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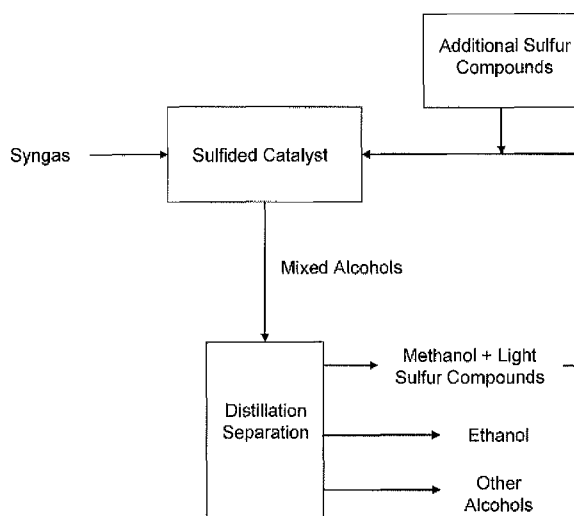
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(54) **Title:** METHODS AND APPARATUS FOR SULFUR MANAGEMENT IN CATALYTIC MIXED-ALCOHOL SYNTHESIS



(57) **Abstract:** The present invention provides methods to maintain selectivity to ethanol from syngas during mixed-alcohol synthesis when methanol is being recycled. In some variations, syngas is fed to an alcohol-synthesis reactor that contains a sulfided metal catalyst, and methanol is separated from ethanol to form a methanol recycle stream that contains sulfur-containing compounds. Recycling the methanol stream back to the alcohol-synthesis reactor allows for adding sulfur to, or reducing sulfur loss from, the sulfided metal catalyst. Optionally, additional sulfur compounds may be introduced to maintain sulfur levels in sulfided metal catalysts. Preferred sulfiding agents, concentrations, and recycle strategies are disclosed herein.

