High surface area mesoporous silica for hydrogen sulfide effective removal

Gomaa Abdelgawad Mohammed Ali 1,2,* , Ahmed Barhoum 3,4,5, Vinod Kumar Gupta 6, Amr Ahmed Nada 5,7, Heba El–Maghrabi 5,8, Ramesh Kanthasamy 9, Essam Ramadan Shaaban 10, Hamed Algarni 11,12, Kwok Feng Chong 1,*

1 Faculty of Industrial Sciences & Technology, Universiti Malaysia Pahang, Gambang, 26300 Kuantan, Malaysia; 2 Chemistry Department, Faculty of Science, Al–Azhar University, Assiut, 71524, Egypt; 3 Department of Materials and Chemistry, Vrije Universiteit Brussel (VUB), Pleinlaan 2, 1050 Brussels, Belgium; 4 Chemistry Department, Faculty of Science, Helwan University, Helwan, Cairo 11795, Egypt; 5 Institut Européen des Membranes, Université Montpellier 2, CC 047, Place Eugène Bataillon, 34095, Montpellier Cedex 5, France; 6 Department of Applied Chemistry, University of Johannesburg, Johannesburg, South Africa; 7 Department of Analysis and Evaluation, Egyptian Petroleum Research Institute, Cairo, Nasr city P.B. 11727, Egypt; 8 Catalysis Department, Refining Division, Egyptian Petroleum Research Institute, Cairo, Nasr city P.B. 11727, Egypt; 9 Faculty of Chemical & Natural Resources Engineering, Universiti Malaysia Pahang, Gambang, 26300, Kuantan, Malaysia; 10 Physics Department, Faculty of Science, Al–Azhar University, Assiut, 71524, Egypt; 11 Research Center for Advanced Materials Science (RCAMS), King Khalid University, Abha 61413, P.O. Box 9004, Saudi Arabia; 12 Department of Physics, Faculty of Sciences, King Khalid University, P.O. Box 9004, Abha, Saudi Arabia

Abstract: Background: Removal of sulfur-containing compounds from the aqueous environment is necessary as these compounds pose potential risks to human health, hygienic management and bring great economic losses due to fouling of resin bed and corrosion of process equipment.

Objective: This work aims to study the H2S removal efficiency using high surface area mesoporous silica (MCM–41).

Method: In this study, mesoporous silica (MCM–41) with a high surface area of 1270 m²/g and high porosity of 69% was prepared by sol-gel technique.

Results: The obtained MCM–41 has exhibited a superior performance in adsorbing H2S from wastewater with a maximum adsorption capacity of 52.14 mg/g. The adsorption isotherm and kinetics of the current adsorption process are best represented by Freundlich isotherm and pseudo-second-order models, respectively.

Conclusion: Therefore, MCM–41 is an excellent adsorbent for wastewater treatment applications.

Keywords: Mesoporous Silica, Sol-Gel, Hydrogen Sulfide, Adsorption, Wastewater treatment.