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Functionalized graphene oxide: A powerful and green nano adsorbent for removal of H_2S gas

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In this research, hydrogen sulfide is adsorbed on amido-functionalized reduced graphene oxide (AFRGO) as a nanoadsorbent. By the use of n-propylamine and allylamine, reduced graphene oxide (RGO) was amidated for the adsorption of hydrogen sulfide. The materials were characterized by adsorption of H_2S, potentiometric titration, scanning electron microscopy (SEM), Fourier-transform infrared (FT-IR) spectroscopy, and X-ray diffraction (XRD) analysis. The effect of the operational conditions of 4000-6000 h-1 space velocities and 60,000 ppm H_2S feed concentrations were examined on adsorption capacity. The results show that H_2S feed concentration, space velocity, and functional groups of adsorbents have a major effect on H_2S adsorption. It was also found that the temperature in the range of 30-70°C had a significant effect on H_2S adsorption. The concentration of H_2S adsorbed in 3 h by AFRGO containing allyl substituent, AFRGO containing propyl substituent, graphene oxide (GO), and reduced graphene oxide (RGO) were reported as 59,710, 59,650, 59,600, and 59,500 ppm, respectively. Hydrogen sulfide adsorption analysis showed that nanoadsorbents increase adsorption capacity of H_2S. In summary, the adsorption of hydrogen sulfide on AFRGO having amide groups was investigated. The routes to AFRGO involve the practical and simple preparation of GO followed by pre-reduction using $NaBH_4$, acyl-chlorination, and amidation. Having prepared the above mentioned compositions, they were used as adsorbents in the adsorption process of H_2S gas. On the basis of the presented results, it can be concluded that AFRGO has more efficiency in terms of H_2S adsorption than GO and RGO adsorbents. This can be attributed to the addition of amide functional group to the main structure creating a polar site for the purpose of chemisorption and physisorption with H_2S gas molecules. In addition to the preparation of new graphene materials, a new method for the elimination of H_2S was presented. AFRGO nanosheets present significant advantages, such as simple handling, high efficiency in a short time, and safety.