Cl. 99

Published May 4, 1943

Serial No. 257,240

ALIEN PROPERTY CUSTODIAN

PROCESS OF SEPARATING ALBUMINOUS PRODUCTS FROM MILK GOOD FOR BEATING AND BAKING

Karl Kremers, Stuttgart, Germany; vested in the Alien Property Custodian

No Drawing. Application filed February 18, 1939

There are different processes of producing albumin from milk. For instance albumin is precipitated by employing heat and chemicals. But in this well known process albumin is considerably reduced in value as it is won by precipitation in irreversible state (may be under the influence of heat or by chemical reaction) which means loss of those qualities of albumin which are good for beating and baking. By this that albumin is limited in use and is for instance not good for baking.

This invention leads to a process which separates albumin contents from milk in such a state that an albuminous product is resulting which is good for beating and baking. For this purpose pH-value of the albuminous contents of milk is elevated up to more than 7 and then water of solution treated in this manner is removed at a temperature that prevents any detrimental influence of heat on colloids of albumin. Grade of temperature depends in a certain way of concentration of albumin and of the special kind of albumin or proteins and may be ascertained at any case. Generally, temperature is beneath 60°C.

This process may be employed either by separating albumin from whey or casein from skim milk. An albuminous product of excellent qualities for beating and baking is obtained from a mixture of skim milk with whey.

Water of solution may be removed either by separators or by evaporating if the points of view mentioned above are taken in consideration.

The practical execution of the process is described in the following.

In order to obtain an albuminous product from whey, first this whey is cleaned by removing slime. Then pH value is raised to more than 7 by adding alkaline materials, without heating up, at low temperature. By this, albumin of whey is changed over to particles which are good for beating and baking. This process may be assisted by simultaneous influence of electric current giving an opalescent muddy of albumin in medium of dispersion. Product treated in the described manner is removed from medium of dispersion up to the desired dry content at a temperature which prevents any detrimental influence on colloids.

Concentration of albumin by separating solvent may be done advantageously in separators. Time of reaction should be fixed in a way that removing of water up to a dry content of 6–12% and the following drying process for instance in a spray-drying-chamber are finished before muddy of albumin, obtained by changing pH, begins to redissolve.

Example I

Purified whey in a continuous flow of liquid gets into an arrangement in which ammonia in gaseous form is supplied in a quantity which is in proportion to the quantity of whey running through. Quantity of supplied ammonia has to give an increase of pH value over 7. At the same time or before or after this, an electric current, preferably alternating current, takes influence on medium of dispersion. Medium of dispersion is leaving arrangement with character of an opalescent muddy which represents a reversible precipitation as it disappears by returning to the original pH value.

It is proven as a fact that the wellknown methods of settling and filtration refuse. Settling the opalescent liquid albumin is in contact with medium of dispersion for a too long time. On account of its reversible character the opalescent muddy may return to the original state of solution. By filtration of the opalescent muddy pressure will denature colloid of albumin.

In contrary to this these disadvantages are avoided by concentrating albumin with separators.

I have found it best to concentrate liquid up to 6–12% dry content and that higher concentrating will denature albumin by pressure. According to this described example opalescent albumin muddy runs into a nozzle separator and leaves it for instance with a concentration of about 8% dry contents.

In order to dry this liquid, spray-drying-chambers have proven best. Drying in contact-drying chambers is detrimental to a certain degree for albumin. Therefore concentrated albumin coming out of the separator runs into a spray-drying-chamber in which water is totally removed from albumin.

In order to obtain a large gain of dry substance with this method, it is possible to raise quantity of concentrated liquid, which contains the opalescent albumin muddy, at the cost of cleared liquid leaving the separator in such a way that a part of the non-proteins and a part of the rest-proteins being in solution get into the dry substance. By this, not only the quantity of the separated dry substance will increase but also a product is obtained which is better for several purposes than pure albumin for instance on account of its content of sugar. This product

is just as good for beating as pure albumin. Special separators are used for this purpose which may be regulated in such a manner that desired purity of product is obtained. If for instance with method described first 1000 ltrs of whey give 800 ltrs cleared liquid and 200 ltrs concentrated albumin, on the second way 1000 ltrs of whey give 500 ltrs cleared liquid and 500 ltrs concentrated liquid. After drying, 35 kg dry albumin-product result from concentrated liquid which have got besides albumin also milk sugar, milk salts and some other materials.

Instead of separating albumin with separators it is also possible to separate it from solvent by drying it together with all the rest of the solid contents. As mentioned above this drying should be done at a temperature which excludes detrimental influence of heat on colloids of albumin. Working with this method, first pH value of whey is elevated with a suitable alkali and then, treated in this way, is concentrated by vacuum vaporisation. Finally concentrated albumin liquid is dried in a spray-drying-chamber.

In this way it is possible also to get a product good for beating and baking with sufficient albumin content. Of course I can reduce percentage of milk salts and milk sugars removing milk sugar from whey before or after concentrating for instance by fermenting or crystallisation.

In both of the cases of protein separation mentioned last protein content of the product made of whey may be raised by adding soluble casein or white of egg or both. It has been proven especially suitable to add alkali-casein or soluble casein containing calcium or both of these materials or also in connexion with materials containing proteins which may improve qualities of products good for beating and baking and may improve stability of albumin foam. Instead of employing alkali, pH value of medium of dispersion may be raised by adding some lime base which may be taken instead of alkali or with alkali. It has proven especially suitable to add calcium hydroxide. Adding these materials, the whole protein of the milk changes over in a product which is good for beating and baking. This method may be used as well for albumin as for casein, also for precipitated milk proteins, acid curds, rennet curds and also with those milk proteins which are still in natural state of colloidal solution.

In order to work with this method for instance milk is creamed and casein of skim milk is precipitated as curds. pH-value of casein precipitation partly leased from whey is raised up by the influence of lime base, especially of calcium hydroxide until pH of the originating colloidal solution passes over 7. Simultaneous with calcium hydroxide a volatile alcali may be used. Now milk serum from casein precipitation is treated in the same away after being concentrated by vaporisation at a temperature which prevents any detrimental influence of heat on colloids of albumin. Both solutions obtained in the described manner are mixed then in a fit proportion and dried in a drying-chamber. It is also possible to elevate pH value in a way that first a dry mixture of milk proteins and lime base is made and then water is added to bring both materials in solution and on the desired pH.

Concentrating whey in a vacuum dryer it is necessary to take care of a high vacuum in order to obtain slow temperatures. The dryer should be absolut clean as rests of other materials reduce qualities of albumin which are good for beating and baking. Therefore albuminous milk serum and for instance creamed milk cannot be concentrated alternately in the same dryer. But it is possible to concentrate whey and skim milk at the same time in a common solution. The remaining dry substance is good for beating and baking. This method is especially simple and economical and gives a very good gain.

You may do this in different way. For instance it is possible first to raise pH only of whey and then mix it with skim milk or mix first whey with skim milk, raise the pH and finely evaporate.

Example II

pH of 5000 ltrs of cleaned whey is first fixed somewhat over 7 with calcium hydroxide. After this 5000 ltrs of skim milk are added. This solution of 10.000 ltrs is concentrated in a vacuum dryer. Then calcium hydroxide is added until pH value goes up to 10. Solution obtained in this way is dried in a spray-drying-chamber. Before entering the atomiser solution may be heated up to a degree of heat which is somewhat over temperature of atomiser.

It has been found that pH of obtained dry substance is somewhat below pH of solution and fluctuates in a certain degree. This fluctuation depends of temperature of process and also of reaction time in state of solution. As on the other side pH of 9–10 is desirable in order to get a product with best qualities for beating it is necessary to fix pH of solution on 10 in order to let it slide up to 9.

Composition of this solution may be changed relative to proportion of quantity of its two parts. As albumin is of higher value than casein it is desirable to raise percentage of whey of common solution.

KARL KREMERS.