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Review

A state-of-the-art review on capture and separation of hazardous hydrogen sulfide (H_2S): Recent advances, challenges and outlook☆

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ABSTRACT

Hydrogen sulfide (H_2S) is a flammable, corrosive and lethal gas even at low concentrations (ppm levels). Hence, the capture and removal of H_2S from various emitting sources (such as oil and gas processing facilities, natural emissions, sewage treatment plants, landfills and other industrial plants) is necessary to prevent and mitigate its adverse effects on human (causing respiratory failure and asphyxiation), environment (creating highly flammable and explosive environment), and facilities (resulting in corrosion of industrial equipment and pipelines). In this review, the state-of-the-art technologies for H_2S capture and removal are reviewed and discussed. In particular, the recent technologies for H_2S removal such as membrane, adsorption, absorption and membrane contactor are extensively reviewed. To date, adsorption using metal oxide-based sorbents is by far the most established technology in commercial scale for the fine removal of H_2S, while solvent absorption is also industrially matured for bulk removal of CO_2 and H_2S simultaneously. In addition, the strengths, limitations, technological gaps and way forward for each technology are also outlined. Furthermore, the comparison of established carbon capture technologies in simultaneous and selective removal of H_2S–CO_2 is also comprehensively discussed and presented. It was found that the existing carbon capture technologies are not adequate for the selective removal of H_2S from CO_2 due to their similar characteristics, and thus extensive research is still needed in this area.

1. Introduction

Hydrogen sulfide (H_2S) has been playing an important part in the origin of life on earth since 3.8 billion years ago, serving as organic product, reactant, proto-enzyme, proto-membrane, and primordial energy source for the chemolitotrophic organisms (Olson and Straub, 2016). After the Great Oxidation Event occurred in 2.3 billion years ago,

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