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Thermal stability of choline chloride deep eutectic solvents by TGA/FTIR-ATR analysis

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ABSTRACT

Deep eutectic solvents (DESs) based on the cation choline have been proposed to date for a variety of applications due to their remarkable physicochemical properties. The thermal stability is one of the first properties of DESs that needs to be known since it limits the maximum operating temperature for which these solvents are useful in many applications. In this work, the thermal stability of eight different choline chloride-based DESs formed using levulinic acid, malonic acid, glycerol, ethylene glycol, phenylacetic acid, phenylpropionic acid, urea, and glucose as hydrogen bond donors (HBDs) has been studied using isothermal and dynamic thermogravimetric analysis/Fourier transform infrared-attenuated total reflectance spectroscopy (TGA/FTIR-ATR) techniques. Isothermal and dynamic FTIR-ATR were carried out to confirm the formation and to show the structural changes with temperature of the DESs, respectively. The onset decomposition temperatures of the DESs were obtained from dynamic TGA. However, the maximum operating temperatures determined by isothermal TGA in long-term scenarios have demonstrated to be significantly lower than the onset decomposition temperatures for every DES studied. The thermal stability and the boiling point of HBDs have a crucial impact on the maximum operating temperature of DESs.

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