Addressing the Capacity of Fluorinated Ionic Liquids and Deep Eutectic Solvents for the Separation and Recovery of Refrigerants

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Within the context of the climate change emergency, the use of fluorinated refrigerants is being regulated to progressively cut the emissions of these gases as a consequence of their elevated Global Warming Potentials. A mid-term solution consists on the recovery and reuse of hydrofluorocarbons (HFCs) to increase their lifespan and reduce their production. Therefore, the development of novel separation processes to selectively separate HFCs is needed for the practical implementation of circular economy principles in the use of refrigerants. In this work, the soft-SAFT equation of state (EoS) is used to assess the feasibility of the absorption of different F-gases in fluorinated ionic liquids (FILs) and Deep Eutectic Solvents (DES). The solubility of a selection of refrigerants, including HFCs and hydrofluorolefins (HFOs) has been studied in several ILs containing a different amount of fluorine atoms. In addition, different DESs have been tested, including some new synthetized systems based on [$HC_4F_9CO_2$] and [$HC_4F_9SO_3$] as hydrogen bond donors (HBD). For these systems, new experimental data, including density, viscosity and F-gas solubility is provided. The more rigorous two-compound approach has been used to describe the DESs with soft-SAFT, increasing the transferability of the models. In all cases, the viscosity of the solvents has also been characterized with the Free-Volume Theory coupled into the EoS. From the theoretical descriptions, further predictions on Henry constants, selectivity and heat of regeneration are provided, so as to critically assess the best solvents in terms of gas recovery [1].

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References:

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