	CUENTA	No. PAGO	FECHA PAGO	Mr. PAGO
ENTERO S CASTRO LTDA	CONSIGNACION	BAJOS POPULAR	050-00110-6	2173/277	27/09/2004	\$6,573,100.00

CONCEPTO

CANT. REGISTRO	CONCEPTO	TOTAL CONCEPTO
1 90039-01-01 COLICITUDES	05 EXAMEN DE PATENTABILIDAD DE INVEN	353,000.00
	TOTAL :	353,000.00

SUM: TRESCIENTOS CINCUENTA Y TRES MIL PESOS

RESPONSABLE : 

RECIBO DE CAJA APLICADO AL EXPEDIENTE N.º

DIVISION DE NUEVAS CREACIONES

RADICACIÓN EXPEDIENTE No. 02- 3266

**EL EXTRACTO DE LA PRESENTE SOLICITUD DE PATENTE DE INVENCION ,
FUE PUBLICADO EN LA GACETA DE PROPIEDAD INDUSTRIAL No 537, DE
FECHA 27 DE FEBRERO DE 2004, EL TERMINO HABIL SEÑALADO POR LA
LEY EXPIRA EL 27 DE MAYO DE 2004.**

NOTA: Dentro del plazo de los seis (6) meses siguientes a partir de la fecha de publicación en la gaceta de Propiedad Industrial, deberá solicitar y cancelar el examen de patentabilidad so pena de que la solicitud caiga en abandono, de acuerdo con lo establecido en el Artículo 44 de la Decisión 486/2000.

SE PRESENTARON OPOSICIONES POR PARTE DE TERCEROS.

SI _____ NO ☒ _____

46
113

**SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO
DIVISION DE NUEVAS CREACIONES**

2020

Bogotá, D.C.

Doctor

Ramiro Castro Duque
Apoderado

Oficio No. 6855

**REFERENCIA: Radicación No. 02- 3266
Trámite 002
Evento 001
Actuación 430
Folios 011**

Como resultado del examen de fondo, realizado con fundamento en el artículo 45 de la Decisión 486 de la Comisión de la Comunidad Andina, se le comunica:

1. DOCUMENTOS ESTUDIADOS.

- Capítulo descriptivo: folios 34 al 46
- Capítulo reivindicatorio: folios 47 al 50

Se acepta reivindicación de prioridad US 6,326,045 del 4 de Diciembre de 2001.

2. OBJETO DE LA INVENCION.

Título: "Método para la producción de harina de maíz precocida y pelada para arepas y tortillas".

La invención se refiere a :

- Un método para elaborar continuamente harina de maíz precocida y pelada a partir de grano de maíz limpio, que comprende los siguientes pasos: acondicionar el grano, triturar el grano, molienda, secar al aire y clasificar la primera fracción del grano para retirar una primera fracción de arenilla de harina y fracción de cáscara. Recolección de las fracciones de arenilla de harina y cáscara la cual constituye una fracción de endosperma-germen. Acondicionar la fracción de endosperma-germen para hidratar parcialmente su endosperma de harina. Precocer la fracción acondicionada de endosperma-germen en una columna de vapor y cocción adicional en un rodillo para efectuar una gelatinización parcial controlada. Enfriar la fracción cocida de endosperma-germen en un secador adiabático para producir un material en hojuelas y secar al aire; estabilizar el material en hojuelas a una deseada humedad, moliendo el material en hojuelas seco en una serie de molinos de rodillos primario y secundario.

-El método comprende mezclar cal con harina integral para arepas para producir harina de masa, la cual se produce en un 80 a 85 % por kilogramo de grano de maíz . El triturado del grano limpio y acondicionado se lleva a cabo con un molido por abrasión produciendo una fracción en bruto y una fracción fina. En el método la fracción de endosperma-germen se retira adicionalmente a través de una serie de aspiradores para aislar la fracción de arenilla de harina y fracción de cáscara como un alimento de animales, representando desde 15 a 20% del peso total de

maíz. La fracción pelada es temporizada rociando agua hasta alcanzar una humedad de 21%, durante 20 min a 30 min.

- La fracción acondicionada se cocina previamente en forma parcial en dos pasos: a) con inyección de vapor en una cocina de columna a una temperatura de vapor de 154 C a 162 C y durante 40 min a 100 min. b) con presión de rodillo controlada y temperatura de vapor (3100 kPa a 3445 kPa y desde 210 C a 240 C).

- La hojuela precocida es secada al aire en dos pasos: a) secado o enfriado adiabático de dicha partícula mientras se retira su humedad desde 18% a 15% y b) secado de tubo de vapor, para disminuir la humedad de partículas desde 15% a 11% a una temperatura de vapor de 135 C a 145C, durante un tiempo de 2 min a 5 min.

- La hojuela seca se muele en un molino de rodillo primario y secundario y se segrega bajo malla 30 a 80. El molido fino es centrifugado en un entoleter para producir una harina para arepas y mezclado con cal para una harina de masa (0.3% en peso basado en harina para arepas). La harina para arepas es hidratada con agua tibia hasta una humedad final de 53 a 60% preferiblemente una humedad de 45 a 49% de humedad final.

Clasificación Internacional de Patentes: B02B 1/08 y B02B 5/02.

3. CLARIDAD DE LA SOLICITUD.

De acuerdo a la Decisión 486 de la Comisión de la Comunidad Andina en su Artículo 30.- *"Las reivindicaciones definirán la materia que se desea proteger mediante la patente. Deben ser claras y concisas y estar enteramente sustentadas por la descripción"*; se hacen las siguientes observaciones al capítulo reivindicatorio:

A lo largo del capítulo reivindicatorio se observa la imprecisión de varios términos los cuales le restan claridad a la solicitud. Los términos y significados que deben ser aclarados se encuentran en las siguientes reivindicaciones:

En la reivindicación 1 se esta presentando un método para elaborar harina de maíz precocida a partir del grano de maíz pelado; en el paso del método que describe el enfriamiento de la fracción cocida de endosperma germen en el cual se muele el material en hojuelas seco en una serie de molinos de rodillos, operación de la cual se recoge: "Un molido fino resultante de un molido en bruto resultante mientras el molido en bruto se procesa adicionalmente"; no es claro en la mencionada operación cuáles son las fracciones obtenidas en la molienda y cuál es el proceso adicional que tiene el "molido en bruto". Luego se presenta lo siguiente: " someter únicamente el molido fino o una centrifugar en un entoleter para aislar un material sucio ligero", no es claro si en este paso el material fino se somete a centrifugación para quitar el material sucio ligero y se debería especificar el término "entoleter".

En la reivindicación 3 se presenta un rendimiento, el cual no es claro con respecto a las unidades a las cuales esta referido.

En la solicitud las reivindicaciones 6 y 7 se encuentran presentando la misma materia por lo que se debería prescindir de una de ellas.

En la reivindicación 8 se debe proporcionar el significado del término "temporizada" indicando específicamente a la operación a la cual se hace referencia así como también se debe aclarar si la fracción pelada es la misma fracción endosperma-germen. En la reivindicación 9 se hace mención de una "fracción acondicionada"; la cual no se había mencionado anteriormente, por lo tanto esta debería definirse dentro de la reivindicación para establecer en que paso del procedimiento se encuentra tal fracción o en qué paso se esta generando.

En la reivindicación 11 se debe aclarar el significado del término "segregar" dentro el contexto de la misma.

Las reivindicaciones 13 y 14 hacen alusión al uso de la harina por medio de la formación de la masa; estando estas reivindicaciones relacionadas con el uso del producto pero no son parte del objeto de la solicitud.

Se le recuerda al solicitante que las modificaciones que se consideren para el capítulo reivindicatorio no deben contener materia nueva con respecto a la presente solicitud.

Según las observaciones anteriormente realizadas, la solicitud no cumple con el artículo 30 de la Decisión 486 y se deben realizar los ajustes necesarios para continuar con el trámite correspondiente de la solicitud. De acuerdo a los cambios que se realicen a la solicitud se debe ajustar el título de la misma.

4. DETERMINACIÓN DEL ESTADO DE LA TÉCNICA

Según la definición dada en el art. 16.- "Una invención se considerará nueva cuando no está comprendida en el estado de la técnica.

El estado de la técnica comprenderá todo lo que haya sido accesible al público por una descripción escrita u oral, utilización, comercialización o cualquier otro medio antes de la fecha de presentación de la solicitud de patente o, en su caso, de la prioridad reconocida.

Sólo para el efecto de la determinación de la novedad, también se considerará dentro del estado de la técnica, el contenido de una solicitud de patente en trámite ante la oficina nacional competente, cuya fecha de presentación o de prioridad fuese anterior a la fecha de presentación o de prioridad de la solicitud de patente que se estuviese examinando, siempre que dicho contenido esté incluido en la solicitud de fecha anterior cuando ella se publique o hubiese transcurrido el plazo previsto en el artículo 40." , se realizó la búsqueda de anterioridades en los archivos con que cuenta esta Oficina y se encontraron los siguientes documentos relacionados con la materia de la presente solicitud:

Nº	DOCUMENTO	TITULO	FECHA DE PUBLICACION
D1	US 3,404,986	Process for manufacturing corn flour	1968-10-08
D2	US 3,730,732	Tortilla and process using water soluble alkaline substance	1973-05-01

Los documentos mencionados se anexan al expediente.

8. EVALUACIÓN DE LOS REQUISITOS DE PATENTABILIDAD

El artículo 14 de la Decisión 486 de la Comisión de la Comunidad Andina establece que: "Los Países Miembros otorgarán patentes para las invenciones, sean de producto o de procedimiento, en todos los campos de la tecnología, siempre que sean nuevas, tengan nivel inventivo y sean susceptibles de aplicación industrial."

En cumplimiento del artículo 14 de la Decisión 486, se procedió a evaluar los requisitos de novedad, nivel inventivo y aplicación industrial con el fin de establecer la patentabilidad de la invención reivindicada en la solicitud en estudio.

6.1. Evaluación de NIVEL INVENTIVO

De acuerdo al art. 18.- *"Se considerará que una invención tiene nivel inventivo si para una persona del oficio normalmente versada en la materia técnica correspondiente, esa invención no hubiese resultado obvia ni se hubiese derivado de manera evidente del estado de la técnica";* se conceptúa:

En la anterioridad D1 se presenta un proceso para la fabricación de harina de maíz el cual consiste en las siguientes etapas: limpieza de los granos enteros de maíz de material extraño por un proceso en vía seca y luego se realiza una limpieza húmeda por medio del rociado de agua caliente, ésta última se realiza con el fin de tener una humedad en el grano entero de aproximadamente 20%.. Con esta hidratación el germen alcanza ciertas propiedades de elasticidad y el grano entero es pasado por un molino degeminador el cual provoca la pérdida de la cascarilla del grano la cual es removida por aspiración con aire. De esta forma queda una mezcla de endosperma y germen. Los granos obtenidos hasta esta etapa del proceso se pueden mezclar con un material comestible estandar el cual consiste en una combinación de porciones finamente divididas de germen y endosperma de maíz con pequeñas piezas de cascarilla. Se desea una parcial gelatinización de la mezcla de alimentos y harinas a través de un sistema de cocción con vapor, el grado de gelatinización se obtienen al pasar la mezcla de alimento y harina a través de rodillos calientes, durante el paso de los rodillos; cualquier partícula granular es aplanada tomando la forma de hojuela, las hojuelas formadas son secadas. El almidón que contienen dichas hojuelas esta parcialmente gelatinizado con un contenido de humedad aproximadamente entre 6-12 %. Estas hojuelas se llevan a una mollienda para obtener finalmente la harina.

En el proceso presentado en este documento se puede apreciar que los pasos básicos del procedimiento que se encuentra presentado en la solicitud son concordantes con los de la anterioridad ya que se encuentran las etapas tales como la limpieza de los grano, para retirar la cascarilla del mismo así como una humectación del grano completo. También se puede encontrar en los dos casos el paso de la cocción del grano con vapor así como la formación de hojuelas y posterior secado de las mismas para obtener finalmente la harina por mollienda.

De esta forma los pasos que se encuentran describiendo en el presente procedimiento son derivables del estado del arte publicado con fecha anterior a la radicación de la presente solicitud.

En el documento D2 se presenta la incorporación de un compuesto alcalino tanto a la masa como a las tortillas con el fin de aumentar su rendimiento y retardar el crecimiento microbiológico en los productos. En esta invención se observó que el aditivo actúa incrementando el rendimiento, la cantidad total de agua usada para preparar la masa de una cierta consistencia es mayor que al preparar la masa sin el aditivo.

La adición del material alcalino soluble en agua a la masa y a la tortilla incrementa el pH en un rango de 7.5 a 9.5 y se incrementa el rendimiento de los productos. Los aditivos pueden ser materiales tales como carbonato de sodio, hidróxido de sodio, fosfato trisódico y se dosifica en concentraciones de 0.25 y 2% en peso para las tortillas y entre 0.12 a 2% en peso para la masa. Estos materiales alcalinos pueden ser incorporados en polvo seco con la tortilla o pueden adicionarse en solución para incorporar a la masa. Debido al alto contenido de humedad de las tortillas y la masa es susceptible al deterioro por ataque de bacterias, hongos, mohos y otros microorganismos al incorporar un material alcalino este mantiene el pH de 8.5 a 9.0 siendo este un rango de pH adecuado para la prevención del daño microbiológico.

Según la anterioridad presentada el uso de compuestos alcalinos en masa y tortillas es conocida siendo estos materiales utilizados bien sea en polvo seco o también pueden ser incorporados en la masa en forma de soluciones; en dicha anterioridad también se contempla la posibilidad de adicionar el material en cualquier paso del proceso.

Por lo tanto la solicitud no cumple con lo establecido en el artículo 18 de la Decisión 486.

En conclusión los requisitos de patentabilidad de la presente solicitud se encuentran afectados así:

Nº	DOCUMENTO	REVINDICACIONES AFECTADAS	REQUISITO QUE AFECTA
D1	US 3,404,986	1 a 12	NIVEL INVENTIVO
D2	US 3,730,732	1 a 12	NIVEL INVENTIVO

En cumplimiento del artículo 45 de la Decisión 486 de la Comisión de la Comunidad Andina, se le indica que debe dar respuesta dentro del término de sesenta días contados a partir de la fecha de la notificación de la presente comunicación. En caso de no dar respuesta al presente requerimiento, o al a pesar de la respuesta subsistieran los impedimentos para la concesión, se denegará la patente.

Notifíquese el presente oficio conforme a lo dispuesto en el numeral 5.2, literal e), del capítulo quinto del título primero de la circular única No. 10 de 2001.

ALIX CARMENZA CÉSPEDES DE VERGEL
Jefe de la División de Nuevas Creaciones.

El anterior requerimiento fue notificado por fijación en lista, de fecha **07 JUN 2007**

CONCEPTO TÉCNICO Nº 0601	EXAMINADOR TÉCNICO CÓDIGO 202064
---------------------------------------	---

PROCESS FOR MANUFACTURING CORN FLOUR

Ernest L. Wimmer, Elm Grove, and John L. Smith, Milwaukee, Wis., assignors to Krume Milling Company, Milwaukee, Wis., a corporation of Wisconsin
Continuation-in-part of application Ser. No. 281,784, Mar. 13, 1964. This application July 18, 1964, Ser. No. 267,882

5 Claims. (Cl. 99-93)

ABSTRACT OF THE DISCLOSURE

Preparation of instant masa flour from whole ground corn meal or mixtures of selected meals or flours by increasing the moisture content to about 18 to 35%, partially gelatinizing between heated rotating rollers, removing the remaining flakes and grinding to form flour.

This invention relates to improvements in food from corn products and method of manufacturing the same, and is a continuation-in-part of application Ser. No. 351,784, filed Mar. 13, 1964 (now abandoned).

Conventional methods for the production of instant corn tortilla flour or corn tortilla doughs are described in such United States patents as U.S. No. 2,584,893, U.S. No. 2,904,257 and U.S. No. 3,013,103. In these and other conventional processes, whole corn kernels are soaked and steeped in hot lime water until the kernels have been completely penetrated by the hot alkaline solution until the kernel has become softened and the hull partially digested. This conventional treatment has descended from the earliest days of Latin American culture. Here such a lime treatment was required because the processed whole kernels were ground by hand between stones to produce a wet dough or masa. Thus the treatment with lime was required to soften and digest the hard-cellulose content of the hull and to peptize or disrupt the protein content of the corn kernel so that the kernels and the hull could be readily disintegrated by the crude grinding methods. Apparently this protein disruption and hull disruption were required to give the dough the proper elasticity and workability for formation of the tortilla type pancake. As is emphasized in U.S. Patent No. 2,584,893, care was required in conventional processes so as not to cook and gelatinize the starch granules of the corn, with the resultant formation of gum and improper texture of the dough. Such over-gelatinization of starch during processing by these conventional techniques was most likely to occur because the whole corn kernels were steeped with such a large amount of water that the moisture content might reach as high as 50%, whereupon gelatinization of starch, particularly in the presence of alkali, could easily occur and thus result in a dough which would be extremely rubbery and elastic. Steeping in hot lime water has been a lengthy and time-consuming process ranging from one to two hours in more recent described improvements to as much as twenty-four hours in the classical method of the ancient cultures. Furthermore, the steeping followed by washing of the lime water before grinding of the masa resulted in extraction and wasting of the vitamins and riboflavin and niacin content of the whole corn. Other alkaline soluble proteins and proteinaceous materials were also discarded by these processes. This loss upon steeping and washing is not only wasteful from a nutritional standpoint but also results in a loss of total yield which in itself is an economical loss.

In conventional processes, particularly where the kernels after soaking, steeping and grinding are to be dried to a stable flour for later reconstitution to a masa or dough, an economic disadvantage is encountered com-

pared to the process of the present invention; inasmuch as excessive energy is required in drying material having such a high level (35-50%) of moisture content. Historically, the flavor which was developed during this conventional processing was one which was a necessary out-come of the lime treatment, as distinguished from a simple aqueous treatment. As indicated, the lime treatment was a requirement to soften the hull and peptize the protein. The resultant effect on flavor was found objectionable by many persons. This flavor is to be distinguished from the rich whole corn flavor which results from the process of the present invention. The present invention represents a complete departure from the classical methods of lime water steeping and digestion of whole kernel corn at high temperatures in aqueous systems.

A major object of the present invention is to provide a corn flour from corn which may be instantly reconstituted into a dough by the addition of ambient temperature water, said reconstituted dough being ideally suited for the production of tortillas, snack foods, and related products.

A further object of the invention is to provide a process of producing the improved flour which completely eliminates the conventional soaking and cooking of whole corn kernels in high concentrations of lime water.

A more specific object of the invention is to produce an instant flour for use in the production of tortillas, snack foods, or the like by a simple process utilizing selected corn meal fractions which are readily obtainable from the conventional dry corn milling process.

A further object of the invention is to provide an improved process of producing flour of the class described which eliminates the washing out or other loss of soluble nutrients such as occurs during the steeping of corn in highly alkaline water with conventional processes.

A further object of the present invention is to provide an improved flour of the class described which is completely stable as to flavor and free of potential rancidity and inherent infestation, the flavor being distinctly novel, rich in whole corn flavor, and devoid of unpalatable flavor characteristics resulting from treatment in strongly alkaline water at high temperature resulting from the usual treatment.

A further object of the invention is to provide, as one phase of the invention, a new type of deep-fried snack food. Many snack foods which are on the market today are prepared by a deep frying process from a special dough produced from corn by the before-described wet-ly alkaline treatment procedure, which imparts the before-described characteristic flavor which is common to all. In the classical procedure, whole kernel corn which has been treated as before described is ground, milled or otherwise worked into a dough which can be shaped and then cut and stamped to give the desired shape to the product, or it can be extruded through dies of various shapes and designs and then cut to yield a product of the desired shape. The shaped raw dough is then deep fried in a bath of hot oil to drive off the moisture and produce a crisp product for packaging and marketing.

The aforementioned process is characterized as requiring large units of capital equipment and is quite time-consuming in dough preparation. Furthermore, the products produced by dough as prepared in this method are characterized by an extremely high oil content generally in the range of 40%, and the high oil content is a factor in the generally short shelf life or stability of the food.

The present invention has been designed to overcome the numerous objections or faults inherent with the conventional processes for the production of deep-fried snack foods as enumerated above. With the present invention the instant tortilla or instant masa flour is used as a raw material for the production of the dough for deep-fried

snack food; the operator merely using the instant mass flour referred to, adding sufficient water to make a workable dough, which is generally in an amount equivalent to 80-120% of the weight of the instant mass flour, and then after mechanical mixing in a dough mixer or kneader, the dough is either sheeted between rollers and stamped of the desired shape or extruded through an orifice of the selected design to yield the desired shape of dough. The advantages of the instant mass flour of the present invention as a raw material are readily discernible. The snack food producer requires merely a dough mixer, an extruder and sheeter, or, of course, a deep fat fryer. Other auxiliary equipment required for the preparation of doughs by the conventional procedures are completely eliminated. The complete preparation of the shaped dough from the dehydrated raw material requires no more than several minutes of mixing with water prior to formation of the desired shape.

The flavor produced upon frying of the dough produced by the present invention is entirely different than any presently marketed deep-fried product. It is completely devoid of the stale flavor characteristic of conventional products, and possesses a full, rich roasty flavor normally associated with whole corn.

Furthermore, it has been found that the oil or fat content of the product produced by this procedure may be as low as 20% of the weight of the snack food, whereas the conventional products possess an oil content in the area of 40% of the weight of the snack food. The economy of the present invention is obvious inasmuch as the oil used in deep frying is the most costly of the raw material utilized in the production of deep-fried snack foods. As previously indicated the lower oil content also results in a longer shelf life or stability inasmuch as it is the oil which is responsible for the rancidity and off-flavors often present in deep-fried snack food items. In addition, the product of the present invention has a lower calorie content.

With the above and other objects in view, the invention consists of the improved food from corn products and method of manufacturing the same, and all of its parts, combinations and steps as set forth in the claims, and all equivalents thereof.

The present invention consists of the utilization of whole ground corn meal or mixtures of selected meals or flours from a commercial dry milling process as raw materials for the production of an instant mass flour. These meals or mixtures of meals and flours are then treated under specially controlled conditions of moisture, temperature, and holding time in such a manner as to impart to the product the specially prescribed degree of starch gelatinization, so that predetermined physical properties are obtained in the product, which is a milled fine, dry flour. The mass or dough obtained by reconstitution of the flour with water possesses the exact desired physical working characteristics and handling characteristics of a mass dough for the production of tortillas and related food products.

Thus, according to the present invention the proper coherence, elasticity and working properties of the reconstituted instant mass flour are obtained by specially prescribed control of the degree of gelatinization of the starch content of the raw material and not by the classical peptization of proteins and solubilization of cellulose gums by various hot alkali treatments of the whole kernel corn followed by grinding and drying.

In the accompanying drawing, the figure is a partially diagrammatic showing of mechanism used in the improved process.

RAW MATERIAL

A raw material for this improved process may be whole ground corn meal or selected fractions of corn meals which are readily available by commercial dry milling processes. Whole ground meals are prepared from either white or yellow corn by mechanical grinding in either

commercially available hammermills, impact or attrition mills or roller mills such that the granulation of the corn meal is at least as fine as a U.S. No. 12 standard mesh sieve. Such meal may be obtained by sifting of the product from the mill through a standard sieve containing the correct sieve and the coarser fractions returned to the mill for remilling.

Although the whole corn meal may serve as a satisfactory raw material, it has been found that a superior product with better flavor can be obtained by blending certain fractions of a commercial corn dry milling process. In this commercial process, which is well known, whole corn kernels which have been cleaned of all foreign material by dry processing, as well as by a rapid wet wash, are sprayed with sufficient warm water so that the average moisture content of the whole kernel is approximately 20%. By holding in the damp state, the moisture added to the kernel with the hull and pericarpizes the germ portion of the corn so as to impart a rubbery rather than brittle characteristic to the germ. Very little of this added moisture actually penetrates the whole corn kernel or endosperm.

When the germ has reached the proper rubbery consistency the whole kernel is passed through a degumming mill such as a Beal Deguminator which rips the hull loose from the kernel, tears out the rubbery germ in as large a single particle as possible, and cracks the endosperm into a minimum number of large clean de-gummed and de-hulled pieces. The very large portions of endosperm are known as pearl hominy and/or flaking grits, while the mixture of germ, hull and smaller portions of endosperm are known as through stock.

The major portions of the hull are easily removed by aspiration with air from the through stock after drying, and the germ and the remaining larger portions of endosperm are recovered on sifters and separated into sub-fractions of germ and endosperm of uniform granulation for further purification. In most commercial dry milling plants the material which passes through a No. 14 U.S. sieve has been found uneconomical for further purification or separation of germ and endosperm fractions. This material is known to the trade as standard meal. It is a mixture of finely divided portions of corn germ and endosperm together with small pieces of hull and various cellular tissues which are the cementing materials which bond the endosperm germ and hull together in the whole corn kernel. A typical analysis of standard meal is given in the following table:

	Percent
Protein	10.1
Fat	3.7
Ash	1.5
Crude fiber	2.9
Moisture	13.3
Starch	61

Any germ rich fraction may be substituted for standard meal. A typical analysis for the more purified flours or meals ("degerminated meals and flours") which are separated from the coarser endosperm particles, i.e. which are recovered from the through stock on sieves coarser than the 14 wire and subsequently fractionated from the germ, is as follows:

	Percent
Protein	6.3
Fat	1.1
Ash	0.33
Crude fiber	0.55
Moisture	10
Starch	61

Blends of the standard meal with the aforementioned meals or flours from the more purified endosperm fractions are excellent raw materials when they are blended together in the ratios of 30-70% standard meal and 30-70% purified corn meals or flours. Whether the raw

5

material is whole corn meal or a blend as above described, the processed flour will have at least 7% protein, at least 2% fat, at least .6% ash, at least .5% crude fiber, and there will be a starch content of at least 50%.

In any case, it is advisable that the raw materials be reduced in granulation so that they pass through at least a No. 12 sieve for better control of cooking which shall be described. It is emphasized that the blend of standard meal with purified chromated or flour as a starting material is desirable not only because of its economic significance, the standard meal being generally unrecovered as a prime product and used mainly as an enrichment for animal feeds, but more importantly the blends of standard meal and purified endosperm and meals and flours are desirable because they yield a finished product which has a richer, more acceptable, and attractive whole corn flavor than can be found in the processing of whole corn meal. This is probably due to the almost complete elimination of the coarse stream hull which as aforementioned is removed early in the dry milling process. The coarse hull contributes very little to the tortilla flavor.

MOISTURE CONTENT PRIOR TO STARCH GELATINIZATION

The moisture content of the meal or mixture of meal and flour prior to the gelatinization of starch content is critical. If there is too much water present the starch will be over-cooked during subsequent processing and the resultant finished product when reconstituted with water can make a dough or masa that will be too rubbery, too sticky, and too elastic to handle. On the other hand, if insufficient water is present there will be insufficient starch gelatinization and the resultant dough of the reconstituted product will be dry, mealy, crumbly, and unmanageable.

The recommended moisture content is in the range of 16-35% of the weight of the mixture of meal and flour. It is best added by spraying the required water into the whole corn meal or mixtures of meal and flour at a 17 while tumbling in a continuous blender 18, or may be done in a batch blender such as a conventional ribbon blender. The water may be normal ambient temperature or may be as warm as 140° F. without deleterious effect provided there is no local gelatinization which might occur if water of excessive temperature is used for the addition. An aging time of approximately one-half hour is recommended so that the water may penetrate the coarse particles of meal, although this so-called aging or tempering time is not critical. Longer tempering times may be used, if convenient, without deleterious effect. If desired partial gelatinization of the meal or mixtures of meal and flour may be initiated, with or without the addition of live steam, by passing the meal or mixtures of meal and flour through a steam-jacketed screw cooker.

The water recommended here is regular fresh water, as available. It has also been found that, if desired, lime water may be used here with little if any effect on flavor or texture of the finished product, inasmuch as there is no long digestion time at high temperatures and high water levels, so that the characteristic, chemical lime-digested flavor is not introduced into the product even when lime water is used as the tempering agent.

CONTROLLED STARCH GELATINIZATION

The desired degree of starch gelatinization is obtained by passage of the tempered meal or mixtures of meal and flour between the nip of heated rotating steel drums or rolls 15 and 16. The rolls or roller may be heated by gas flames up to the desired temperature or they may be hollow drums which are heated externally with steam under pressure. Generally the surface temperature of these drums will be in the range of 275-300° F. The rotating pairs of drums are pulled tightly together so that there is a tight nip or pinch through which the tem-

6

pered corn meal must flow, during which passage, any granular particles are squeezed to a flake which is concurrently dried, and the starch gelatinized by the heat content of the drums. As before mentioned, the meal or mixtures of meal and flour may be partially gelatinized before passage between the nip of the heated rolls, by causing the meal or mixtures of meal and flour, with or without the addition of live steam, to pass through a steam-jacketed screw cooker, the rest of the partial gelatinization being accomplished in the nip of the heated rolls.

The degree of gelatinization may be controlled by such factors as the temperature of the drum, the speed of the drum which governs the contact time of the corn meal with the heated surface (such speed being such as to provide substantially instantaneous contact time), the tension which is applied by the adjustment members 19 and springs 20 in drawing the drums together, and the available moisture in the corn meal or in the mixture of meal and flour as previously described.

The degree of starch gelatinization is the most critical factor in determining the proper working and handling characteristics of the doughs which are subsequently prepared from the improved dried product. This shall subsequently be described under the section entitled "Specification of Degree of Gelatinization and Its Determination."

MILLING OF GELATINIZED FLAKES

The corn meal which now contains partially gelatinized starch as a result of being cooked and dried on the heated drums 15 and 16 are now in the form of large flattened sheets or flakes. The moisture content is now preferably approximately 6-12% and in any event less than 14%. These flakes are now routed to a milling device such as a hammer mill, attrition or impact mill, and the flakes are reduced to a fine flour. The flour is sifted to remove material coarser than a U.S. No. 40 mesh sieve and the coarse material is returned for further grinding. The milling device should also be adjusted so that there is not an excessive amount of very fine material in the finished flour, as this might result in lumping of the dough when reconstituted with water. It is advisable that no more than 70% of the material pass through a U.S. No. 100 sieve.

STABILITY OF INSTANT MASA FLOUR

The flour produced under the conditions described above has been shown to have excellent stability in regard to resistance to rancidity and to oil-oxidation, and is extremely resistant to development of insect infestation. It is believed that the resistance to rancidity and the stability towards subsequent infestation is the result of the high temperatures to which the meal and/or mixtures of meal and flour have been subjected during the roll processing. Under these conditions the enzymes responsible for production of rancidity are undoubtedly destroyed, and at the same time any insect eggs which may be normally present in the corn products are also destroyed by the high roll temperatures. Furthermore, stability to rancidity is undoubtedly also a result of the fact that the present product has never been digested at high moisture levels nor digested with high alkaline waters, and therefore no free fatty acids have been generated from the fats which are present. It is these free fatty acids which are more readily susceptible to the development of subsequent rancidity. At this point it should be emphasized that the corn meal raw materials of the present invention, when in the moistened state, are subjected to high temperatures for more seconds or less as opposed to the lengthy steeping operations in hot alkaline waters which were heretofore described as classical procedures and which encourage insipient rancidity.

D2 121

1

1,730,732

TORTILLA AND PROCESS USING WATER SOLUBLE ALKALINE SUBSTANCE

Manuel Juan Rubio, Bridgeport, Conn., assignor to Roberto Comand Barona, Victor Herman, Monterey, Mexico

No Drawing. Continuation-in-part of application Ser. No. 58,141, July 24, 1970, and Ser. No. 58,644, July 27, 1970. This application May 2, 1972, Ser. No. 249,424 Int. Cl. A23I 1/10

U.S. Cl. 99-88 R

5 Claims

ABSTRACT OF THE DISCLOSURE

To increase the yield of dough and tortillas by incorporating water soluble alkaline substances. Also to retard the microbiological spoilage of tortillas which are unleavened, unshortened food products made of nixtamalized corn or nixtamalized corn flour by adding water soluble alkaline substances.

DISCLOSURE OF INVENTION

This application is a continuation-in-part of my application Ser. No. 58,141, filed July 24, 1970, for Tortilla and Process Using Water Soluble Alkaline Substances and of my application Ser. No. 58,655, filed July 27, 1970, for Tortilla and Process Using Alkalizing Substances both now abandoned.

One aspect of the present invention is to increase the yield of tortilla dough and tortillas.

Another aspect of the invention is to retard the microbiological spoilage of tortillas and tortilla dough.

Tortillas and tortilla dough are made from corn which is steeped in calcium hydroxide or sometimes in sodium hydroxide or the like, to produce a reaction with the corn known as nixtamalization. The nixtamalized corn having a chemical combination with calcium hydroxide or the like is then ground into corn flour which is combined with water to make tortilla.

This steeping during which the reaction occurs is done at an elevated temperature of say 80° C. and then it can also be properly said that there is cooking at this time. In addition to the reaction already mentioned and its important general effect on the product that is involved, the steeping has the effect of softening the hull, thus allowing the water to penetrate through the hull into the corn, and also of causing a reaction specifically between some of the calcium and at least some of certain of the oils originally present in the corn to produce special compounds which add to the taste.

This steeping reaction with alkali such as calcium hydroxide produces a product having the ingredients of the corn splitized with calcium hydroxide or the like, leaving some alkali free and producing in the tortilla dough if no additive is used a pH in the range from 6.5 to 6.7, there having been a washing operation after the steeping.

I have discovered that if a water soluble alkali such as sodium hydroxide or the like is added to the tortilla dough in controlled proportions as described below, it will have two additional effects which are not obtainable if nixtamalized corn flour is used without additional sodium hydroxide or the like.

2

- (1) The yield of tortilla dough and tortillas is increased.
- (2) Microbiological spoilage of tortillas and tortilla dough is retarded.

At the same time, if this alkali is added after the washing, it has some of the effects already mentioned as occurring during the nixtamalization, the softening and the reaction already mentioned having already taken place at the time of the nixtamalization.

The results indicate that the sodium hydroxide or the like if used in the correct quantities produces these different effects because at the dough stage it no longer reacts with the corn in the same way that the calcium hydroxide, sodium hydroxide or the like reacted with the corn during steeping.

The alkali in the original steeping does not and cannot secure the later benefits as to yield and microbiological spoilage which the addition of alkali in controlled proportions after the washing secures, because the original alkali has to a considerable extent been removed in the intervening washing, which leaves the overall product afterwards at a pH of less than 7, as already indicated, and is part of the normal overall process of making a tortilla.

BACKGROUND OF THE INVENTION

Many experiments which apply to preventing the microbiological spoilage of the usual wheat, whole wheat and rye bread, commonly known, are not effective when applied to tortillas and tortilla dough because of the marked difference in their composition from the breads mentioned above. Among these differences are:

(1) Tortillas are made from whole corn, that is, corn which contains its germ, hull, bran, etc. Bread is made from dehusked, degermed and debraned wheat.

(2) Dehusked, degermed, debraned wheat used in making bread undergoes no chemical treatment before grinding. Whole corn used in making tortillas always undergoes the chemical treatment of steeping in lime water at pH 12 before grinding.

(3) Dehusked, degermed, debraned wheat used in making bread is ground into a flour in the dry state. Steeped whole corn used in making tortillas is ground into a dough in the wet state, after which the dough is either dried into a flour or used directly to make tortillas.

(4) The dough used for making bread is always prepared from dry dehusked, degermed, debraned wheat flour. The dough used for making tortillas may be prepared either from dry hulled whole corn flour or directly by grinding whole corn steeped in lime water at pH 12.

(5) In addition to dehusked, degermed, debraned wheat flour, the dough used for making bread always contains some of the following ingredients: shortening, a leavening agent (yeast, air, or baking powder), salt, sugar, milk solids or milk, eggs or egg solids, and water. Dough used to make tortillas only contains ground hulled whole corn and water.

(6) The final moisture content of bread after baking is approximately 20%; that of tortillas after cooking is approximately 45%. Due to its lower moisture content, bread is much less subject to microbial spoilage than tortillas.

(7) Bread is baked inside an oven by hot air at a temperature 425-500° F. for 30 to 60 minutes. Tortillas are cooked on a hot plate at 250-410° F., each side or

125
17

3

face being exposed alternately to the heat for 15 to 20 seconds, after which the first side is again exposed for an additional 15 to 20 seconds.

(8) Other differences between bread and tortillas are the following:

- (a) Dehulled, degenerated, debranned wheat flour used in breadmaking is usually bleached; lined corn flour used for making tortillas is never bleached.
- (b) Bread is usually leavened; tortillas are never leavened.
- (c) Bread is always baked in the shape of loaves or rolls; tortillas are always shaped in the form of round, flat discs.
- (d) The structure of bread is largely due to the presence of proteins known as "gluten and gliadin" which are components of dehulled, degenerated, debranned wheat. Corn contains no such proteins, so that the structure of tortillas is due mostly to their starch component.

The basic material for making tortillas is lined corn dough, whose preparation is described below:

Flat discs of dough of diameter 4-6 inches and height 2-3 millimeters are prepared either by hand, by use of any mechanical equipment which squashes or presses pieces of dough, or by any suitable automatic machine.

After they have been made, the flat discs of dough are cooked on a hot plate whose temperature varies from 290-410° F. In the cooking process, each face or side of the disc is alternately exposed to the heat for 15 to 20 seconds, after which the first side is again exposed for an additional 15 to 20 seconds.

The cooked discs or tortillas have a moisture content of 40-45% and are ready to eat.

Lined corn dough may be prepared from lined corn flour of size smaller than 45 U.S. Standard Mesh, 8-12% moisture content and pH 6-7. The dough is made by mixing 1.0-1.4 pounds of tap water per pound of flour.

Lined corn dough may also be made directly by grinding corn which has been steeped in limewater. In such case 1 pound of corn is steeped overnight in 0.5-0.8 pound of water, initially at boiling temperature, which contains 0.5-1.5% calcium hydroxide. It should be noted that when the corn is added to the limewater, the latter is either at or close to its boiling temperature. However, after both ingredients have been mixed, no further heat is applied so that the temperature of the mixture drops gradually during the steeping process.

INCREASE OF YIELD ON DOUGH AND TORTILLAS

It might be mentioned that tortillas, when normally prepared as described herein and without additives of any kind, have a maximum shelf life of 12 to 13 hours. After such time they are spoiled by microorganisms and become hard or stale.

It is known that tortillas when kept under conditions in which no moisture is lost, nevertheless become hard and inflexible with the passage of time and break or crumble easily when flexed or bent. This effect increases with time. Freshly made tortillas are very flexible but lose their flexibility with the passage of time. Hardening is appreciable after 24 hours, marked after 48 hours and almost complete after 72 hours if the product is kept at room temperature. It should be noted that the hardening or staling effect increases with decreasing temperature. At temperatures below room temperature, therefore, hardening proceeds at a faster rate than at room temperature and vice-versa. Hardening becomes still faster when you go from temperatures in between ordinary room temperature and freezing temperature to temperatures below the freezing point of water in the tortillas.

In determining the flexibility index a tortilla is bent around a bar of known radius, and this is tried with successively smaller bars until a bar is found which is the smallest around which the tortilla just breaks when it is flexed. A more flexible tortilla will just break when

4

it is bent around a smaller bar than a less flexible tortilla. A higher flexibility index corresponds therefore to bars of lower radii and indicates higher flexibility.

TABLE 1

(Variation of the flexibility index of tortillas with time at room temperature)

Flexibility index after the following elapsed time					
0 hr.	24 hr.	48 hr.	72 hr.	96 hr.	
8.5	7.7	6.5	5.9	5.1	

Table 1 gives typical values for variation of the flexibility index of tortillas with time at room temperature.

Hardening or loss of flexibility of tortillas is believed to be due to a physico-chemical change in the starch component of tortillas which is known as retrogradation. This phenomenon has been credited to substances other than tortillas and is described in the technical literature (Whistler 1965).

The additive of the present invention imparts the property of retarding the loss of flexibility of tortillas with time. It must be mixed with the dough used for making tortillas, although as later explained, the mixture may be achieved in various ways.

Thus, in respect to this aspect of the invention, tortillas stored under conditions in which no moisture is lost from them become stale more slowly because of the additive of the invention, which retards hardening with time, retards loss of flexibility with time, increases the freshness of the tortillas, prolongs the flexible shelf life of the tortillas and increases the freshness of both freshly made tortillas and also reheated tortillas.

INTRODUCING THE ADDITIVE INTO THE DOUGH AND INCREASING THE YIELD

The additive may be introduced into the dough in any of several different ways. It may be added to the dough as an aqueous solution or dispersion which is thoroughly mixed in the dough to form a uniform distribution of the additive. Since this involves the addition of water to the dough, allowance must be made for the water incorporated with the additive, and compensation may be required in respect to the quantity of other water added. If the dough is made from lined corn flour, the additive may be dissolved or dispersed in the water which is subsequently to be mixed with the flour in order to make the dough. It will be understood that where the additive acts to increase the yield, the total amount of water used to make the dough of a certain consistency is greater than if the additive was not employed.

In some cases it is preferred to mix the additive with the dry lined corn flour prior to mixing the flour with the water.

ADDING ALKALINE SUBSTANCES TO INCREASE THE YIELD

The addition of edible water soluble alkaline materials to the tortilla dough so as to increase the pH to a range between 7.5 and 9.5 markedly increases the yield of tortilla dough and tortilla. The additives may be materials of the character of sodium hydroxide, sodium carbonate, sodium bicarbonate, trisodium phosphate, disodium hydrogen phosphate, and in doses between 0.25 and 2% on the weight of the tortillas or between 0.12 and 2% on the weight of the dough.

Table 2 shows the increase in yield.

TABLE 2

(Typical yield values obtained by addition of sodium hydroxide to dough and tortillas made from lined corn flour)

Expt. of sodium hydroxide based on weight of tortillas	Yield of tortillas per lb. of flour	
	Control	With NaOH
0.25% (control).....	8.000	1.000
1.0%.....	8.000	1.000

These alkaline materials may be incorporated as dry powders with the tortilla flour used in making up the dough or they can be dissolved in the water used in making the dough or they can be added in solution to incorporate with the dough, due allowance being made for the water which is introduced.

Example 1

Retarded corn flour is mixed in a dough mixer with about 150 percent of water on the weight of the dry material, the water having incorporated within it 1% of sodium hydroxide on the weight of the tortilla. The result is shown in the table.

Example 2

The procedure of Example 1 is followed except that the dough is made and then a 1% water solution of sodium hydroxide is incorporated in the dough mixer, due allowance being made for the water.

Example 3

The procedure of Example 1 is carried out except that sodium carbonate is incorporated. The results are comparable to the extent of the change in pH.

Example 4

The procedure of Example 1 is carried out except that trisodium phosphate is incorporated. The results are comparable to the extent of the change of pH.

ADDING ALKALIZING SUBSTANCES TO RETARD MICROBIOLOGICAL SPOILAGE

This section deals with the addition of substances to kneaded corn dough and/or tortillas for the purpose of retarding microbiological spoilage and increasing their shelf life.

It is known that kneaded corn dough and tortillas, because of their relatively high moisture content, are very susceptible to attack and spoilage by bacteria, yeasts, molds and other microorganisms. Kneaded corn dough has a higher moisture content than tortillas and is therefore more susceptible to spoilage. Table 1 gives typical moisture contents and shelf lives for kneaded corn dough and tortillas.

TABLE 1

(Typical moisture contents and shelf lives at 25° C. for kneaded corn dough and tortillas without addition of any kind)

Product	Moisture content (percent)	Shelf life at 25° C. (hours)
Dough	45-50	4
Tortillas	15-20	12

The shelf life is the time required to detect unmistakable signs of microbiological spoilage in the product. In kneaded corn dough and tortillas these signs include production of off-flavors and odors, production of "ropy" (a polysaccharide resulting from the growth of certain bacteria such as *B. mesentericus*) and appearance of moldy spots. The shelf life of a product depends upon the temperature at which it is stored. Lower temperatures correspond to longer shelf life in normal conditions. The spoilage which first occurs depends on the temperature. In kneaded corn dough and tortillas the first sign of spoilage at higher temperatures (above 30° C.) are usually off-flavors due to growth of bacteria, while at lower temperatures (below 30° C.) the first signs are appearance of moldy spots. Table 4 gives typical shelf lives of kneaded corn dough and tortillas at different temperatures.

TABLE 4

(Typical shelf lives of kneaded corn dough and tortillas at different temperatures)

Product	Storage temperature (° C.)	Shelf life (hours)
Dough	37	4
	25	12
	15	24
Tortillas	37	8
	25	12
	15	24

The additives of the present invention have the property of retarding the growth of microorganisms which cause spoilage of dough and tortillas. They may be mixed with the dough, whether it is desired to preserve the dough as such or convert it into tortillas. The shelf life of dough containing the additives as well as the tortillas made from such dough are increased in the manner that will be subsequently shown.

The additives of the present invention may be incorporated in one of the following ways:

(1) They may be added to the dough as an aqueous solution, dispersion or suspension which is thoroughly mixed in the dough to form a uniform dispersion of the additive or additives. Since this involves the addition of water to the dough, allowance must be made for the water incorporated with the additive or additives and compensation may be required in respect to the quantity of other water added.

(2) If the dough is made from kneaded corn flour, the additive may be dissolved, suspended or dispersed in the water which is subsequently to be added with the flour in order to make the dough.

(3) In some cases it is preferable to mix the additive with dry kneaded corn flour prior to mixing the flour with the water.

The additive used in the present invention is capable of maintaining a pH of 8.5 to 9 and may be of a material of the class consisting of sodium, potassium and calcium hydroxides, sodium carbonate, sodium bicarbonate and any other material suitable in a concentration of from 0.1 to 0.6% of the weight of the tortilla, and additives in an amount to maintain a pH of 8.5 to 9 are what should be used in this invention when it is desired to prevent microbiological spoilage.

The following table shows a typical benefit from the addition of sodium hydroxide or sodium carbonate to tortillas at 25° C. in preventing microbiological spoilage:

TABLE 5

Effect of certain alkalinizing substances in increasing the shelf life of tortillas at 25° C.

Type of additive and dose	Shelf life, hours
0.3% calcium hydroxide	48
0.3% calcium hydroxide	72
0.4% sodium carbonate	24
Control	12

The other alkalinizing substances mentioned if they maintain a pH of 8.5 to 9.0 produce a similar effect on shelf life against microbiological spoilage of tortillas.

In view of my invention and disclosure, variations and modifications to meet individual whim or particular need will doubtless become evident to others skilled in the art, to obtain all or part of the benefits of my invention without copying the process and product shown, and I therefore claim all such further as they fall within the reasonable spirit and scope of my claims.

Having thus described my invention, what I claim is new and desired to secure by Letters Patent is:

1. A process of increasing the yield of tortillas, which comprises mixing retarded corn or retarded corn flour with water to make tortilla dough and incorporating in the dough from 0.12 to 2% on the weight of the tortilla dough of a water soluble edible alkaline substance, thereby producing a dough pH of between 7.5 and 9.5.

2. A process of claim 1, in which the substance is sodium hydroxide.

3. A process of claim 1, in which the substance is a compound of the class consisting of sodium carbonate and sodium bicarbonate.

4. A process of claim 1, in which the substance is a sodium phosphate.

5. The process of increasing the resistance to microbiological spoilage of tortilla dough which consists of

126
173