Electrochemical separation of sulfuric acid and sugar from the effluent of the pretreatment and hydrolysis of biomass with concentrated sulfuric acid

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Bioalcohols such as bioethanol and biobutanol can be produced from waste woods, corn stover, straw, and many other biomasses by hydrolysis and fermentation. The pretreatment and hydrolysis of biomass with concentrated sulfuric acid can quickly convert lignocellulosic materials to C5 and C6 sugars. In order to apply the sugar-containing hydrolysate to the fermentation, the sulfuric acid should be almost totally removed in advance. We have proposed electrochemical separation of the hydrolysate using an anionic ion exchange membrane to successfully obtain a sulfuric acid-rich phase containing less than 0.1 wt% sugars and a sugar-rich phase containing less than 1 wt% sulfuric acid. Separation performance of the electrochemical cell was examined under various conditions including electrode types, hydrolysate circulation rates, current density, operating temperature, and connection manners of multiple cells. The electrochemical separation technique is expected viable in terms of relatively short time and high selectivity of separation, total acid removal, and recovery of sulfuric acid and sugar at high concentrations.