Continuous alcohol fermentation integrated with product recovery

Researcher: Wim Groot
Supervisors: Ir K.Ch.A.M Luyben, dr ir R.G.J.M. van der Lans
Institute: Delft University of Technology, Department of Biotechnology,
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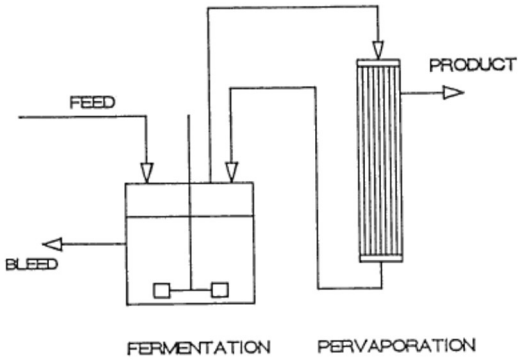
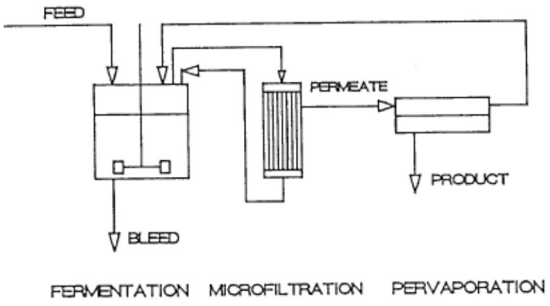
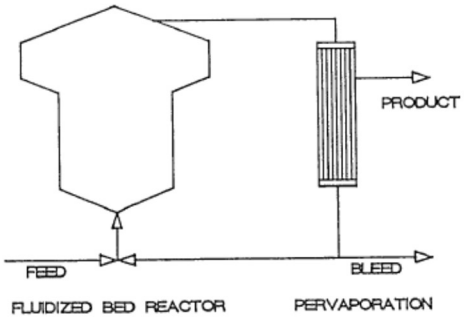
Description







Compared to a conventional process, in-situ alcohol recovery can reduce the effect of product inhibition in a fermentation leading to the following improvements:
-The substrate concentration in the feed can be increased. This will result in a reduction in the process streams, including the waste water stream, which may lead to lower process costs.
-The costs of product recovery can be reduced, provided that the separation technique is competitive with the conventional distillation of alcohols.
In literature the majority of studies dealing with alcohol recovery reflect the search for suitable recovery techniques. Experimental work on in-situ recovery is restricted to laboratory scale, and pilot plant studies have not been reported. For ethanol production, some studies consider mathematical modelling of integrated processes, and provide simulations on the optimal fermentation/recovery conditions. Pervaporation is a process that can effectively be used to remove volatile compounds from fermentation liquids. Fermentation broths may contain several compounds, and it is desirable to be able to predict pervaporation fluxes of the separate compounds. Results on the pervaporation of butanol from water with silicone rubber suggest that the solution/diffusion mechanism may be used in which the membrane is regarded as a dilute solution. There are several possibilities to realize integration of fermentation and pervaporation: fermentation using suspended cells and recirculation of broth via pervaporation unit; using cell free recirculation resulting from separation by microfiltration, a fluidized bed reactor or using immobilized cells in the fermentor. This project addresses all methods and compares qualitatively and quantitatively for a large-scale process and from the viewpoint of energy efficiency.

Publications from the project

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