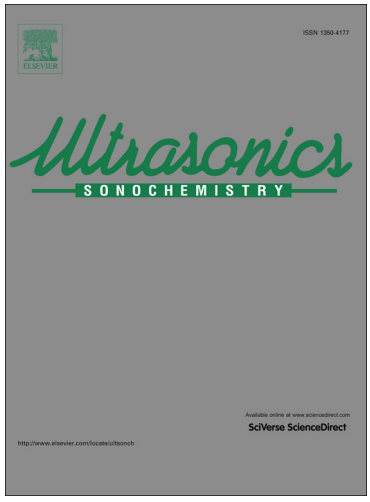

Multi-objective optimization of oxidative desulfurization in a sono-photochemical airlift reactor

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Multi-objective optimization of oxidative desulfurization in a sono-photochemical airlift reactor

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Abstract

Response surface methodology (RSM) was employed to optimize ultrasound/ultraviolet-assisted oxidative desulfurization in an airlift reactor. Ultrasonic waves were incorporated in a novel-geometry reactor to investigate the synergistic effects of sono-chemsitry and enhanced gas-liquid mass transfer. Non-hydrotreated kerosene containing sulfur and aromatic compounds was chosen as a case study. Experimental runs were conducted based on a face-centered central composite design and analyzed using RSM. The effects of two categorical factors, i.e., ultrasound and ultraviolet irradiation and two numerical factors, i.e., superficial gas velocity and oxidation time were investigated on two responses, i.e., desulfurization and de-aromatization yields. Two-factor interaction (2FI) polynomial model was developed for the responses and the desirability function associate with overlay graphs was applied to find optimum conditions. The results showed enhancement in desulfurization ability corresponds to more reduction in aromatic content of kerosene in each combination. Based on desirability approach and certain criteria considered for desulfurization/de-aromatization, the optimal desulfurization and de-aromatization yields of 91.7 % and 48 % were obtained in US/UV/O_3/H_2O_2 combination, respectively.

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