ISGC 2019
May 13th - 17th

N°680 / OC
TOPIC(s) : Alternative solvents

Deep eutectic solvent to decrease the cost of CO2 capture processes

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PURPOSE OF THE ABSTRACT

Aqueous amine absorbent processes are efficient technologies for the capture of carbon dioxide produced by large scale power plant. The process can be described in two steps: 1) a gas rich in CO2 is flowed through an aqueous amine solvent: the carbon dioxide is then selectively adsorbed in the liquid phase, and the clean gas is released. 2) The aqueous phase loaded with CO2 is transfer into a stripper where it is heated until most of the CO2 absorbed is released as pure gas. The CO2 can then be valorized or sequestrated. Unfortunately, the classical process based on alkanol amine use is too expensive to be operating by the industry. If the cost of the solvent regeneration could be reduced, the CO2 capture by aqueous amine would become profitable for some industries. One approach to decrease the cost of the regeneration of the solvent is to decrease the volume of the solvent to be heated.

Solvents with a Lower critical Solution Temperature (LCST) are fully miscible at low temperatures but separate into two liquid phases at higher temperatures. As illustrated in the Figure below, after the sorption step, the solvent is heated in a decanter and only a part of the solvent is send to the stripper. This separation at moderate temperature is decreasing substantially the cost of the process. Many systems composed of water, amine and CO2 have been tested but none have ideal properties for the process.

The aim of the work was to test Deep Eutectic Solvents (DES) presenting a LCST for CO2 capture and desorption. Lower critical temperatures of tertiary and quaternary systems of water, amine and DES, with and without CO2 were measured. Moreover, at low temperature, CO2 solubility was determined, and, at higher temperature in the biphasic systems, the volumes of both phases were estimated and the concentrations of all species were determined. Overall, we found one LCST solvent composed of {water, sustainable DES, and amine} with great potential properties for CO2 capture.

FIGURES

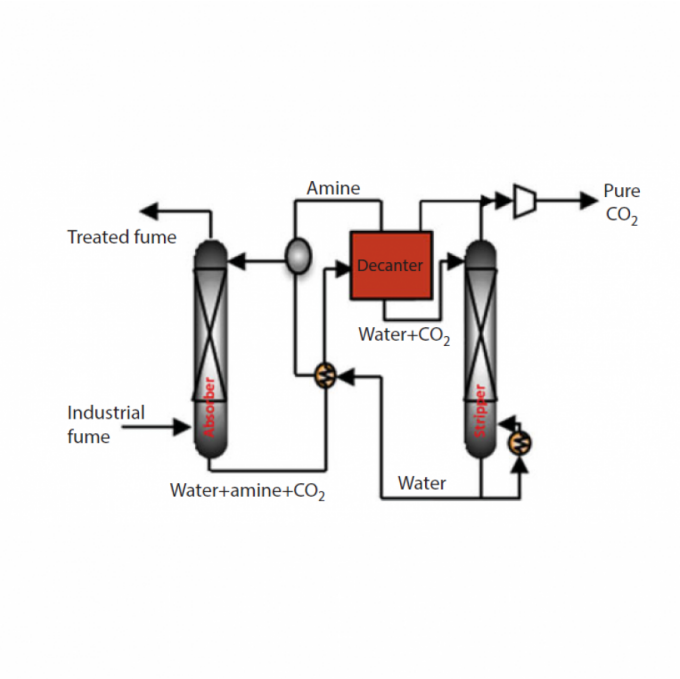

FIGURE 1
Schematic representation of the CO2 capture process with an LCST solvent [1]

FIGURE 2

KEYWORDS
Deep eutectic solvent | CO2

BIBLIOGRAPHY