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Bio-polymeric Ionic Liquid Gels for the Desulfurization of Fuel

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Fossil fuel is until now the most widely used energy resource. For this reason, minimizing the amount of harmful compounds produced after fuel combustion is still challenging, together with the research of greener eco-sustainable alternative sources. To achieve this goal, the desulfurization of fuel can be efficiently applied allowing the reduction of toxic sulfur species produced after fuel combustion.[1]

In the last decades, Ionic Liquids (ILs) replaced the use of organic solvents for extractive desulfurization of fuel, however to overcome ILs leaching in fuel, they can be trapped in a semisolid matrix like the one of supramolecular gels.[2] In this framework, the combination of ILs and biopolymers has been proposed to obtain polymeric gels that can be used as eco-sustainable adsorptive materials. Gels were prepared using biopolymers such as chitosan (CS), cellulose (CE) and cellulose acetate (CEOAc) as a single gelator or in combination. ILs differing in anion coordination and cross-linking ability, as well as in the cation aromaticity or length of the alkyl chain, were selected.[3]

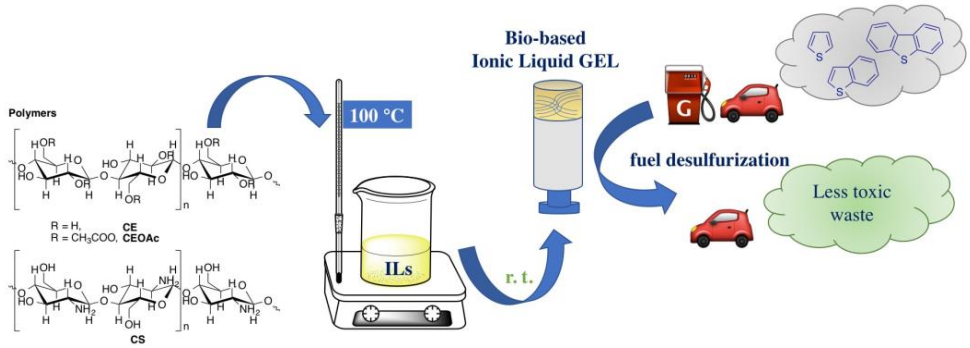

Figure 1: Biopolymer structures, schematic representation of IL gel preparation and of fuel desulfurization.

Gelling and swelling ability, porosity, morphology, rheology and mechanical response were studied as a function of the polymer and IL used. The best performing gels were tested for fuel desulfurization using a fuel mimicking solution of thiophene (T), benzothiophene (BT) and dibenzothiophene (DBT) in hexane. Bio-based polymer gels proved to be promising adsorbents for fuel desulfurization allowing 84% removal efficiency to be reached for T and 60% for DBT and BT in a multistage apparatus. In addition, gels could be reused without any leaching of IL or polymer in fuel, proving to be competitive with other adsorbent materials currently used.

[§]Until March 2022.

References:

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