BY-PRODUCT RECOVERY IN INDUSTRIAL WASTEWATER POLLUTION CONTROL

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Keywords: Dairy industry, Food industry, Microfiltration, Pig farm, Pulp and paper industry, Ultrafiltration

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Summary

By-products from most industries become waste when they are not recovered. This article gives examples of by-product recovery from industries such as pulp and paper, dairy, pig farm and food processing.

Although the recovery of by-products will require new processes, the investments on those processes will be paid-back easily from the benefits brought by those by-products. Also, in order to have a sustainable development, by-product recovery will play a significant role in all industries in the near future.

1. Introduction

From the environmental point of view, by-product/waste recovery is an efficient method of waste reduction. But in the past, only a low percentage of by-product/waste was recovered. This approach obviously reduces the waste disposal or pollution problem. There are many examples on by-product/waste recovery.

In pulp and paper industry, as conventional treatment, an evaporator is used to recover lignosulphonates of all molecular weights together. This does not have much economical value. Ultrafiltration helps to separate the high molecular lignosulphonates from low molecular weight lignosulphonates.

High molecular weight lignosulphonates can be used to produce industrial products like dispersing agents and spinning solvent for polyacrylonitrile fibres. The low molecular weight lignosulphonates can easily be treated by conventional biological treatment.

In cheese production, whey waste can be treated by cross flow ultrafiltration (CFUF). CFUF permits the retention and concentration of proteins and allows lactose and salts with the permeate through the membrane. Protein can be used as animal and human food while permeate can be used for lactose preparation.

From pig waste effluent, grit can be separated and sold to worm farmers. Biogas can be generated from anaerobic digestion of the effluent. Also, humus solids can be produced that can be used as fertilizer.

In pineapple processing, fruit drops and juice drips can be collected which will increase the juice and reduce the treatment cost of the waste. In canned soup manufacturing recycling of solid waste and scrap material, reduction of the enamel and thinner waste can be utilized as waste minimization. In a desiccated coconut industry, wasted coconut water was recovered as a commercial drink and reducing the BOD of the wastewater by about 50%.

2. Case Studies

2.5. Pulp and Paper Industry

Conventionally, an evaporator is used to recover lignosulphonates of all molecular weight fractions together. This does not have much economic value. As shown in Figure 1, ultrafiltration helps to separate the high molecular weight lignosulphonates (which remain in the concentrate) from low molecular weight lignosulphonates (which escape into the permeate).

The recovery of high molecular weight lignosulphonates from the concentrate of ultrafilter is not only economical but also eliminates part of the pollution problem. This can be used to produce industrial products like dispersing agents and spinning solvent for polyacrylonitrile fibers. The low molecular weight lignosulphonates can easily be treated by conventional biological treatment.

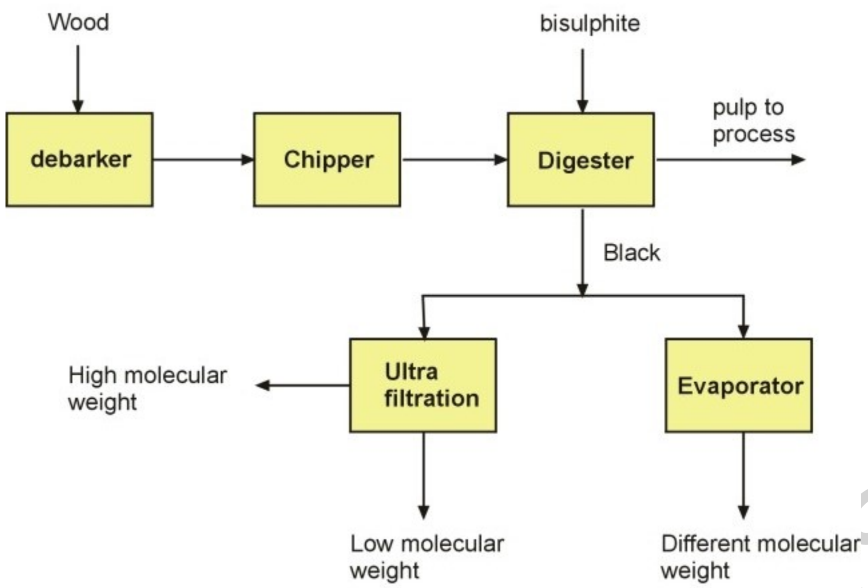

Figure 1. Pre-industrial implementation of ultrafiltration of black liquors in a paper mill, Landes, France (Ben Aim, 1988)

A pilot-scale study made using inorganic ultrafilter membranes of carbon-zircona indicated that this process is techno-economically feasible. The operating conditions of ultrafiltration is presented in Table 1.

Temperature	90–140°C
Pressure	7.5 bar
Flux	L/m^2h^{-1}
Operating cycle before washing	More than one month
Cleaning solution	Acid or alkali

Table 1. Operating conditions of ultrafiltration (Ben Aim, 1988)

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Biographical Sketches

Veeriah Jegatheesan is currently a senior consultant with Australian Water Technologies, Sydney, Australia. He obtained his B Sc Eng , M Eng and Ph.D. degrees from University of Peradeniya, Sri Lanka (1983), Asian Institute of Technology (AIT), Thailand (1992) and University of Technology Sydney (UTS), Australia (1999), respectively. His areas of interests are designing and modeling water and wastewater treatment systems, modeling water quality in drinking water distribution systems, cleaner production/industrial waste minimization and environmental impact assessment. He has published over 30 articles as journal papers, international conference papers, books/book chapters and technical reports in his areas of interest. In addition to his current position as a senior consultant with Australian Water Technologies in modeling biofilm growth and disinfectant decay in drinking water distribution systems, has worked in the capacity of senior consultant in water and wastewater treatment systems in Thailand, senior measurement engineer in Sultanate of Oman and teaching assistant in department of civil engineering and engineering mathematics of the university of Peradeniya, Sri Lanka.

Roger Ben Aim is currently the Professor of Industrial Process Engineering at Institut Nationale des Sciences Appliques (INSA), Toulouse, France. He was one of the key figures in the creation of Water Engineering Department and Research Laboratory at the University of Montpellier, France. He also established two technical research centers for solid-liquid separation technologies and membrane processes in Agen, France. He has widely published in the field of solid-liquid separation technologies, particularly in the area of membrane separation processes for water and wastewater treatment. Dr. Ben Aim is a key member of the European Membrane Society, and has been involved in several international research projects.

S. Vigneswaran is currently a Professor and Head of Environmental Engineering Group in Faculty of Engineering, University of Technology, Sydney, Australia. He has been working on water and wastewater research since 1976. He has published over 175 technical papers and authored two books (both through CRC press, USA). He has established research links with the leading laboratories in France, Korea, Thailand and the USA. Also, he has been involved in number of consulting activities in this field in Australia, Indonesia, France, Korea and Thailand through various national and international agencies. Presently, he is coordinating the university key research strengths on “water and waste management in small communities,” one of the six key research centers funded by the university on competitive basis. His research in solid liquid separation processes in water and wastewater treatment namely filtration, adsorption is recognized internationally and referred widely.