

***GOGANI COMPANY***

***Manufacturer of Pharmaceutical***

***& Biological Machinery***

***Bioprocess Solution***

***Bioprocess Consultation***

# ***Casein***

***(Processing Systems & Machinery)***

## Casein

The proteins in milk are consisting of casein – from which cheese is made – and serum or whey proteins. However, casein can also be in pure form by acidifying the milk to the isoelectric point at pH 4.6 by either lactic acid or mineral acid.

The resulting casein is washed to remove as much of the acid whey as possible, after which it is passed through a decanter and then dried in a special type ring dryer.



## Caseinates

Caseinates are produced by dissolving the precipitated casein by means of sodium hydroxide or calcium hydroxide. Caseinates are typically used as protein source in coffee-whitener, emulsifier and foam stabilizer in ice-cream and desserts, and emulsifier/water-binder in meat products.

Freshly precipitated acid casein curd is the best starting material for production of spray dried ca-seinates. The type of acid used for the precipitation of the casein (casein precipitates at the iso-electric point corresponding to a pH of 4.6) does not matter. However, if the end-product is to be used for animal or human consumption, a lactic acid fermented/precipitated skim milk is pre-ferred.

As solutions of sodium casein contain practically only protein, they will have a high viscosity. The viscosity will increase with increasing solids content, but also if the concentrate is kept at a high temperature for a long time. Also the pH plays a role, and the viscosity is lowest in the pH range of 6.6-7.

Because of the high viscosity the solids content in the re-dissolved concentrate has to be kept low and is usually in the range of 18-24 % depending upon the process.

At a proportion of approximately 80 percent, casein is the most important protein fraction in cow's milk. GOGANO Co. process lines support the recovery of casein by acid or rennet precipitation.

Isolated casein is a valuable raw material for a wide variety of industrial sectors. The food industry uses casein in powdered form as high-quality protein. It also has great importance as a binder for paints, for gluing plywood, as a photoresist in etching and for the manufacture of adhesives, putty, textile finishes and block stains for leather.

Casein is present in milk in colloidal solution.

Depending on temperature, casein particles range in size from 10 to 200  $\mu\text{m}$ . Particle sizes between 10 and 30  $\mu\text{m}$  are described as casein submicelles, above that as casein micelles. Casein consists of long chains of molecules of 20 different amino acids. These molecule chains are combined into submicelles which are held together by phosphate salts.

In order to isolate the casein, the casein micelles must be precipitated out of the milk. This becomes possible when the surface charge and consequently the repulsion forces of the casein molecules are reduced so that coagulation can take place. The alternative processes are called acid or rennet precipitation.

In acid precipitation using a mineral acid, the positively-charged hydrogen ions penetrate the casein micelles, as a result of which the negative net charge of the casein micelles drops. Simultaneously the hydrate shell and the number of the doubly charged calcium ions are also reduced. The same-polarity charge and therefore the repulsion forces are reduced, so that the forces of attraction predominate. The heat energy of the particles causes them to collide and unite into larger aggregates which then precipitate out of the milk.

Unlike acid precipitation, which is reversible, in rennet precipitation, micelle components are irreversibly cleaved off. The rennet enzyme cleaves the calcium-insensitive hydrophilic part. Around 50 percent of the net negative charge of the casein surface is thus lost, weakening the protective hydrate shell and exposing the calcium-sensitive part of the casein on the surface of the micelle. Aggregation now takes place in the second coagulation phase following the enzymatic reaction. The actual gelation takes place by bridging the aggregates with calcium ions.



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طراحی فرآیندهای بیولوژیکی

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