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EDIBLE LIQUIDS LOADED ONTO FIBROUS VEHICLES IN DRY, FREE RUNNING, STABLE FORM

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General object of the present invention is to provide new methods of dehydration and the products thereof, relating particularly to non-fibrous, liquid food, such as for instance non-drying sugar solutions, molasses, eggs, cream and others, by displaying such liquids on suitable fibrous vehicles in such a way that they form a free running powdered mass, which appears dry to the touch, or appears to be dehydrated, though actually retaining moisture in the form of an extremely fine layer of greatly extended surface.

Another object is to provide actual dehydration of such liquids by transferring all or part of their moisture onto suitable fibrous vegetable vehicles through absorption.

Another object is to provide means of reducing non-fibrous liquids to a dry powdered mass by combining them with a relatively small proportion of preferably absorbent, fibrillous food material, the total surface of which has been greatly enlarged.

Another object is to provide means of efficient moisture removal by evaporation, even at room temperature, by increasing the exposed surface of such liquids through spreading them as a microfilm on suitable fibrous vehicles on which they remain after drying.

Another object of the present invention is to provide new and economical food products particularly for the baking and confectionery industry, resulting from the combination of perishable or non-drying liquids with fibrous vegetable vehicles according to the present invention.

Another object is to provide a new and economical raw material for the macaroni manufacturing industry, which permits the transportation of such perishable ingredients as eggs for instance in stable, non-perishable, dry-to-the-touch form and the further reduction of such products to the form of compressed bricks.

Another object is the reduction of liquids to substantially dry form by loading them onto suitable fibrous vegetable vehicles for the purpose of introducing perishable or hygroscopic or non-drying liquids into free running, dry powered food mixes.

Another object is to provide means of storing and transporting the raw cane or beet juices which are substantially crystallizable in an economical form for further use or processing.

Another object is to utilize the fuel value of molasses for combustion without atomization equipment.

Still further objects and advantages will appear from the more detailed description set forth below,

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it being understood however, that this more detailed description is given by way of illustration only and not by way of limitation, since various changes therein may be made by those skilled in the art without departing from the scope and spirit of the present invention.

Contrary to the practice of established commercial dehydration, the complete removal of the water, or substantially complete removal, is not required in the various applications of the present invention, which relates primarily to the production of free flowing particles having a relatively high moisture content. Where the loaded material, such as sugar syrups for instance is non-perishable even in its original liquid form, the object of the invention is achieved, when the thickness of the liquid film is sufficiently reduced to produce freely moving particles, even though no actual removal of moisture may have taken place. Likewise, in the case of perishable liquids, the object of the present invention is achieved when such liquids are reduced to a microfilm covering the fibrous vehicle in such a way that the individual particles are dry to the touch and free flowing, even though no actual removal of moisture may have taken place, as the case may be. The perishable phase of the new product resulting from such combination has become non-perishable, as a consequence to being extended over a vastly enlarged area.

I have found that fibrous vegetable material will supply the required surface, at the same time supplying a denominator common to practically all food. In that way the resultant new products may be used advantageously wherever the liquid load would normally have been used alone in combination with other fibrous or solid food.

In practice, the general object of the present invention is achieved by choosing first a suitable vehicle for a particular liquid which it is desired to unload thereon. Among the most desirable type of vehicles are sugar beet, sugar cane and sorghum and other grasses or cereal straws which are typical of the following composition, represented by dry peanut hay:

Protein	10.6
Fat	5.1
Fiber	23.8
N-free	42.2
Mineral	9.7

The vehicle, for instance the foregoing, is first comminuted to a particle size of between 50 and 100 mesh, preferably 75 mesh. Depending upon the method of disintegration employed, the enlargement of total surface is accompanied by the additional exposure of a certain amount of fibrils, the capillary action of which becomes immediately available for additional moisture resorption.

The liquid load material is then incorporated, the vehicle: load ratio, or load coefficient depending upon the type of load as well as its density. In the case of cream I have started with a load coefficient of 2.5, and in the case of low purity sugar solutions of high invert content, I have started with a load coefficient of 1.75 or smaller. In most applications of my invention the ratio is between 0.5 and 2.5, preferably 1. After the capillary absorption capacity is fully satisfied, the mass turns dry and brittle. It is then subjected to a second disintegrating step which will comminute the mass into still finer particles of 75 to 175 mesh, preferably 150, at which time an additional quantity of the liquid is loaded upon the vehicle. In the course of this second comminution step new cross sections and fibrils are uncovered in addition to a still further enlarged total surface which is made available for the deposition thereon of the added liquid phase. It depends upon the final desired load coefficient to determine how often the process is repeated. As the ultimate load capacity is reached and the microfilm appears barely dry to the touch, I have found it preferable to add to the last milling step a quantity of between one half and five percent, preferably 2.5% of extremely fine vehicle substance in the form of a powder of finer than 200 mesh, preferably 300 mesh. This quantity, which does not contain added load material will serve to effectively keep the film of adjoining particles apart from each other and thus insuring the free running properties indefinitely.

An alternative method consists in applying the first disintegration step to the vehicle in the presence of the liquid itself and/or applying a tearing action to the fibers in a similar way as certain beaters act upon pulp in the manufacture of paper. In fact, as I am not limiting the present invention to the production of edible free running powders or compressed bricks thereof, but wishing to include the final products also in the form of edible sheets, felts or in the form of macaroni-like strips or other forms protruded from suitable openings, I desire to include herein by reference all of those manufacturing steps as they are now known in the manufacture of paper, but as applied to the edible product of the present invention. In its application to sugars, I have loaded cane fiber with its respective soluble solids in accordance with the procedure described in the present invention, and I have obtained load coefficients far in excess of the natural relationship existing in the mature plant itself as illustrated by the following Example No. 1. I have also loaded sugar syrups of lower purity to cane or beet fiber such as maltose-dextrose mixtures, final sugar factory syrups, refinery black strap or intermediate products from the sugar refining process. In the case of sorghum cane, the high amount of invert sugar, otherwise not recoverable or utilizable in dry free running form, makes the resultant flour a very efficient means to utilize without loss and in convenient form all of the plant ingredients for food purposes.

By reducing the final particle size of the products of the present invention to between 20 to 80 microns, the product may be dispersed also in liquid food preparations or in drinks, gelatinous desserts and the like.

Example No. 1

	Pounds
Dry bagasse of 50 mesh	100
Concentrated cane juice of 65 Bx	200

The ingredients are intimately commingled by a bread-kneading action. After the first drying is completed the mass is comminuted to 125 mesh, and a further quantity of 100 pounds of concentrated cane juice of 65 Bx. is incorporated. The resulting product after drying is powdered in the presence of 60 pounds of powdered bagasse of 250 mesh.

The product was used in the manufacture of biscuits to which it added not only an excellent flavor and improved keeping qualities, but it also increased the volume considerably without proportionate increase in cost.

It was found that improved flavors were obtained by adjusting the pH of this product to between 4.8 and 5.2 preferably pH 5. When using the above product as part of fruit fillers, a still lower pH level produced further improved fruit flavor.

It was also found that the method as shown in the foregoing example may be advantageously employed to store and transport cane or beet juice in dry form preferably in the form of compressed bricks which do not require any further packaging. In making such bricks the ratio between vehicle and load can be decreased far beyond the natural relationship as it exists in the mature plant itself, even calculated on the basis of total solids.

Another economically more important application consists in the combination of bagasse with the final syrups from the sugar manufacture. By employing the method of the present invention, a high load coefficient may be realized and residual syrups of high invert content may thus be transported in dry form without requiring packaging of any sort.

Where the foregoing examples referred to bagasse it is also understood that other grasses or other dried vegetable vehicles may be employed, such as for instance beet pulp, cereal straws, sorghum cane and others.

The fibrous vegetable vehicle of the present invention may be advantageously employed, among other uses, for the storage and transportation of fresh egg substance. I found that the eggs may be incorporated either in the form of a homogenous mass or preferably they are first combined with the concentrated cane juice, final syrup and the like to form a homogenous egg-sugar mixture. This syrup is then loaded onto the required quantity of a suitable vehicle, to remain thereupon in perfectly stable, non perishable, dry, free running form, which may be shipped in bulk or blocked.

The term micro-film will—since it varies in thickness for various combinations of load and vehicle—for the purpose of the present invention be limited to mean a film of such thickness which appears dry to the sense of touch.

The use of the products made by the present invention is not limited to the baking industry, where it affords a means of utilizing in convenient to handle form all of the solids of the cane juice and similar products. Nor is its use limited to the role as a stabilizing vehicle for a great number of perishable liquid food substances. For instance, one of the novel uses includes the use of such products as a fruit flavored filler in the baking and confectionery industry at lowered pH levels.

Another advantage resides in the manufacture of improved feed preparations. I have found that the evil taste of residual blackstrap for instance can be improved considerably, merely by being reduced to the size of a microfilm. For instance, one part of blackstrap, if consumed as a mixture with one part of finely chopped beet pulp, leaves a revolting taste, it being actually consumed in the form of a heavy, sticky film of blackstrap syrup. If the same quantity of blackstrap is displayed over the identical quantity of beet pulp, but reduced to a microfilm in accordance with the present invention, I obtain a pleasant tasting product, notwithstanding the fact that identical quantities are being consumed. This is an important phase of the present invention.

Among the further advantages of the present invention are its use as a storage vehicle for relatively large quantities of molasses. Largely increased quantities of molasses even of high invert sugar content can thus be deposited upon finely comminuted bagasse fiber in such a way that the final compressed blocks displace little more space than the bagasse itself. Molasses so stored do not require expensive storage or shipping equipment and may be burned if desired without the necessity of atomization and without the formation of excessive slag.

Where the fibrous vehicles of the present invention are destined for consumption as food it has been found that the flavor of the product was improved, if the fiber, beet pulp for instance, is submitted to a toasting treatment, sufficient to impart to it a golden discoloration.

The term vegetable fiber as used herein is meant to include vegetable feed stuff in dry or dehydrated form. Although the present invention refers particularly to certain types of load and vehicle, I have found that the process has equally important applications in the field of dehydrated fruits and vegetables, particularly as it relates to the addition of ½ to 10% of ultrafine vegetable substance powder of preferably finer than 200 mesh. Certain dehydrated fruits, particularly those high in invert sugar content, not only are highly hygroscopic but resist the removal of their residual moisture. In that case the addition of a small percentage of such extremely fine substance will extend the total available area sufficiently to produce a free running product. The production of this quantity of extremely finely powdered substance is facilitated, if a small quantity of powdered sugar of the same fineness is simultaneously incorporated.

An alternative procedure of the process of the present invention consists in comminuting the entire vehicle portion into several portions of different mesh, as the following example may illustrate:

Ten percent of 50 mesh; 25 percent of 100 mesh; 35 percent of 150 mesh; 20 percent of 200 mesh and the remaining 10 percent of 300 mesh.

The entire mass of the load is then incorporated successively into the various fractions of the vehicle beginning with the largest mesh first and successively adding the smaller particle size fractions. In this manner, free running conglomerates are obtained, which, though somewhat different in character than the particles obtained by first described procedure, exhibit similar relationships of surface to volume.

A further alternative procedure of the present invention is the following, which however is limited to crystallizable sugars or sugar solutions of sufficiently elevated purity with respect to sucrose or dextrose, to permit ready crystallization. This alternative procedure effects the transfer of the liquid syrup not by the aforedescribed repetitive loading steps, but by withdrawing instantaneously substantially all of the moisture from the syrup by means of the water absorbing vehicle, thus forcing instantaneous solidification of the soluble solids, partly through crystallization and partly in amorphous form, which solids are depositing themselves upon the finely powdered particles of the vehicles, forming a mass of completely dry, free running compounds within about 60 seconds or even less, said compounds having the appearance as a free running sugar.

Example No. 2

	Pounds
Powdered bagasse or beet pulp, of preferably 150–200 mesh Tyler screen	100
Sugar	300

The sugar, which may vary widely in purity is first converted into a syrup, which is then concentrated to about 80 to 90 Brix and then permitted to get supersaturated, although I also obtain a satisfactory product of different characteristics without previous supersaturation. At this point the entire portion of finely powdered fibrous vehicle is added to the hot liquid, from which it absorbs readily the greater portion of the free moisture content. The mass is stirred violently at the same time causing almost instantaneous solidification of the mass in the form of a finely divided powdery substance and completely different both in appearance and rate of crystallizaton from ordinary sugar solutions, which are forced to crystallize or solidify from highly concentrated solution. The crystallization or solidification of the sugars is intantaneous and takes place concurrently with an instantaneous transfer of the moisture content upon the vehicle and this effect of instantaneous transfer has been satisfactorily obtained even at sugar concentrations of 70° Brix, when ordinary crystallization procedures will not produce results. The conversion of the liquid fiber mixture to a dry, free running solid may vary from one instant to a few seconds or even to as much as a few minutes, depending primarily upon the ratio of vehicle to total moisture and degree of concentration of the syrup. I have found that the preferred ratio at 80 Brix is about two to one, that is two parts of powdered pulp for every part of moisture present at the moment of combining the two. The product so obtained is different from that obtained by the above described process of repetitive loading and it is also different from the product obtained by crystallizing heavily concentrated or supersaturated sugar solutions by agitation, whereby a mass of hard lumps is formed. However the product of the present invention forms a noncaking free running sugar composition, or, where lumps do form they are soft lumps which readily disintegrate when handled.

The process is of particular economy where low purity juices or syrups are used, as all of the soluble solids are converted into dry, noncaking particles without leaving a mother liquor or other noncrystallizable residual syrup.

Although the production of a dry, free running, noncaking powdery mass is the important object of the present invention, it is also possible to adjust the conditions of crystallization so that the mass can be poured to form bricks or blocks upon solidification.

What I claim is:

1. The process of converting a non-fibrous food solution into a "dry-to-the-touch" state, comprising mixing a relatively large quantity of said solution as a liquid with a relatively small quantity of finely comminuted substantially dry fibrillous food material and coating the particles of said material with a film of said solution, comminuting the resulting material to a fineness greater than the fineness of said food material, and mixing said resulting material with a further quantity of said solution and coating the particles of said resulting material with said solution.

2. The process set forth in claim 1 in which the ratio between the quantity of said food material and the quantity of said solution is between 0.5 and 2.

3. The process set forth in claim 1 in which the quantity of said solution is subtantially the same as of said food material.

4. The process set forth in claim 1 in which the ratio between the quantity of said food material and the quantity of said solution is between 0.5 and 2, and in which the comminution of said food material corresponds to at least 50 mesh.

5. The process of converting a non-fibrous food solution into a "dry-to-the-touch" state, comprising mixing a relatively large quantity of said solution as a liquid with a relatively small quantity of finely comminuted substantially dry fibrillous food material and coating the particles of said material with a film of said solution, comminuting the resulting material to a fineness greater than the fineness of said food material, and mixing said resulting material with a further quantity of said solution and coating the particles of said resulting material with said solution, and mixing the resulting material with a relatively small quantity of said food material comminuted finer than the material resulting from the last comminuting step.

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