Graphene Cyclodextrin Nanosheets as a Potential Corrosion Inhibitor for Oil and Gas Pipelines

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Saudi Arabia is the is one of the largest oil producing countries in the world. Internal corrosion in pipelines is one of significant challenges in oil and gas industry. The effect of severe corrosion can cause potential operational and financial loses to pipelines, tanks and other valuable assets. It occurs at all stages of production, from downhole to surface equipment and processing facilities. The objective of this work is to develop graphene nanosheets modified by cyclodextrin to function as a corrosion inhibitor for carbon steel. Graphene is a well-known material for its non-toxicity and biodegradability characteristics which makes it a potential environmentally friendly inhibitor. Graphene cyclodextrin nanosheets were used to produce water soluble composites and evaluated for their potential to inhibit both acid and hydrogen sulfide salt corrosion. Surface characterization of corroded carbon steel samples immersed in the corrosive medium with and without the selected inhibitors for 1h was accomplished by Scanning Electron Microscopy (SEM), Energy Dispersive X-ray spectroscopy (EDX), and X-ray Diffraction (XRD) techniques. Standard corrosion monitoring techniques, such as weight loss and electrochemical techniques, were employed to evaluate the corrosion inhibition effect of the developed composites. The study revealed an improved performance of the prepared inhibitor with the efficiency of 95% starting from a 1-4% concentration, proving higher than non-coated carbon steel pipes. The developed materials have the potential be used in a safe, economical and environmentally friendly capacity, which makes them a promising solution for oil extraction, refining equipment and pipelines.

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