Investigation on ammonia recovery and concentration via sweep gas membrane distillation process

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As a pollutant to water body and toxic chemical to human health, mitigating ammonia contamination has attracted significant attentions from both academia and industry. On the other hand, ammonia serves as a valuable chemical in the production of fertilizer and as a clean energy which avoid the emission of greenhouse gas. One of the major ammonia comes from urine production, where effluent contains high concentration of ammonia (~3.5 to 5.5 wt%). Traditional wastewater treatment method are likely to incur high cost or extra chemical consumption when treating wastewater at this high concentration. As a comparison, membrane distillation is considered an alternative solution due to its ease of operation and lower energy cost. At high ammonia concentration, partial pressure of ammonia is significantly higher than water vapour, which provides a facile way for direct ammonia recovery and concentration from the ammonia wastewater.

In this work, we present a simply sweep gas membrane distillation process for ammonia recovery from wastewater. Starting with 5 wt% ammonia aqueous solution, we can easily obtain 25 wt% concentrated ammonia aqueous solution at an optimized operation conditions. We have also conducted comprehensive investigation on how the operation conditions affect the recovery ratio and ammonia concentration in the permeate side.

Keywords: sweep gas membrane distillation, ammonia recovery, operation condition optimization, PVDF membrane