Study reveals how sulfate-reducing bacteria respond to biocides

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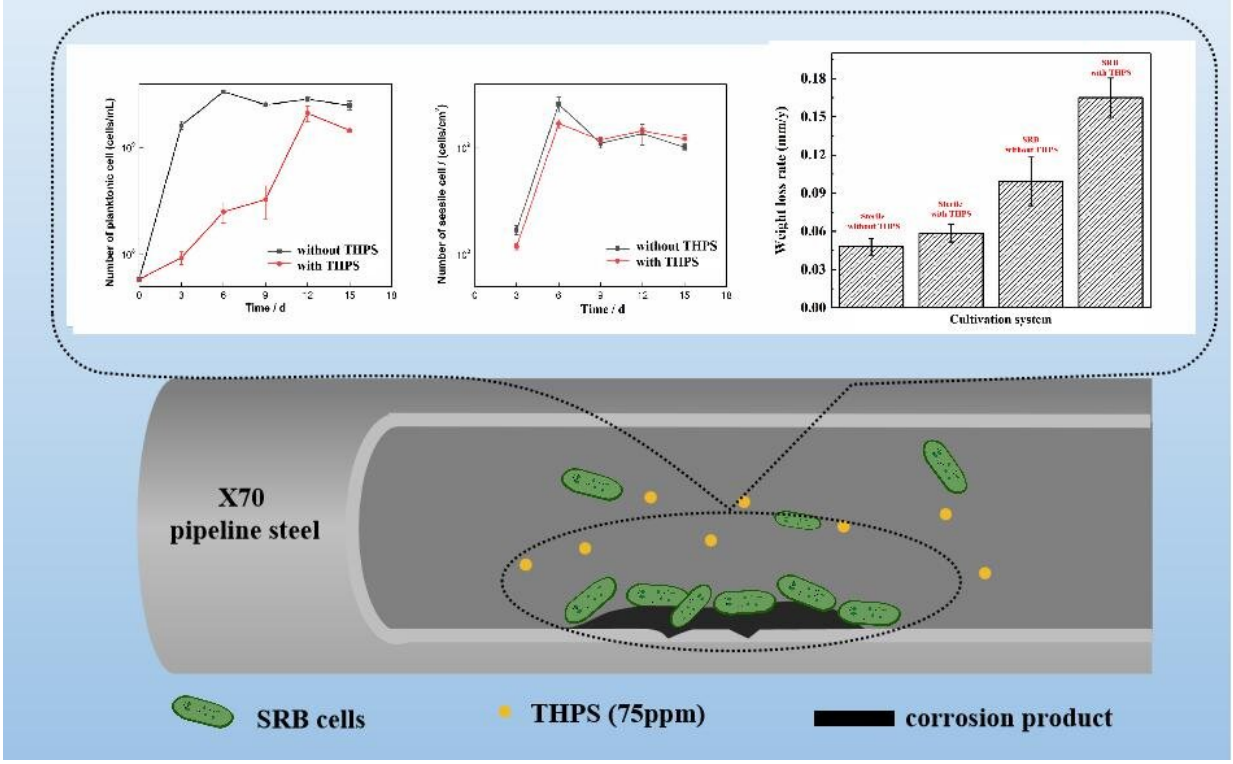

The illustration image of the MIC mechanism of pipeline steel under a tolerated THPS concentration (75 ppm) for D. hontreensis SY-21. Credit: IOCAS

Almost all materials immersed in seawater are suffering from microbiologically influenced corrosion (MIC). MIC catalyzed by sulfate reducing bacteria (SRB) can cause pipeline network damage. The non-

oxidizing biocide tetrakis hydroxymethyl phosphonium sulfate (THPS) is widely used as MIC control measure.

A long-term application of large amounts of chemical biocides not only causes environmental pollution, but also enhances the microbial resistance to biocides. However, it remains unclear how SRB cells attached to metal surfaces (and potentially forming biofilms) respond to a biocide treatment and how the resulting MIC is affected.

Recently, a research team led by Prof. Duan Jizhou from the Institute of Oceanology of the Chinese Academy of Sciences (IOCAS) provided new insights into the biofilm formation and corrosion mechanism of pipeline steel under a tolerated THPS concentration for Desulfovibrio hontreensis (D. hontreensis) SY-21.

The study was published in *Bioelectrochemistry*.

The researchers determined the tolerated THPS concentration for D. hontreensis SY-21 via culturing on culture media plates with different THPS concentrations.

They found that the concentration of 75 ppm THPS was the tolerated THPS concentration for D. hontreensis SY-21, as a strong inhibitory effect on the growth of D. hontreensis, without suppressing it completely, was observed at this biocide concentration.

They also analyzed the effects of THPS on SRB cell counts via counting planktonic and sessile cells with or without THPS. THPS delayed and partially inhibited the growth of planktonic cells of D.hontreensis, while the number of bacteria was not affected by THPS addition.

The weight loss of coupons in SRB media with or without the addition of THPS was 0.165±0.015 mm/y and 0.100±0.019 mm/y, respectively. The

steel weight loss was about 65% higher in the biotic assays when THPS was added, compared to the mean determined in biotic systems without THPS.

THPS concentrations with THPS (75 ppm) addition increased the corrosive effect of the presence of D. hontreensis by promoting the growth of sessile cells and biofilm formation, said Prof. Duan.

Therefore, the use of the biocide in practical applications needs to be properly considered and managed.

More information: Liting Xu et al, Inadequate dosing of THPS treatment increases microbially influenced corrosion of pipeline steel by inducing biofilm growth of Desulfovibrio hontreensis SY-21, *Bioelectrochemistry* (2022). DOI: 10.1016/j.bioelechem.2021.108048

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