



## ISOTHERMAL MODELLING BASED EXPERIMENTAL STUDY OF DISSOLVED HYDROGEN SULFIDE ADSORPTION FROM WASTE WATER USING EGGSHELL BASED ACTIVATED CARBON

(Model Isoterma Berdasarkan Kajian Penjerapan Hidrogen Sulfida Terlarut daripada Air Sisa Menggunakan Karbon yang Diaktifkan Berasaskan Kulit Telur)

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### Abstract

This paper reports on the experimental work using batch process conducted to determine the adsorption capacity of dissolved hydrogen sulfide in the synthetic wastewater onto the activated carbon which is derived from the eggshell. Fourier Transform Infrared Spectroscopy (FTIR), Energy-Dispersive X-ray Spectroscopy (EDX), Scanning Electron Microscopy (SEM), and particle size distribution have been used to characterize the prepared material. The raw materials of chicken eggshell are adopted to retrieve the carbon content which is then activated using KOH as the activation agent. The examined concentration of dissolved hydrogen sulfide is ranging from 100 to 500 ppm. The maximum adsorption capacity of the dissolved H<sub>2</sub>S onto the activated carbon is 289.3 mg/g and the equilibrium time is 6 hours. The examined pH value in this study is ranging from 4.5 to 5.5. The two well-known equilibrium adsorption isotherm models, i.e. the Langmuir and the Freundlich models, are employed. It is found that the adsorption isotherm capacity agrees very well to the Freundlich isotherm model. This paper attempts to show the difficulties of converting CaCO<sub>3</sub> to carbon due to the fact that the raw material contains higher calcium (Ca) content instead of carbon. It is concluded that the carbon derived from the chickens' eggshells is very beneficial for treatment of dissolved H<sub>2</sub>S in waste water.

**Keywords:** adsorption, hydrogen sulfide, chicken eggshells, activated carbon, isotherm

### Abstrak

Kajian ini melaporkan mengenai kerja eksperimen menggunakan proses kelompok yang dijalankan untuk menentukan kapasiti penjerapan hidrogen sulfida terlarut dalam air sisa sintetik ke dalam karbon yang diaktifkan dihasilkan daripada kulit telur. Spektroskopi Inframerah Fourier (FTIR), Spektroskopi X-ray Tenaga Serakan (EDX), Mikroskop Imbasan Elektron (SEM), dan taburan saiz zarah telah digunakan untuk mencirikan bahan yang disediakan. Kulit telur ayam sebagai bahan mentah telah digunakan untuk mendapatkan semula kandungan karbon yang kemudiannya diaktifkan dengan menggunakan KOH sebagai agen pengaktifan. Julat kepekatan hidrogen sulfida yang diperiksa adalah di antara 100 hingga 500 ppm. Kapasiti penjerapan maksimum H<sub>2</sub>S terlarut ke dalam karbon diaktifkan adalah 289.3 mg/g dan masa keseimbangan selama 6 jam. Julat nilai pH yang diperiksa dalam kajian ini di antara 4.5 hingga 5.5. Kedua-dua model penjerapan isoterma keseimbangan terkenal seperti model Freundlich dan Langmuir telah dilaksanakan. Kapasiti penjerapan isoterma didapati selari dengan model isoterma Langmuir. Kajian ini cuba menunjukkan kesukaran untuk menukar CaCO<sub>3</sub> kepada karbon disebabkan oleh bahan mentah