

1+1=3! Hybrid processes

More than the sum of two unit operations

Hybrid processes in separation operations are characterized by the combination of two unit operations. Each unit operation itself is considered to be a separation process, but the combination allows the individual separation operations limitations to be overcome. Smart integration leads to a noticeable reduction in investment costs, discharge costs and energy costs.

The combination of rectification with membrane technology benefits hugely in the capacity increase of rectification columns. Integration of a vapor permeation unit can prevent from a costly investment into a new or additional rectification column.

The benefits of a hybrid process combining vapor permeation with rectification are illustrated by a comparison with a distillation process (see fig.). Vapor-Liquid-Equilibrium (fig. bold-black) causes the need of many theoretical stages (fig. red) until reaching an azeotropic mixture, where further distillation is not possible (fig. yellow star). This leads to loss of product, high energy consumption and makes further separation steps necessary. The driving force for the vapor permeation process is a partial pressure gradient from feed to permeate. The selective separation utilizes a different behaviour of the mixture components while being dissolved in the membrane and diffusing through the membrane (fig. green). The essential advantage is the independency from Vapour-Liquid-Equilibrium. So both separation operations, distillation and vapor permeation operate within their optimum range of concentrations and enable their efficient operation.

Based on the explicit results of the evaluation, Siemens deliverables range from recommendations over process design packages up to EPC.

Project examples

- Separation of alcohols, water and high boiling point components using hybrid process vapor permeation / rectification. Advantages compared to existing rectification:
 - huge energy savings,
 - reduced operating costs,
 - optimized alcohol recovery and simple separation of high boiling point residuals
- Ethanol dehydration by rectification/ pervaporation
- Solvent recovery by vapour permeation/adsorption

Interested? Contact us!

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Your Benefit

- Minimization of energy consumption by integration
- Increased product quality
- Reduced operating costs
- Process development, optimization and realization from one source
- Separation of azeotropic mixtures
- Solvent recovery

Our range of services

- Process development
- Process optimization
- Feasibility studies in lab-scale
- Pilot plant operation and erection
- Equipment design and scale-up
- Process comparison
- Process design package
- EPC

