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Solvent Extraction of Coal Tar Absorption Oil with Continuous Countercurrent Spray Column

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Solvent extraction of absorption oil by aqueous solution of methanol was evaluated using a continuous countercurrent spray column. The structure of the spray column is simple so that the mass transfer phenomenon in the column can be easily examined. The measured liquid-liquid equilibria between the absorption oil and aqueous solution of methanol phases required for calculation of mass transfer coefficients were found to agree with previous values. The operability and separability of extraction using the spray column were then studied. The density of the dispersed raffinate phase was sufficiently larger than that of the continuous extract phase to carry out countercurrent operation without entrainment of dispersed phase droplets into the continuous phase or flooding in the range investigated in this study. Mass transfers of components of interest could be detected in the bench scale spray column with effective height of about 0.5 m. The nitrogen heterocyclic compounds were extracted preferentially to other compounds, such as homocyclic compounds, from the absorption oil, and the separation of these compounds was governed by the liquid-liquid equilibrium. The highest yield and separation selectivity of nitrogen compounds with this column were about 0.4 and 30, respectively. Since the overall mass transfer coefficients increased with the flow rate of the continuous extract phase, some mass transfer resistance occurred in the continuous extract phase.

Keywords: Coal tar, Absorption oil, Solvent extraction, Continuous countercurrent operation, Spray column, Mass transfer rate

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