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Deep eutectic solvents (DES)-based materials for the integration of desulfurization and denitrogenation processes of fuels

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PURPOSE OF THE ABSTRACT

Removal of sulfur and nitrogen compounds from fossil fuels is a key issue, given the stringent legislations and increasing demands for gasoline and diesel quality, as well as the impact on the environment and public health. Hydrotreating processes are the current technology used for removal of such compounds in the oil refineries, around the world. Nevertheless, these processes present several drawbacks, such as, high cost of operation and reduced efficiency in the removal of refractory sulfur and nitrogen compounds [1]. Thus, the search for new and sustainable alternatives or complementary processes is mandatory.

Ionic liquids and recently Deep Eutectic Solvents (DES) have been explored as alternative key players for the removal of sulfur and nitrogen from fossil fuels, using several approaches [2,3]. To date, extractive desulfurization/denitrogenation (EDS/EDN) using liquid-liquid approach or solid-liquid approaches are two of the most promising desulfurization alternative processes due to their simple operation, low cost and benign effects on the final fuel quality.

Recently, our group tested and ranked a wide range of DESs according to their effectiveness in the removal of different refractory sulfur compounds from a model fuel [4]. Due to the excellent performance of DES, in the present work we explore the development of a methodology capable of simultaneously removing the sulfur compounds and also nitrogen compounds. Four different fuel pollutants (namely: thiophene, dibenzothiophene, pyridine and carbazole) were dissolved in hydrocarbons, in order to mimic a fuel, and liquid-liquid extraction efficiencies with several DES were determined. After finding the most suitable system, we were challenged to solve sustainability issues, such as, the recycling of the chosen DES extractant, as well as its use in different real fuel matrixes.

FIGURES

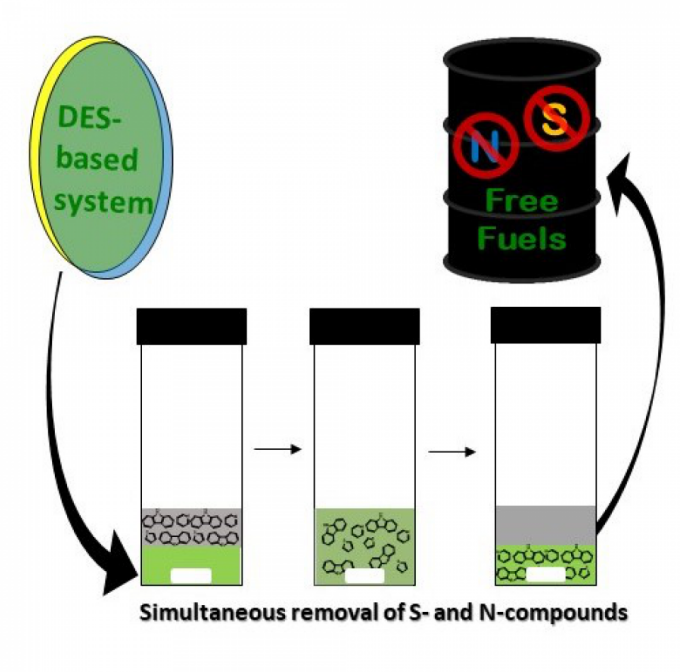

FIGURE 1

Figure 1.

Schematic representation of the simultaneous extractive desulfurization and extractive denitrogenation process

FIGURE 2

KEYWORDS

Deep eutectic solvents | Simultaneous desulfurization and denitrogenation | Deep extractive desulfurization | Deep extractive denitrogenation

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