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Adsorption Based Removal of Gas Phase H_2S Using Date Palm Pits Based Granular Activated Carbon

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Extended Abstract

Air pollution is a global concern and its mitigation and control is of utmost importance. In line with this goal the present study establishes successful application of **date palm pits based granular activated carbon** (GAC) material for gas phase H_2S pollutant removal. Indeed several previous studies do report production of activated carbon from date palm pits (AbdulKarim and Abu Al-Rub 2004; Al-Hameed 2009; Al-Muhtaseb et al. 2008; Awwad et al. 2008; Banat et al. 2003). Nevertheless application of date palm pits based GAC for air pollution control, has never been reported. The present findings confirmed that GAC produced from respective agricultural by-product can be successfully used for gas phase H_2S removal under a varying set of conditions. GAC was produced employing chemical activation method, using 60% (weight/weight) phosphoric acid solution at an impregnation ratio R [R = (volume-acid/weight-date pits)] of 1.6 and activation temperature of 500°C for a 2 h hold time. The specific surface area (SSA_{BET}) value for the prepared GAC sample was obtained employing the classical BET theory and nitrogen adsorption isotherm data. A physiosorption setup (Micromeritics ASAP 2020, USA) was employed to obtain the respective nitrogen adsorption isotherm data. The BET adsorption isotherm for respective GAC sample yielded specific surface area (SSA_{BET}) value of 822 m^2/g. The dynamic continuous gas flow adsorption experiments for H_2S removal experiments were completed using the same GAC without any further treatment. Results for 10 ppmv H_2S (gas flow rate 2 L/min; GAC column inner diameter was 6.35 mm; GAC bed depths vary between 6 and 18 cm; column break through time $\tau_{0.05}$; column exhaustion time $\tau_{0.95}$) showed that short column length of 6 cm yield low exhaustion time value, nevertheless for 12 cm and 18 cm column lengths H_2S adsorption exhaustion time values were high. The exhaustion of GAC column in all cases expired at several hours which indeed showed high overall capacity of produced GAC for H_2S removal. Hence when operated in series, the columns could be used for much longer time before exhaustion and replacement for regeneration. In summary the present study establishes successful application of date palm pits based GAC for the removal of gas phase H_2S as model pollutant. Further details will be presented along with possible mass transfer mechanisms.

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