
Size effect of conductive magnetite powder on the enhanced microbial corrosion of Q235 carbon steel by *Desulfovibrio vulgaris* Hildenborough

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Abstract

Conductive magnetic nanoparticles can affect the corrosion process of microbial influenced corrosion (MIC). In this work, the effects of different size Fe_3O_4 nanoparticles (NPs) on the MIC process of Q235 carbon steel by *Desulfovibrio vulgaris* Hildenborough (DvH) are investigated. Surface examination, electrochemical testing, and starving studies demonstrated that Fe_3O_4 nanoparticles influence microbial adhesion and accelerate corrosion. Interestingly, The impact of 100 nm nanoparticles on corrosion was the most noticeable, followed by 10 nm nanoparticles. Starvation experiments indicated a lower consumption amount of sulfate ions caused by DvH in the presence of 10 nm nanoparticles, further supporting the reduced MIC promotion effect compared to 100 nm nanoparticles treatment. Mechanistic research showed that 10 nm Fe_3O_4 NPs cause DvH to produce more reactive oxygen species (ROS) than 100 nm nanoparticles. ROS can penetrate cells, disrupting the cell membrane's electronegative property and interfering with bacterial metabolism and gene expression, ultimately leading to bacterial death. This study offers new insights into strategies for controlling MIC.