

Recovery of Protein from Potato Starch Effluent



Background

The Avebe Foxhol site produces starch from potatoes. Potato starch production involves washing and grinding potatoes to produce a pulpy liquor of potato fruitwater, starch and fibres. The starch is extracted and refined by hydrocyclones, and the fibres are then separated from the liquor by centrifuge. The residual potato fruitwater contains protein, sugars and minerals at a concentration previously too dilute to recover.

The Foxhol site alone produces 2.2 million cubic metres per year of this potato water, which was originally disposed of without treatment into the North Sea and into Holland's canals. The effect was a major contamination of the waterways, the contaminants giving rise to strong odours and killing water life. This caused a public outcry.

Cleaner Production

In the late 1970's and early 1980's, Avebe made a major effort to clean up its production. After several years of test work, internal recycling has become possible by installing a reverse osmosis plant to concentrate the potato fruitwater to a level at which the protein could be recovered economically by coagulation.

The process installed at Avebe utilises open-channel tubular membranes which can handle

high levels of suspended solids without clogging, and which are easy to clean. Since the concentration process is non-thermal and does not involve a change of phase, it is energy-efficient and does not change the nature of the proteins. The system which is designed for continuous operation, comprises six parallel process lines.

Following concentration of the potato water, protein is extracted from the concentrated stream by steam coagulation and dried. The product is a high grade protein concentrate used in animal feeds for small animals, such as piglets, poultry, furred animals including dogs, cats and minks. The residual potato water is evaporated and used for the enrichment of the potato fibres and incorporated in a cattle feed. The process thus produces two saleable products.

Due partly to the reverse osmosis process and partly to a counter-current extraction process installed at the same time, the volume of process water intake was reduced from 7 m³/tonne of potatoes to 0.6 m³/tonne, saving 17 million m³ of water per annum. The process also recovers 1.1 million cubic metres per year of water (the filtrate from the reverse osmosis process) which is recycled within the factory to further reduce process water intake. Effluent emissions are thus greatly reduced.



Enabling Technology

Reverse osmosis is a process which separates water from dissolved and suspended solids using a membrane made of organic material.

A pressure of 40–50 Bar is applied to force water through the membrane while dissolved substances are retained. The process thus produces two streams: a concentrated liquor and clean water. The equipment is in the form of robust, open-channel membranes with the features of high retention and low-fouling.

Advantages

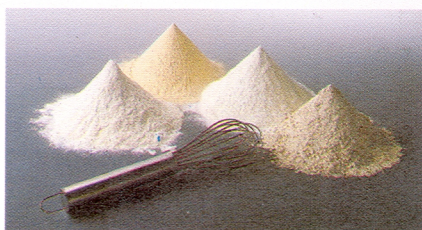
Major reduction in the volume of process water consumed through the recycling of wastewater.

The reduction in the quantity of water handled enables the heat coagulation and evaporation plant to be half the size, so giving capital and energy cost savings.

Production of two by-products from the effluent.

Economic Benefits

An effluent treatment problem is solved and wastewater disposal costs are avoided. Water consumption is also reduced, with further savings. Two by-products are produced, both of which generate revenue. The overall cost to Avebe of concentrating the liquor with reverse osmosis at the time of installation was approx. US\$0.54/m³ of potato water treated. The economic benefits depend upon the market value for the by-products as well as water and wastewater charges.



Country

The Netherlands

Industry

Starch Manufacture

Companies

Avebe is the largest potato starch producer in the world. Founded in 1919, Avebe is now an international cooperative with four starch production plants in Holland, the largest being at Foxhol. The company also have plants in Germany, France, Sweden, Thailand and the USA.

PCI Membrane Systems Ltd is a specialist in membrane filtration equipment with 25 years experience in solving a wide range of effluent and processing problems. The company has a UK manufacturing base, and up to 90% of its business is exports.

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