

# Indicators of microbial corrosion of steel induced by sulfate-reducing bacteria under the influence heterotrophic bacteria with biocontrol properties

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## INTRODUCTION & AIM

Microorganisms play an important role in the processes of microbiologically influenced corrosion (Beech & Gaylarde, 1999; Andreyuk et al., 2005; Telegdi et al., 2020).

There are many studies of eco-friendly “green” biocides-inhibitors, in particular, based on microbial metabolites, for the prevention of microbial corrosion (Zuo, 2007; Plaza & Achal, 2020; Wang et al., 2022; Shi et al., 2023; Wang Q. et al., 2023; Wang D. et al., 2023).

The effect of *Bacillus velezensis* strain NUChC C2b, *Streptomyces gardneri* strain ChNPU F3 and *Streptomyces canus* strain NUChC F2 on the ability of *Peribacillus (Bacillus) simplex* strain ChNPU F1 isolated from the soil ferrosphere to form biofilms on the glass surface was investigated (Tkachuk & Zelena, 2022). Currently, indicators of microbial corrosion of steel induced by *Desulfovibrio oryzae* NUChC SRB2 under the influence of *Bacillus velezensis* NUChC C2b and *Streptomyces gardneri* ChNPU F3 have not been investigated, which was the purpose of this study.

## MATERIALS AND METHODS

### Investigation of the sensitivity of sulfate-reducing bacteria to supernatants from cultures of heterotrophic bacteria with biocontrol properties

To study the sensitivity of sulfate-reducing bacteria *D. oryzae* NUChC SRB2 (MT102714.1 in the GenBank) to supernatants from cultures of heterotrophic bacteria with biocontrol properties - *S. gardneri* strain ChNPU F3 (KX349221 in the GenBank) and *Bacillus velezensis* strain NUChC C2b (MN749356.1 and MN749357.1 in the GenBank), the diffusion method in agar using wells in an agar medium was used.

### Investigation of the corrosion activity of sulfate-reducing bacteria

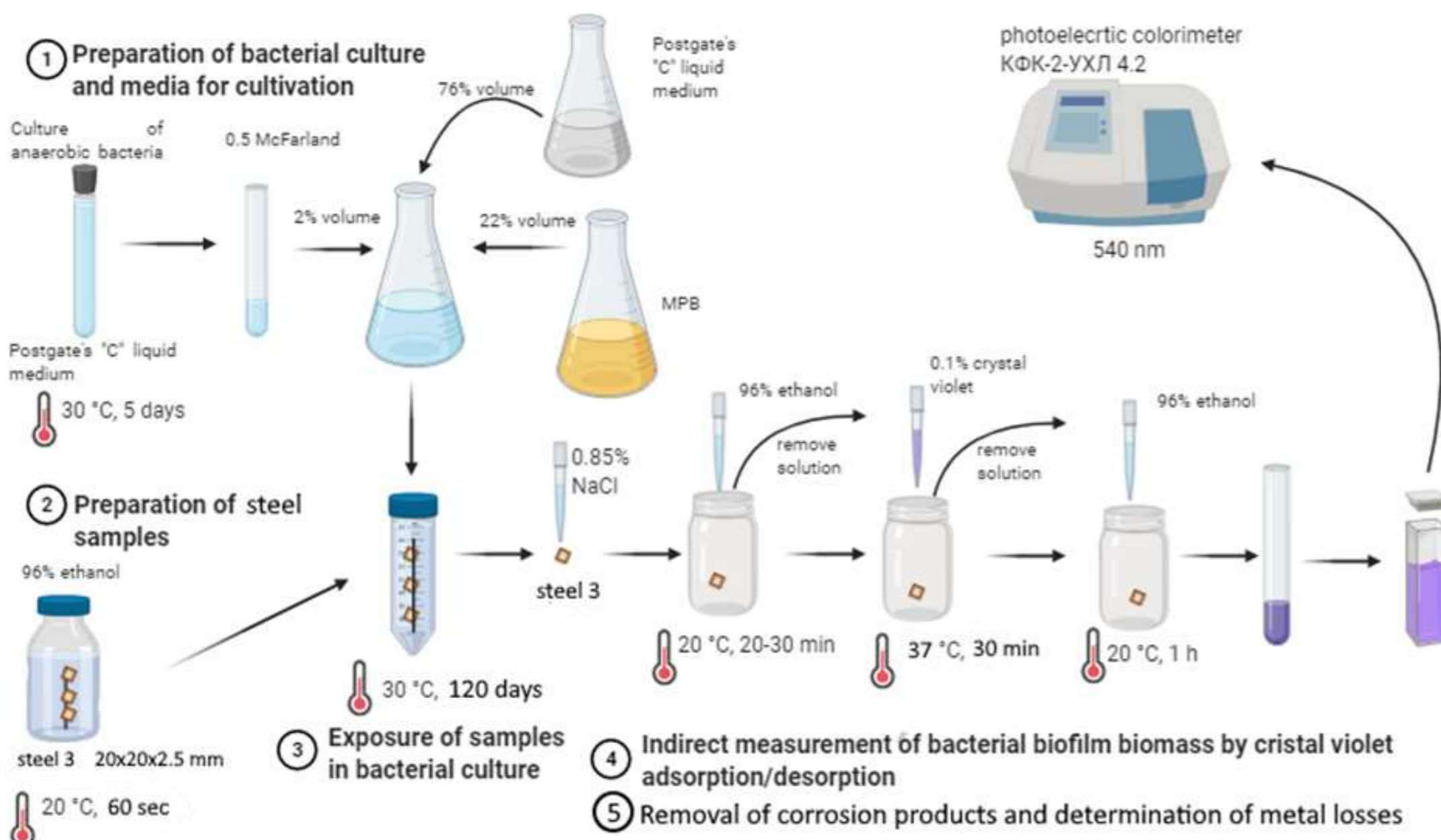


Fig. 1. Scheme of the experiment

## RESULTS & DISCUSSION

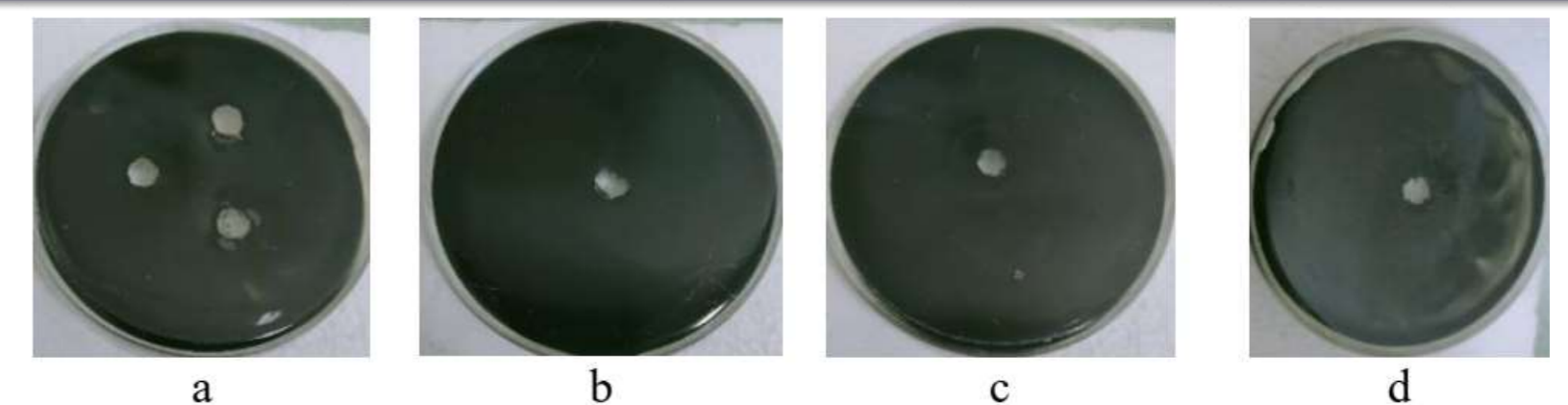


Fig. 2. The results of the study of the sensitivity of *D. oryzae* NUChC SRB2 to the supernatant of the studied cultures (the experiment with the wells): a - MPB was added into the wells; b - the supernatant from MPB cultures of *S. gardneri* ChNPU F3 was added into the well; c - the supernatant from MPB cultures of *B. velezensis* NUChC C2b was added into the well; d – mixture of supernatants of the specified strains of *S. gardneri*:*B. velezensis* (2:1) was added into the well. It can be seen that SRB are developing, there are no zones of growth inhibition

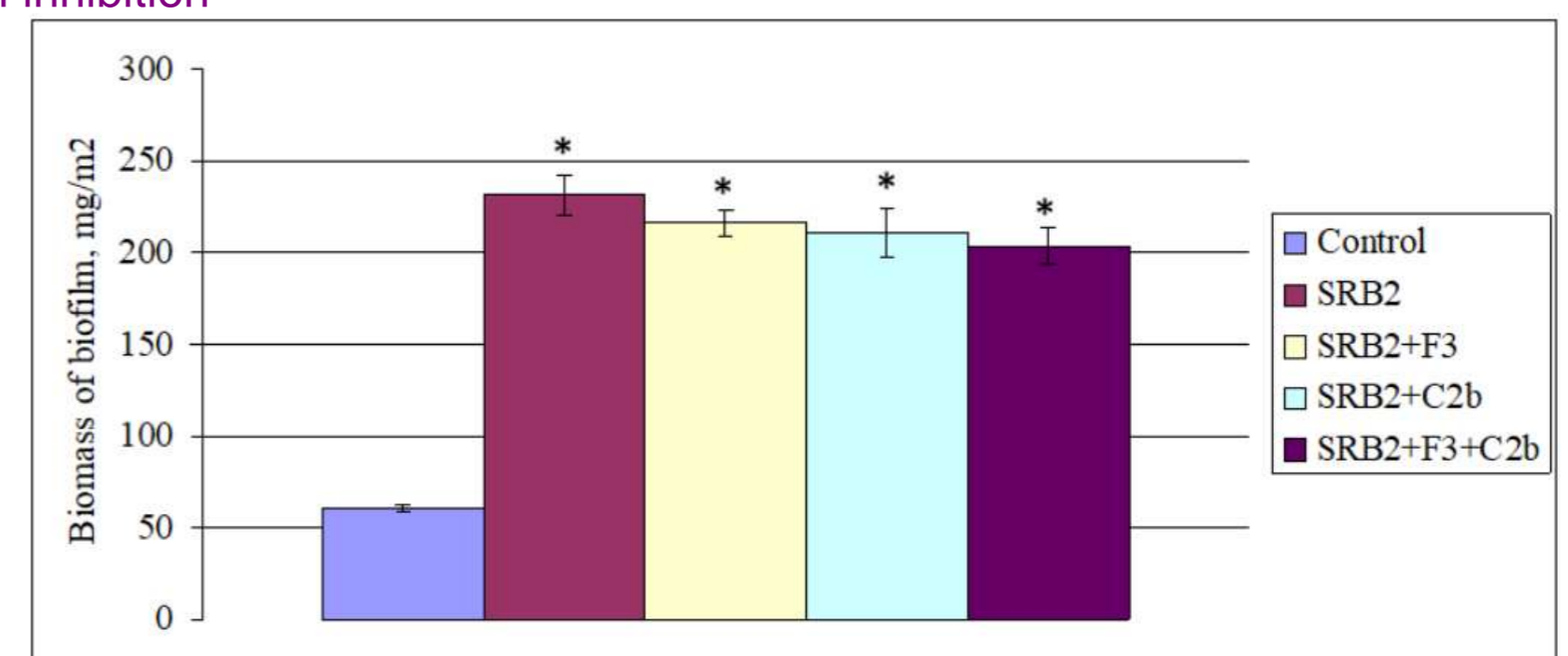


Fig. 3. Biofilm biomass on the steel samples  
Note: the differences are significant \* compared to the control at p ≤ 0.05

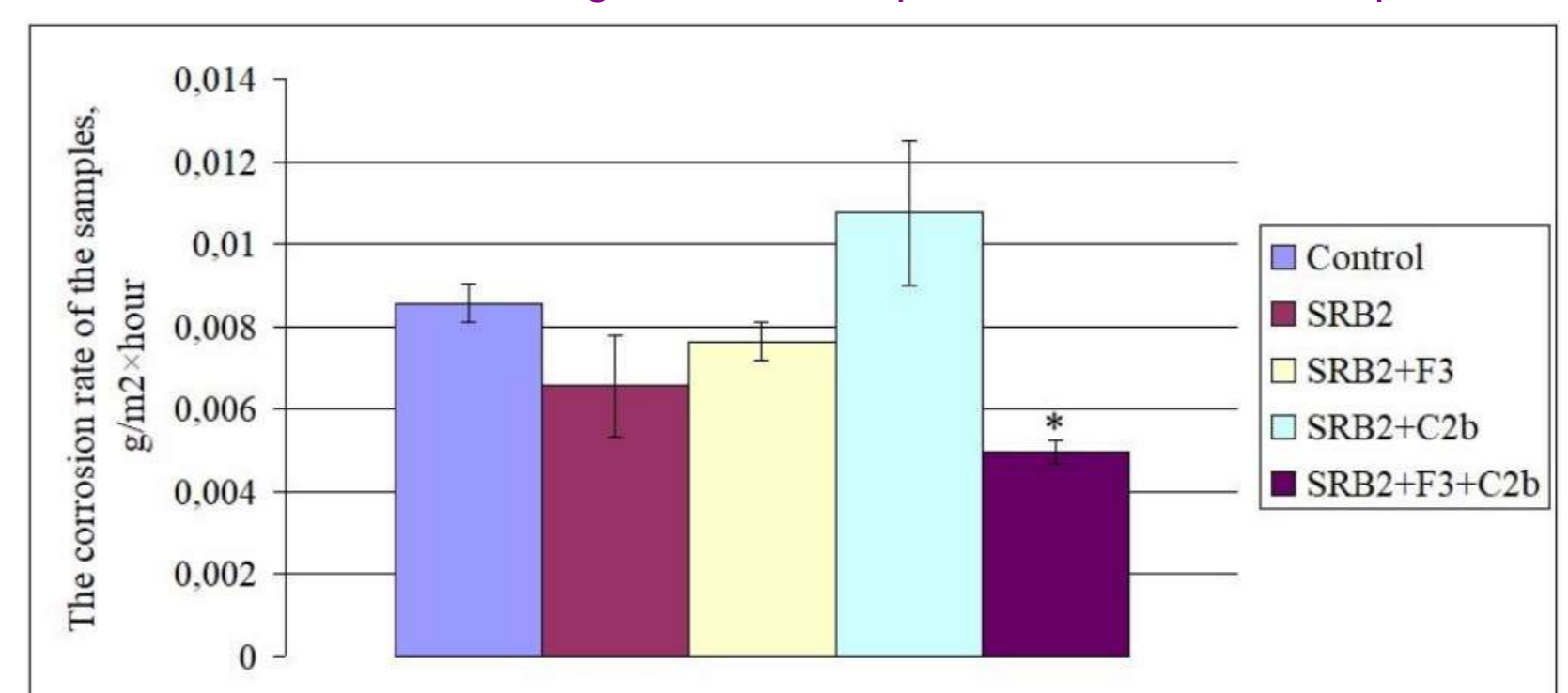


Fig. 4. The corrosion rate of the steel 3 samples  
Note: the differences are significant \* compared to the control at p ≤ 0.05

## CONCLUSION

In terms of biofilm-forming ability, the studied strain of SRB is moderately adherent to steel 3. The decrease in biofilm-forming properties of *D. oryzae* under the influence of the supernatants from MPB cultures of *S. gardneri*, *B. velezensis* and their mixture, the protective properties of the studied supernatants in relation to microbial corrosion of steel influenced by *D. oryzae* was not detected. It is possible that the observed reduction in corrosion rate for the supernatants mixture variant compared to the control indicates the potential of this mixture to protect against corrosion in SRB environments, but this requires further investigations.

## FUTURE WORK

The prospect of further research is the search for bactericidal, anti-biofilm, anti-corrosion properties for other combinations of supernatants from cultures of heterotrophic bacteria.