Mass transfer study in eductor liquid-liquid extractor: dimensional analysis and RSM modeling

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Abstract

In this work, the mass transfer performance of a new eductor liquid-liquid extractor is investigated experimentally and modeled by dimensional analysis and response surface methodology (RSM) with utilization of water/acetic acid/toluene system. A correlation is derived for overall mass transfer coefficient versus the Reynolds number, throat to nozzle area ratio, projection ratio, and the two phases flow rates ratio. Based on obtained results, Reynolds number is known as a most effective parameter. As well, different hydrodynamic and geometrical parameters, giving the same Sauter mean dimeter, have different mass transfer coefficients due to differences in droplet size distribution. Also, the RSM studies shows that effects of the parameters are in the order of the two phases flow rates ratio, the venturi throat to nozzle tip distance, nozzle diameter, and venturi throat diameter. The maximum overall mass transfer coefficient is obtained equal to 0.000278 m/s for the studied system.

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