Development of a Hybrid Soft Sensor for the Real-Time Monitoring of Ammonium Salts in Ammonia-Based CO_2 Capture Processes

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Ammonia-based CO_2 capture processes consume energy to regenerate ammonia from ammonium salts. The type and concentration of the salts need to be monitored to prevent excessive consumption in regeneration energy. Thus, real-time monitoring for energy control is beneficial for energy and cost saving. The objective of this study is to develop a hybrid soft sensor to monitor ammonium salts in real time by linking the partial least square (PLS) model as a data-driven model to the vapor-liquid-solid (VLS) model as a thermodynamic model. pH, conductivity and temperature are used as the inputs for the data-driven model whose outputs are subsequently fed into VLS model as constraints. The results of the hybrid soft sensor are correlated at a level of $R^2 > 0.80$ with the results of instrumental analysis. Therefore, the hybrid soft sensor can be used to control regeneration energy and enhance the energy efficiency of ammonia-based processes.