Abstract for

CO_2-based Fuels and Chemicals Conference 2024, 17-18 April Cologne

Amino-acid based carbon capture - A novel, efficient and wide range applicable Carbon Capture Process Technology

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Carbon Capture process technologies are gaining more and more interest in the transformation process of diverse industries. Consequently, existing process technologies are further developed to widen their field of application and increase their efficiency. Furthermore, new process technologies are developing. While in the past carbon capture in industrial applications was focused on processes like methane steam reforming or flue gas treatment of eg coal fired power plants more and more new sources of CO_2 are considered for carbon capture application, eg from biogas treatment with high CO_2 content to Direct Air Capture.

We present a novel process for Carbon Capture based on the absorption of CO_2 by an aqueous acceptor solution containing the natural amino acid L-Arginine, wherein the aqueous deviates of CO2 can be bound and stored at atmospheric pressure. A complete removal of CO_2 from a carrier gas can be achieved over the full range of areas, eg from Direct Air Capture to flue gas treatment to biogas cleaning or respectively from CO_2 concentrations of 400 Vppm to 50 V% or higher. The process is capable to reduce the CO_2 content in the offgas below detection limit due to the strong absorption capability of L-Arginine. For the absorption process a membrane contactor was developed but alternatively a typical washing tower can also be applied which leaves the option to optimize the process setup for the specific application. The bounded aqueous derivates of CO_2 can be selectively separated from the acceptor solution by electrodialysis. CO_2 spontaneously flashes out from the receiving solution yielding CO_2 product of high purity. Results from lab experiments for cleaning a flue gas containing contaminants like NO_2 and SO_2 will demonstrate the capability and efficiency of the developed process. Although the types of membrane have not yet been optimized the lab experiments show that the absorption efficiency is close to 100% and that the energy efficiency of a further optimized pilot plant has the potential to be significantly below 2 GJ/t_{CO2} which is compared to many other technologies quite low. Another advantage of the developed process is the opportunity to absorb CO_2 continuously but to run the power consuming desorption in line with the availability of renewable power which allows to support the stabilization of the power grid. The used chemicals for absorption and as acceptor solution for desorption are not hazardous and pose another advantage for the application of the new process in non-industrial areas compared to e.g. current amine based solutions.

Thus, a new process can be provided to extract, transport and selectively release CO_2 of high purity. The developed process is environmentally harmless and is operated electrically at atmospheric pressure without a need to add heat which results in an easy to operate process.