

Turning Whey Into WPC for Calf Feed

Combined UF/RO membrane system processes more than 1 million lb of whey per day

It was an offer they couldn't refuse.

In early 1995, David Grant, president of Strauss Veal Feed, approached management at the AMPI (now Foremost Farms) cheese plant in Appleton, Wis., about installing a membrane system to produce whey protein concentrate (WPC).

"We were looking for very high-quality source of WPC as a base for calf feed," says Grant.

After reaching an agreement, Grant and Foremost Farms contracted with Niro Inc. to design and build a system to make WPC containing 35% protein and 30% total solids from mozzarella whey. The system was installed in December 1995.

The process starts with reverse osmosis (RO) to remove water and pre-concentrate the whey, and then uses ultra-filtration (UF) to produce WPC. The membrane systems process up to 70,000 lb of whey per hour and produces approximately 6,000 lb per hour of finished WPC-containing product. (This number varies somewhat depending on the whey being processed.)

The process starts by pumping whey through a fines-saver to remove coarse fines, a clarifier to remove remaining cheese solids, a separator to remove fat, and a pasteurizer. Pasteurized whey

is stored in two holding tanks, from which it is pumped into the RO system at a rate up to 140 gal per minute (70,000 lb per hour). The whey contains 6 to 9.5% total solids depending on the type of mozzarella being produced. The following example is based on whey containing 8% TS.

Recirculating flow

The RO system consists of four identical stages with each stage having 15 vessels. Each vessel contains four 3-ft long, 4-in diameter spiral-wound thin film composite elements having 7 sq meters of filter area. Thus each vessel has 28 sq meters of filter area and each stage has 420 sq meters of filter area. The system incorporates single- and multiple-stage Fristam high-pressure centrifugal pumps to maintain its operating pressure of 450 to 550 psi.

Each stage is a recirculating system. A pump draws whey from the feed line into the stage where it splits and flows in parallel through the 15 vessels. Permeate passes through the membranes and is removed continuously, while retentate discharges into a common line, flows back into the main feed line and continues to the next stage. Once the system is in balance, actual recirculating flow is three times

the infeed rate (420 gpm).

This procedure repeats itself in each stage with the main flow becoming more concentrated at each stage. Ultimately, the system removes 42,000 lb of water per hour as permeate, leaving 28,000 lb per hour of concentrated whey containing 20% total solids discharging from the RO system directly into the UF system.

The UF system also has four stages. It is similar to the RO system except that each stage contains 11 vessels and the membranes are made of polyethersulfone.

Lactose and ash are removed in the permeate while the WPC stays in the recirculating retentate stream. Final discharge from the UF system consists of 22,000 lb of permeate per hour containing 3,800 lb of ash and lactose, and 6,000 lb per hour of retentate containing 1,800 lb of 35% WPC.

The Appleton plant mixes vitamins and minerals into some of the WPC solution to produce calf feed that it ships directly to Strauss' customers. The remainder of the WPC is sent to Strauss.

"We're very pleased with the product from Appleton. It's lived up to all of our expectations," says Grant. Reprinted with permission from Dairy Foods Magazine.