

VLE of a $\text{H}_2\text{SO}_4\text{-H}_2\text{O}$ System and a Concentration Process of Sulfuric Acid Solution for SI and HyS Cycles

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The sulfur-iodine (SI) cycle and the hybrid-sulfur (HyS) cycle to produce hydrogen from water require a multistage distillation column or a set of flash drums to concentrate a sulfuric acid solution. In order to design a concentration process of the sulfuric acid solution which can be applied to the cycles, its static and dynamic simulation is essentially demanded. The Electro-NRTL model for the aqueous solution was selected to calculate T-x-y equilibrium values, and then the BIPs used in the Electro-NRTL model were evaluated by comparing with the partial and total pressures of a $\text{H}_2\text{SO}_4\text{-H}_2\text{O}$ system reported in Perry's chemical engineers' hand book. Based on the Electro-NRTL model and the determined BIPs, a commercial computer code 'ChemCAD v6.0.1' was used to simulate a multistage distillation column. From the results of the simulation, it has been revealed that a H_2SO_4 solution of 98 wt % can be obtained by the two consecutive distillation columns which are operated at 0.1 bar and 0.07 bar, respectively. The effect of the internally installed plate numbers on the performance of the distillation column was analyzed. The optimized column system is anticipated for a distillation column equipped with 2 ideal plates and a 2nd plate feeding system from the bottom plate of the 1st column.