
Exploration of aspartame-based formulation as a green substitute for toxic chemicals used in the protection of oil and gas tubing during acidizing operation

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Abstract: The Sustainable Development Goal 12 advocates for producing, using, and consuming green and sustainable commodities. This advocacy and other such calls are mounting pressure on the oil and gas industries to transit and embrace green chemicals for their operations. Oil well acidizing is an important process for maximizing the output of oil reservoirs. Still, it involves the pumping of a highly concentrated acid solution into the wellbore thus making the use of inhibitors a necessity to reduce the corrosion damage. The inhibitive potential of a formulation consisting of aspartame (a derivative of aspartic acid and phenylalanine), potassium iodide (KI), and sodium dodecyl sulphate (SDS) for T95 steel in 15 wt.% and 28 wt.% HCl solutions have been explored at elevated temperatures. The formulation has been found to produce excellent corrosion inhibition with inhibitive performance increasing with a temperature rise. A 6.80 mM of the formulation can bring down the corrosion rate of T95 steel in 15 wt.% HCl solution from 186.37 to 14.35 mm/y and protect the metal surface by 92% at 90°C. The formulation performs even better in 28 wt.% HCl solution where 96% surface protection is achievable at 90°C. Corrosion inhibition by the formulation arises from the adsorption of aspartame molecules enhanced by KI and SDS leading to the formation of a dense hydrophobic layer on the metal surface. The formulation is a highly promising substitute for toxic acidizing corrosion inhibitors.

Keywords: Corrosion inhibitors; Eco-friendliness; Aspartame-based inhibitors.