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 $8.1\times10^{13}$ 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 $5.9\times10^{16}$ 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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