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U.S. Department of Transportation

SunGrant INITIATIVE South Central Region

Project Title: *Saline Extractive Distillation for Ethanol Separation*

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Rationale

The thermal energy demand for producing fuel ethanol from the fermentation broth of a state of the art corn-to-fuel ethanol plant in the U.S. is largely satisfied by combustion of fossil fuels, which impacts the possible economical and environmental advantages of bio-ethanol over fossil fuels. To reduce the thermal energy demand for producing fuel ethanol, a process integrating salt extractive distillation – enabled by a new scheme of electrodialysis and spray drying for salt recovery – in the water-ethanol separation train of a state of the art corn-to-fuel ethanol plant is investigated. Process simulation using Aspen Plus® 2006.5, with the ENRTL-RK property method to model the vapor liquid equilibrium of the water-ethanol-salt system, was carried out.

Project Outcomes

- The integrated salt extractive distillation process resulted in a thermal energy savings of 30%, when compared with the state of the art process for separating fuel ethanol from the beer column distillate.
- A thermal energy savings potential of 8.1*10^13 J (as natural gas HHV) per year with an operating cost savings potential on the order of 500,000$ per year can be estimated for producing 151.4 ML of fuel ethanol (99.95 wt%) per year. An overall maximum energy savings potential of 5.9*10^16 J (as natural gas HHV) per year could be realized for the targeted 117.4 GL of fuel ethanol to be produced in the U.S in 2022, if fermentation is the process of choice.

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