

Carbon dioxide capture and Utilization

Energy and the environment are two of the most important issues of this century. More than 80 % of our energy comes from the combustion of fossil fuels and it is well-accepted that carbon dioxide is the most prominent anthropogenic greenhouse gas leading to global warming. It is mainly released by burning fossil fuels/ biomass as a fuel and by certain industrial and resource extraction processes. Atmospheric CO₂ concentrations have indeed increased by almost 100 ppm since their pre-industrial level, reaching 410 ppm in 2015 with a total annual emission of over 37 Gt. The removal of carbon dioxide from industrial applications has also become essential in the fight against climate change. A variety of methods namely membrane separation, chemical absorption, and adsorption have been reported for sequestration of carbon dioxide from flue gases emitted from the combustion of fossil fuels.

CSIR-IIP is actively engaged in the CO₂ capture from flue gases by using adsorption and absorption methods. Solid adsorbents like zeolites, activated carbons, MOF, COF and advanced class of materials such as nano-tube / fibres etc. are being used where the adsorption capacities can be enhanced. These materials, after functionalization by amines, can improve their adsorption capacity substantially.

Another important area of research is the utilization of carbon dioxide as a feedstock for the production of high value chemicals. CO₂ can be used as feedstock for the production of many chemicals such as urea, carbonates/polycarbonates, acetic acid, isocyanates, carbamates, formaldehyde and formic acid etc. Recently, it has been proposed that carbon dioxide can be considered as a mild oxidant and oxygen transfer agent and can be utilized as an oxygen source or oxidant. CSIR-IIP is actively working in the area of conversion of CO₂ to high value chemicals such as cyclic carbonates, polycarbonates, carbamates, DMC, methanol, olefins as well as photoreduction of CO₂ to fuel and chemicals. A number of projects are being under progress in this important area of research.