CO_2 Solubility Performance of Deep Eutectic Solvents

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The overwhelming scientific and techno-economic analysis has the consensus that aqueous mono-ethanol amine (MEA) scrubbing techniques significantly penalizing the energy sector for CO_2 capture both in combustion processes. Studies have shown that ionic liquids are very promising alternative capture solvents for CO_2 and other toxic gases since; their physical and chemical properties at various temperatures could be adjusted through modifying their cationic and anionic moieties. Additionally, extremely low vapor pressures, high thermal and chemical stability, non-flammable nature, high solvation capacity, and promising gas solubility features, ionic liquids have emerged as attractive compounds since the last decade. Moreover, modifying solvent properties at room temperature through hydrogen bond donors, ionic liquids mixtures may have great potential for efficient CO_2 absorption. Since, mixing two or three components capable of intermolecular interactions through the hydrogen bonding generate deep-eutectic solvents (DES), with depressed freezing point and other eutectic physical properties that lie well below each of the individual constituents of the mixture. DES compounds can be easily prepared with high purity unlike ionic liquids and choice of the additional solvent help to further tune the properties and produce novel compounds with considerable low cost, less or even none toxicity and bio-degradable nature. Based on advantageous features, we report preparation of novel deepest melting point eutectic solvent prepared from non-toxic choline chloride and levulinic acid. The initial findings have indicated that, this novel DES has extremely low melting point, strong thermo physical stability and appreciable CO_2 capturing capacity. TGA, FTIR, viscosity, density, pH, and thermal conductivity analysis have also indicated the suitability of this material for CO_2 and other gases solubility. Moreover, the repeated use of material at various temperature and pressure without any decrease in CO_2 capturing capacity makes this material capable to be considered for further investigation on larger scale applications.