Unique corrosion reinforcement mechanism of pipeline oil sludge with sulfate-reducing bacteria on X60 steel and the targeted long-term inhibition of DMTT delivery

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Abstract

This work investigated the microbial corrosion behavior of X60 pipeline steel under pipeline oil sludge enriched with field-separated SRB and compared the corrosion inhibitory effects of biocides CTAC and DMTT on X60 steel SRB-MIC in different mediums. Oil sludge possessed corrosive property. The oil sludge medium prevented the escape of H_2S from SRB metabolism, which caused acidification of the oil sludge. The number of planktonic and sessile cells in the solution medium increased and then decreased, while the cell counts in the oil sludge medium continued to increase. The corrosion rate of carbon steel in SRB oil sludge was 1.6 times higher than that in SRB solution. The corrosion of the X60 coupons in SRB mediums was mainly localized, with corrosion pits up to 252.6 μm wide and 34.05 μm deep in the SRB oil sludge system. The excellent water-soluble CTAC effectively inhibited the SRB-MIC in solution but had little effect on the SRB-MIC in the oil sludge. The MIC in solution and in oil sludge was inhibited for a long period of time by 100 ppm DMTT. Application of DMTT in pipelines covered by oil sludge may be a new method for long-lasting inhibition of SRB-MIC.

Keywords Microbiologically influenced corrosion (MIC); Pipeline oil sludge; Sulfate-reducing bacteria (SRB); Resistance probe technique; Biocide

Reference

[1] Zixuan Xu, Tiansui Zhang, Huihai Wan, Hongwei Liu, Tingyue Gu, Hongfang Liu, Accelerated development of Ti-6Al-4V microbial corrosion triggered by electroactive sulfate-reducing Desulfovibrio ferrophilus biofilm in enriched artificial seawater containing soluble electron shuttle, *Corrosion Science*, 220, 2023, 111306.
[2] Zixuan Xu, Tiansui Zhang, Huihai Wan, Ying He, Junqiang Wang, Renyang He, Hongfang Liu, Electrochemical investigation of the “double-edged” effect of low-dose biocide and exogenous electron shuttle on microbial corrosion behavior of carbon steel and copper in enriched seawater, Electrochimica Acta, 476, 2024, 143687.