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Project Title: *Breaking the Cost Barrier for Bio-Ethanol; Reactive Adsorption of Fermentation Broth*

DR. MARY REZAC

Project Goal

- To develop reactive adsorption technology for the efficient technical-scale recovery of ethanol from fermentation broths.

Project Outcomes

- Unlike conventional ethanol recovery systems, where separation of ethanol from water relies upon differences in the boiling points of the components, in the study system, we attempted to achieve separation by selectively reacting ethanol with a chemical moiety tethered to the surface of a solid support and subsequently reversing the reaction to recover purified product.
- This study demonstrated that several chemical species could be used for selective and reversible reaction with ethanol to form stable products.
- An increase in temperature of less than 30°C was sufficient to reverse the reaction.
- Detailed engineering design analysis indicated that the use of distillation to recover dilute ethanol from the fermentation broth consumes nearly 40% of the total energy of the ethanol production process. The beer column consumes approximately 60% of the total energy required by the separation system (or about 24% of the total used in the plant); the ethanol concentration to the rectifying column is nearly 58 wt%.
- Replacement of the distillation column with ethanol selective membranes operated in a pervaporation mode has the potential to significantly reduce the overall energy demand.



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Other Sources of Funding:

Indirect costs are charged at a rate of 25% to all the total direct costs. Cost share is paid by Kansas State University.