

Optimised Line Solutions for Whey

Tetra Pak supplies complete line solutions for cheese and whey powders using engineers and technologists with vast experience in building and operating plants in the dairy ingredients sector.

By Nick Adamson PhD, Sub-category Manager Powder Ingredients

Much has been written about the increase in value of whey. Tetra Pak design philosophy secures and maintains whey quality and ensures that all co-products are processed for best returns. 'Protect What is Good' is Tetra Pak's brand promise.

Whey value is dictated by the level of protein denaturation, microbiology and acid content. High quality milk is fundamental as is the cheese or casein process. Temperature sensitivity of whey proteins limits the degree of bacteria heat kill achievable.

Pre-treatment

Pre-treatment is critical, and controls are in place to limit the growth of spores. Ultrafiltration (UF) or microfiltration (MF) of milk optimise cheese process capacity and harvest valuable native whey permeates before exposure to the cheese process.

Raw whey is unstable with starter cultures multiplying and acidity increasing rapidly. Pre-treatment (clarification, separation, pasteurisation) runs in-line with the cheese process. Bactofugation is used routinely on semi-hard style cheeses such as Gouda, but should also be considered for high spore milk and third party whey.

Process temperatures are limited to < 76°C to prevent protein denaturation and yield loss, especially in whey protein isolate (WPI) processing. Calcium phosphate precipitates readily at



Tetra Pak Filtration Solutions UF plant for WPC production

elevated total solids, temperature and pH; typically it should be minimised before UF and maximised in permeate processing.

Fractionation and concentration

Membrane filtration is well established. Spiral wound membranes dominate most applications; ceramic typically being used for bacteria removal where narrow pore size distribution minimises protein loss.

UF retains the proteins to make whey protein concentrates (WPC) typically up to 82% protein in dry matter. MF is the preferred method to remove fat

for making whey protein isolate. High temperatures prior will increase the protein loss in MF retentate.

Nanofiltration (NF) is used to make demineralised 40% (D40) or in combination with electro-dialysis and ion-exchange to produce D70 and D90. Reverse osmosis (RO) and NF are ideal for

- concentration of whey to > 30% TS to reduce transport costs
- concentration prior to evaporation to reduce capital, building size and running costs
- pre-concentrating WPC and WPI to > 37%TS prior to drying to improve powder properties and drying efficiency
- pre-treatment for permeate when making high purity lactose



A typical whey process

A compelling technical argument exists for the use of demineralisation before UF to gain greater control over the mineral content of WPCs and permeates. In time, we may also see a commercial justification.

Evaporation, crystallisation and drying

Often dairy processors wish to have the flexibility to make a range of milk and whey derived powders. Evaporators can be designed with a high degree of flexibility.

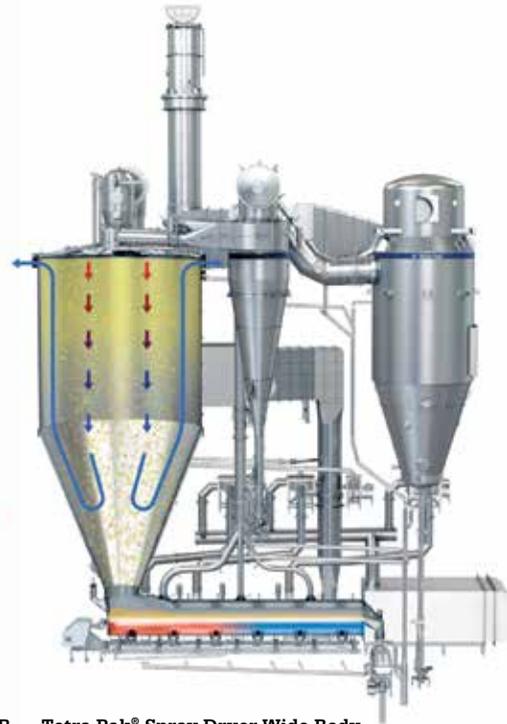
Mechanical vapour recompression (MVR) evaporator designs displace thermal vapour recompression (TVR) where electricity prices are favourable.

Pre-concentration with membranes allows the use of a single MVR calandria to concentrate whey and permeate from 20-25%TS to 60-70%TS. The total cost of ownership and stability of total solids vastly improved.

Tetra Pak wide body dryers are ideal for milk, whey, demineralised whey, WPC, WPI and infant formula. Due to the high lactose content of permeate a crystallisation belt is added to allow for post-crystallisation of lactose into the non-sticky monohydrate form. Lactose



Tetra Pak® Falling Film Evaporator MVR



Tetra Pak® Spray Dryer Wide Body

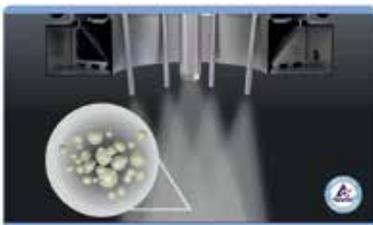
is dried using a fluid bed following crystallisation and decanting.

Protein drying presents challenges for agglomeration and bulk density; wettability and dispersability being important functional properties. Tetra Pak's patented swivel lance design ensures a high degree of impingement of spray and fines streams resulting in strong agglomerates. Gentle conveying systems ensure minimal breakdown.

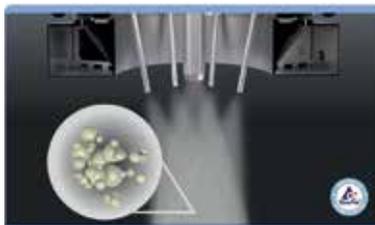
Tetra Pak's powder line solutions are based proven concepts that are op-

timised upstream and downstream. Customer goals plus a deep knowledge of ingredient markets and processing are combined to derive solutions that optimise return on investment, provide sensible flexibility and are delivered on common automation, design and project execution platforms.

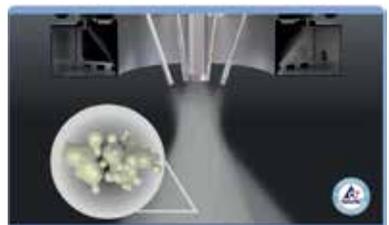
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No agglomeration



Medium agglomeration



Maximum agglomeration