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Intensification of mass transfer process using deep eutectic solvents and nanosuspensions

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In an attempt to reduce the usage of hazardous solvents and procedures in industrial processes, replacement of conventional organic solvents has become an important area of research. Research and application of deep eutectic solvents (DESs) in extraction processes, due to their green character, provide many options and could significantly contribute to the advancement of green technologies and reduce the negative impact of industry on the environment. DESs are applied in the processes of extractive desulfurization and denitrification instead of conventional catalytic processes hydrodesulfurization (HDS) and hydrodenitrification (HDN). These classical processes require high costs due to high temperatures and pressures and the use of considerable amounts of hydrogen and catalysts in the process. Moreover, HDS and HDN aren't very successful in removing cyclic sulfur and nitrogen compounds such as thiophene, dibenzothiophene, carbazole and pyridine. This study examines mass transfer in extraction processes by using DESs and possible improvement of mass transfer with nanosuspensions. It is known that the application of nanosuspensions improves thermal properties as a result of Brownian motion of well dispersed nanoparticles within the suspension. Improvements of mass transfer by diffusion and/or convection can be expected due to heat and mass transfer analogy. The experiments are focused towards preparation of stable nanosuspensions with DESs as base fluids, their implementation and achieving improvements in the extraction of thiophene (sulfur compound) and pyridine (nitrogen compound) from model fuel FCC gasoline. Extractive denitrification proved to be more successful process than extractive desulfurization due to higher solubility of pyridine than thiophene in DESs. Furthermore, extraction with DESs and nanosuspensions showed better performance compared to extraction with conventional solvents.

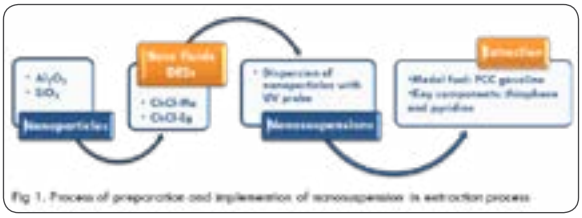

Fig 1. Process of preparation and implementation of nanosuspension in extraction process

Recent Publications

1. Zhang Q, De Oliveira Vigier K, Royer S and Jerome F (2012) Deep eutectic solvents: syntheses, properties and applications. Chem. Soc. Rev. 41:7108-7146.
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3. Yin J, Wang J, Li Z, Li D, Yang G, Cui Y, Wang A and Li C (2015) Deep desulfurization of fuels based on an oxidation/extraction process with acidic deep eutectic solvents. Green Chem. 17:4552-4559.
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Biography

Anamarija Mitar is a Postgraduate PhD student of Chemical Engineering and Applied Chemistry on Faculty of Chemical Engineering and Technology, University of Zagreb. Her scientific activity began in the development of green technology. Attention is focused on the development of new, environmentally friendly solvents (ionic liquids and deep eutectic solvents) which would satisfy the technological and economic requirements. The areas of her scientific research are thermal separation processes; extraction using green solvents and transport properties of nanofluids.

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