

Solvent Selection for Liquid-Liquid Extraction of Acetic Acid from Biomass Hydrolysate

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Biofuels are one of the most hopeful alternative energy sources to fossil fuels. However, the processing and production of biofuels needs improvement to be economically competitive in the current market. One drawback is the presence of naturally occurring compounds that decrease the bioethanol production rate and yield; these are called inhibitors. A resolution to this problem is to remove the inhibitors from biomass fermentation broth prior to fermentation. This project examined liquid-liquid extraction (LLE) for removal of acetic acid, a major inhibitor. Initially, a stock solution of glucose, xylose, acetic acid, and water was combined with an additional organic solvent to form a two-phase system. After mixing, the concentrations of the components in the water phase were analyzed using high performance liquid chromatography (HPLC). The compounds remaining in the solvent-rich phase were calculated via a simple mass balance. Nine different organic solvents were tested with the same mixture of compounds, after which the four most effective solvents were tested with liquid fermentation broth. The four best solvents were: ethyl acetate, butyl acetate, ethyl propionate, and isobutyl acetate. These four solvents had the highest split fraction, meaning that the acetic acid separated in the desired direction into the organic solvent. Butyl acetate was the best solvent because it extracted the most acetic acid, while retaining the sugars within the aqueous phase. Further research must be done on the organic phase analysis to ensure that the compound mass balance is closed. This research can help promote a more efficient production of biofuel.