Accepted Manuscript

Desulfurization of liquid hydrocarbon fuels via Cu2O catalyzed photo-oxidation coupled with liquid–liquid extraction

Xiaoming Gao, Jiao Fei, Yanyan Shang, Feng Fu

PII: S1004-9541(17)31524-0
DOI: https://doi.org/10.1016/j.cjche.2018.01.022
Reference: CJCHE 1031

To appear in:

Received date: 7 November 2017
Revised date: 22 January 2018
Accepted date: 24 January 2018

Please cite this article as: Xiaoming Gao, Jiao Fei, Yanyan Shang, Feng Fu , Desulfurization of liquid hydrocarbon fuels via Cu2O catalyzed photo-oxidation coupled with liquid–liquid extraction. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Cjche(2017), https://doi.org/10.1016/j.cjche.2018.01.022

Desulfurization of liquid hydrocarbon fuels via Cu_2O catalyzed photo-oxidation coupled with liquid–liquid extraction

Xiaoming Gao, Jiao Fei, Yanyan Shang, Feng Fu

Department of Chemistry and Chemical Engineering, Shaanxi Key Laboratory of Chemical Reaction Engineering, Yan'an University, Yan'an, 716000, Shaanxi, China

Abstract: By combining the photochemical reaction and liquid–liquid extraction (PODS), we studied desulfurization of model fuel and FCC gasoline. The effects of air flow, illumination time, extractants, volume ratios of extractant/fuel, and catalyst amounts on the desulfurization process of PODS were analyzed in detail. Under the conditions with the air as oxidant (150 mL min^{-1}), the mixture of DMF-water as extractant (the volume ratio of extractant/oil of 0.5) and photo-irradiation time of 2 h, the sulfur removal rate reached only 42.63% and 39.54% for the model and FCC gasoline, respectively. Under the same conditions, the sulfur removal rate increased significantly up to 79% for gasoline in the presence of Cu_2O catalyst (2 g L^{-1}). The results suggest that the PODS combinded with a Cu_2O catalyst seems to be a promising alternative for sulfur removal of gasoline.

Keyword: desulfurization; photo-oxidative; gasoline; extraction; Cu_2O; catalyst

1. Introduction

Because the sulfur-contained compounds in the fuel are converted to toxic SOx during their combustion, which not only contributes to acid rain and soil pollution, but also poisons catalysts for decontamination of car exhaust gases [1-5]. Consequently, there are stringent requirement for the sulfur content in fuels in many countries [6]. However, conventional hydrodesulfurization methods (HDS) can hardly produce the desired fuels that can well fit with these requiems owing to the low reactive aromatic thiophenes and their derivatives existed in the liquid fuels [7,8]. Therefore, it is of great importance to develop more advanced approaches/advanced technologies to HDS to achieve deep desulfurization of fuel gasoline.

So far, various alternative techniques to HDS have been investigated to deeply desulfurize hydrocarbon fuels, such as adsorption [6,9,10], oxidative desulfurization (ODS) [11,12], and biocatalytic treatment [1]. Among them, ODS is one of the most