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SEPARATION SCIENCE & ENGINEERING

乳酸与醇在酸催化反应精馏耦合过程中的应用

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摘要：The purification of lactic acid based on the esterification of raw lactic acid from fermentation broth and then the catalytic distillation hydrolysis of n-ethyl lactate simultaneously to achieve pure lactic acid is reported. The esterification kinetics of lactic acid with n-ethanol catalyzed by strong-acid cation-exchange resins (Amberlyst-15,D001, D002, NKC, 002) was studied under the condition that simulates the real catalytic environment. Experimental results were correlated by a Langmuir-Hinshwood model and the nonideality of the solution was taken into account by using activities calculated by the universal quasichemical functional group activity coefficient (UNIFAC) method.A good agreement between the model and the experimental data was achieved. Continuous purification experiments were conducted to find the optimum column configuration and operation condition for the system. The effects of various parameters, e.g. the length of different section of the column, feed rate and ratio of reactants, packing material and catalyst type, were studied.This novel system shows good separation results in lab scale, and is potential for industrial application.

关键词：乳酸；酯化反应；离子交换树脂；催化精馏；

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Purification of Lactic Acid by Heterogeneous Catalytic Distillation Using Ion-exchange Resins

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Abstract The purification of lactic acid based on the esterification of raw lactic acid from fermentation broth and then the catalytic distillation hydrolysis of n-ethyl lactate simultaneously to achieve pure lactic acid is reported. The esterification kinetics of lactic acid with n-ethanol catalyzed by strong-acid cation-exchange resins (Amberlyst-15,D001, D002, NKC, 002) was studied under the condition that simulates the real catalytic environment. Experimental results were correlated by a Langmuir-Hinshwood model and the nonideality of the solution was taken into account by using activities calculated by the universal quasichemical functional group activity coefficient (UNIFAC) method.A good agreement between the model and the experimental data was achieved. Continuous purification experiments were conducted to find the optimum column configuration and operation condition for the system. The effects of various parameters, e.g. the length of different section of the column, feed rate and ratio of reactants, packing material and catalyst type, were studied.This novel system shows good separation results in lab scale, and is potential for industrial application.

Key words lactic acid; catalytic distillation; purification; ion-exchange resin; hydrolysis;

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