

## Deep Eutectic Solvents: Green Applications

Enas Nashef\*

<sup>1</sup>Department of Chemical Engineering, Khalifa University, United Arab Emirates

\*([enas.nashef@ku.ac.ae](mailto:enas.nashef@ku.ac.ae))

**Abstract** – Recently, ionic liquids (ILs) have attracted considerable attention in scientific research as green solvents. Owing to their low vapor pressure, ILs were qualified as green solvents. However, the "green affiliation" of ILs is now contested by many research groups. The hazardous toxicity and the very poor biodegradability of many ILs have been reported in the literature. Additionally, their synthesis generally requires a large amount of salts and solvents. These drawbacks and the high price of common ILs delayed their industrial applications. To overcome these drawbacks, a new generation of solvents, named Deep Eutectic Solvents (DESs), has emerged. DESs can be formed by mixing, at moderate temperature, two or more components that can be chosen to be cheap, renewable and biodegradable. These compounds are capable of forming a eutectic mixture with a melting point lower than that of the individual component. DESs are generally liquid at temperatures lower than 100 °C.

Many DESs have similar physical-chemical properties to those of ILs, while being much cheaper and environmentally friendlier. Owing to these advantages, there is growing interest in DESs in many fields of research. DESs are chemically tailorable solvents since they can be designed by properly combining various quaternary ammonium or phosphonium salts with different hydrogen bond donors (HBD) or complexing agents. Hence, task-specific DESs with different physical-chemical properties can be prepared.

In this work, we discuss the important contributions of DESs in diverse applications, e.g. electrochemical processes, catalysis, synthesis, absorption of CO<sub>2</sub>, desulfurization of fuels, separation, and dissolution and extraction processes.

*Keywords – Deep Eutectic Solvents, Green Solvents, Environment, Sustainability, Engineering Applications*