

KINETIC, ISOTHERM AND EQUILIBRIUM STUDY OF ADSORPTION OF HYDROGEN SULFIDE FROM WASTEWATER USING MODIFIED EGGSHELLS

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ABSTRACT: The studies of adsorption equilibrium isotherms and the kinetics of hydrogen sulfide–water systems on calcite–based adsorbents prepared from eggshells were undertaken. The effects of operating variables, such as contact time and initial concentration, on the adsorption capacity of hydrogen sulfide are investigated. The modified eggshells are characterized using different analytical approaches such as Scanning Electron Microscopy (SEM) and Fourier Transform Infrared (FTIR). The batch mode adsorption process is performed at optimum removal conditions: dosage of 1 g/L, pH level of pH 6, agitation speed of 150 rpm, and contact time of 14 h for adsorbing hydrogen sulfide with an initial concentration of 100–500 mg/L. In the current study, the Langmuir, Freundlich, Temkin, and Dubinin models are used to predict the adsorption isotherms. Our equilibrium data for hydrogen sulfide adsorption agrees well with those of the Langmuir equation. The maximum monolayer adsorption capacity is 150.07 mg/g. Moreover, the kinetics of H₂S adsorption using the modified calcite of eggshells follows a pseudo–second–order model. From the current work, it has been found that the calcite eggshells are a suitable adsorbent for H₂S containing wastewater. Most importantly, chicken eggshells are waste products that are vastly available; hence, they could serve as a practical means for H₂S adsorption.

ABSTRAK: Kajian keseimbangan isoterma penjerapan dan kinetik sistem air– hidrogen sulfida terhadap penjerap berasaskan calcite yang disediakan daripada kulit telur telah dijalankan. Kesan pembolehubah operasi seperti masa jerapan dan kepekatan awal pada kapasiti penjerapan hidrogen sulfida disiasat. Kulit telur yang telah diubahsuai dianalisa menggunakan cara analisis yang berbeza seperti Scanning Electron Microscopy (SEM) dan Fourier Transform Infrared (FTIR). Proses penjerapan untuk mod batch dilakukan pada keadaan penyingkiran optimum: dos 1 g/L, tahap pH pH 6, kelajuan pergolakan 150 rpm dan masa jerapan 14 jam untuk menjerap hidrogen sulfida dengan kepekatan awal 100–500 mg/L. Dalam kajian semasa, model Langmuir, Freundlich, Temkin dan Dubinin digunakan untuk meramalkan isoterma penjerapan. Data keseimbangan yang diperolehi untuk penjerapan hidrogen sulfida mengikut baik persamaan Langmuir. Kapasiti maksimum penjerapan monolayer adalah 150.07 mg/g. Selain itu, kinetik penjerapan H₂S menggunakan kalsit kulit telur yang diubah suai didapati mengikut model pseudo–tertib kedua. Dari kerja semasa, ia telah mendapati bahawa calcite daripada kulit telur adalah penjerap sesuai untuk H₂S yang mengandungi air sisa. Perkara yang paling penting, kulit