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Editorial Article

Co_2 Capture: State of the Art

Kanti Kumar Athankar

Department of Chemical Engineering, Institute of Engineering & Science, IPS Academy Indore, India

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***Corresponding Author**: Kanti Kumar Athankar, Department of Chemical Engineering, Institute of Engineering & Science, IPS Academy Indore, India. E-mail: kanti.kumar@rediffmail.com

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Editorial

The enhanced CO_2 concentration in the atmosphere is directly proportional to the global warming. The atmospheric CO_2 concentration is more or less 280 to 400 ppm during pre-industrial era and expected to enlist >500 ppm by 2050 [1,2]. Emission at the current rate would lead the adverse effect in the future could be larger as compared to the last century [3]. World energy consumption will see a 48% increase from 2012 to 2040 and fossil fuel sources will still account for 78% of the world energy consumption in 2040 [3]. The Paris Accord bind countries towards reduction of CO_2 emissions by at least 50% are necessary to restrict the global temperature rise to 2°C by 2050[4]. Owing of hefty challenge, it is imperative to reduce CO_2 emissions from fossil fuel consumption. Overall cost and the required energy is the bottlenecks towards commercialize the CO_2 capture and storage process at large scale. Few technologies for instance physical or chemical solvent scrubbing, [5-7] gas membrane separation, [8-13] pressure swing absorption, [14,15] surface absorption and adsorption, [16-19] metal organic frameworks, [20-27] amine based technology [28] have been applied to the CO_2 capture. Owing of the high energy consumption, storage, cost raised concerns towards widespread implementation of carbon capture storage. Recently, ionic liquids (ILs) have been emerging as potential contenders for CO_2 capture due to their superior physicochemical characteristics, including low melting point, high thermal stability, adjustable structure, and good recyclability [29,30]. However, the solubility of CO_2 in conventional ILs is limited due to the physical absorption. In order to achieve better performance, some special groups (e.g.−NH_2, −OH) were introduced to the anion or the action of ILs. The amine-functionalized IL has been chosen as the most promising candidate for CO_2 capture.

At present, the energy penalty paid for the processes aimed to carbon capture and sequestration (CCS) is high. The current estimate is that one needs a carbon tax of ca.

$70-100 per ton of CO_2 to recover the costs. Among the three steps constituting the CCS process (capture, transportation, and storage), capture constitutes the most energetically demanding, accounting for about 70-80% of the total cost. Implementation of CCS facilities would increasingly make available gig tons of CO_2 that must be disposed of. Sequestration, the last step in CCS, involves CO_2 long term storage in a subterranean or submarine site. As an alternative, recycling of CO_2 in valuable chemicals, such as, for example, fuels would have the double benefit to avoid the cost associated with the sequestration step and to valorize CO_2 as chemical feedstock.

Relevance of the technological and economic aspects for carbon capture has been discussed. The article covers broad aspects of carbon capture and separation, highlighting the importance of diverse approaches to foster the development of a carbon neutral society. The maturity of the field gives the important message that CCS is a technology that can be implemented tomorrow in a world for which reducing CO_2 should be one of the highest priorities. I hope, this article promote the readers to allowing a further and decisive development in this area.

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