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Review

A review on CO_2 capture via nitrogen-doped porous polymers and catalytic conversion as a feedstock for fuels

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ABSTRACT

The minimisation of the continuously enhancing level of the CO_2 released to the atmosphere is one of the most significant issues faced by the scientific community. Rigorous research efforts have been carried out for the development of sustainable and cost-effective nitrogen-rich porous adsorbent materials for energy-efficient and enhanced polar gas separation, i.e. pre-combustion and post-combustion CO_2 capture. Among different porous adsorbent materials, the covalent triazine frameworks (CTFs) are found to be remarkable candidates for CO_2 capturing because of their facile and scalable synthesis, high surface area, permanent porosity, structural tunability, synthetic diversity, low density, high hydrothermal and physicochemical stability. A contextual overview is described on the key challenges in CO_2 sequestration, parameters consideration for the design of CO_2 selective porous adsorbents, evaluation criteria for the adsorption processes, assessment criteria for the selection of suitable adsorption configuration, and the factors influencing the CO_2 adsorption capacity. This review comprises deep critical scrutiny of the current investigation and development on Triazine-, benzimidazole-, and triazole-based COPs with improved CO_2 storage capacities. The conversion of CO_2 into useful products including the carbon monoxide (CO), methane (CH_4), methanol (CH_3OH), and other products including the hydrocarbons has been critically reviewed by using the heterogeneous catalysis. Finally, a concise conclusion and recommendation section are presented indicating that the area of Triazine-, benzimidazole-, and triazole-based COPs for CO_2 capture needs more attention to synthesise the next-generation materials for real-time applications.

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