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Rapid desorption of CO2 from deep eutectic solvents at lower temperature: An alternative technology with industrial potential

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PURPOSE OF THE ABSTRACT

The emission of greenhouse gases is responsible for global warming that plague the world [1]. CO2 is mainly responsible for the climate disturbances and significant environmental pollution, thus causing rising of the earth temperature and also giving rise to the huge number of hurricanes, heatwaves and excess rain in some places on earth. Therefore, CO2 separation has become one of the essential solutions to greenhouse gas control and, at the same time, we have started to see it as a C1 building block. On the other hand, the toxicity of many common solvents also causes negative impact in terms of environmental pollution and hazards to living organisms due to their high volatility, hazardous nature and low thermal stability. Therefore, sustainable solvents are targeted such as ionic liquids (ILs) and deep eutectic solvents (DESs) for as wide range of material formation and chemical processes [2]. To overcome the ILs drawbacks like tedious synthesis procedure, expensive precursors and high viscosity, DES have emerged as potential candidates for CO2 capture and separation owing to their special functional groups, higher CO2 solubility, and selectivity as well as outstanding properties, such as non-volatility, designability, low viscosity and low cost of starting materials [3]. Correctly designed DESs enable the captured CO2 to be easily released from the saturated solvents, resulting in decreased energy consumption and more favorable environmental profile in CO2 capture processes than the traditional amine scrubbing. Herein, we introduce as family of economical, thermally stable and low viscous deep eutectic solvents for CO2 capture from conventional amine and polyamines. The prepared anion-functionalized ionic liquids (ILs) and their DESs with ethylene glycol (EG) display a negligible solvent loss, low cost and low viscosity, and are characterized by a high uptake of CO2 (22 % w/w) in DESs at 298.15 K and 1 atm. The solubility of CO2 determined by gravimetric technique and 13C NMR was used to examine the desorption efficiency of CO2. The regeneration of CO2 at lower temperature (80 °C) show that 80-90% desorption efficiency of CO2 can be achieved from DESs/ILs, at atmospheric pressure. The excellent reversible uptake of CO2 was performed with no significant loss of absorption capacity for four consecutive cycles, at 100 °C.
There are many advantages for desorption of CO2 from DESs at lower temperature such as utilization of bad heat, low solvent loss, no hazardous chemical formation, lesser corrosive nature and reusability. Therefore, DESs are suitable candidates for replacing the conventional aqueous amine technology.

References
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FIGURES

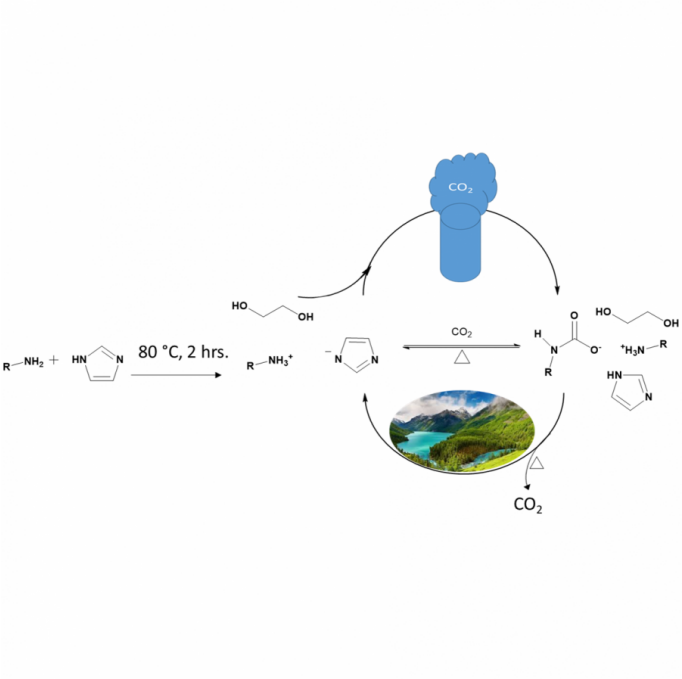

FIGURE 1
Reversible CO2 capture
DES synthesis and reversible CO2 capture

FIGURE 2

KEYWORDS
Deep eutectic solvents | Reversible CO2 capture | Desorption | Polyamines

BIBLIOGRAPHY