ECP 2024 Conference

The 3rd International Electronic Conference on Processes

29–31 May 2024 | Online

Mechanisms of biodeterioration of structural materials by *Streptomyces* spp.: a review

Nataliia Tkachuk [1,*] and Liubov Zelena [2,3]

[1]Department of Biology, T.H. Shevchenko National University "Chernihiv Colehium", Chernihiv, Ukraine

[2]Department of Virus Reproduction of the Danylo Zabolotny Institute of Microbiology and Virology, NAS of Ukraine, Kyiv, Ukraine

[3]Department of Biotechnology, Leather and Fur of the Kyiv National University of Technologies and Design, Kyiv, Ukraine

INTRODUCTION & AIM

The processes of biodegradation of materials, harmful from the point of view of practical human activity, are considered as their biodamage, which should be prevented and eliminated. Sulfate-reducing and thione bacteria are considered the main corrosively active groups of microorganisms. Streptomycetes are considered as heterotrophic bacteria-companions of the main groups of material damagers. To summarize results of available scientific researches and reviews devoted to the participation and supposed mechanisms of structural materials biodamage, caused by streptomycetes, the presented study was performed.

RESULTS & DISCUSSION

Table 1. Corrosion activity of streptomycetes

Cause of corrosion activity	Species (compound)	Researched construction material	References
Powerful biofilm	*S. parvus* strain B7	carbon steel, stainless steel	Parthipan et al., 2018b
Poor biofilm	*S. lividans* strain TK23.1	SAE 1018 steel	Jayaraman et al., 1997a; Jayaraman et al., 1997b
	S. pilosus strain DSM40714	mild steel 37/AISI 10-18	Volkland et al., 2000
Changes in electrochemical parameters	*Streptomyces* sp.	steel A3	Li et al., 2010
Production of corrosive compounds	*S. gardneri* strain ChNPU F3, *S. canus* strain NUChC F2 (ammonia)	steel	Tkachuk & Zelena, 2021
	Streptomyces sp. (sulfuric acid)	concrete	Vupputuri et al., 2015; Nasrazadani et al., 2016
	Streptomyces sp. (organic acids)	X65 steel	Wang et al., 2023a
Biodegradation of corrosion inhibitors	*Streptomyces* sp.	benzimidazole-coated mild steel	Hussain et al., 2021

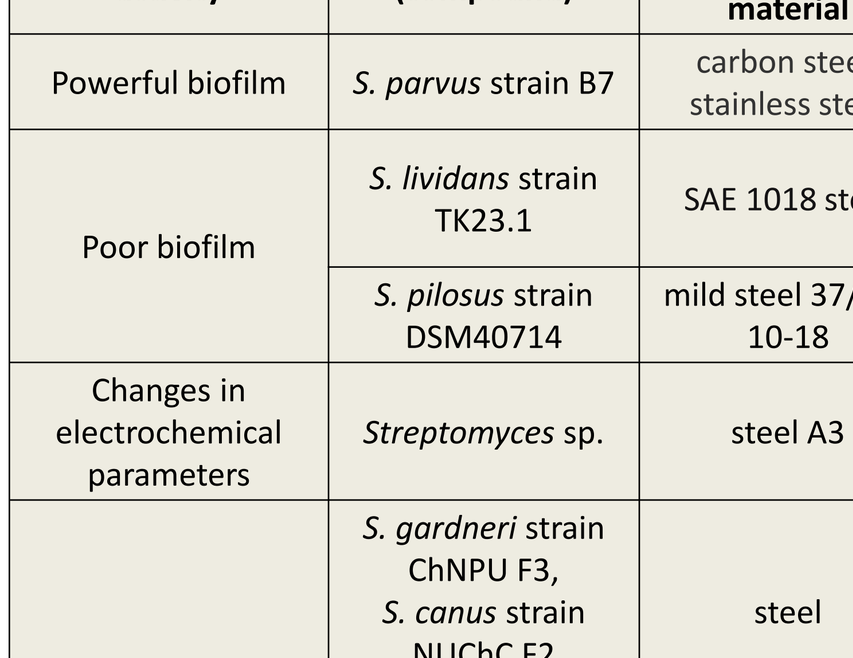

Figure 1. Mechanisms of participation of streptomycetes in biodeterioration of structural materials.

CONTACT
nataliia.smykun@gmail.com
zelenalyubov@gmail.com

Table 2. Anticorrosion and antibiofouling activity of streptomycetes

Protective activity	Species (compound)	Researched construction material	References
Non-viable and fully developed biofilm	*S. lividans* strain TK24	SAE 1018 steel	Jayaraman et al., 1997a; Jayaraman et al., 1997b
Anticorrosion and/or antimicrobial/ antibiofouling compounds	*S. griseus* (albomycin)	zinc	Okon, 2010
	Streptomyces sp.	steel	Ignatova-Ivanova et al., 2015
	Streptomyces sp. (amino acids: phenylalanine, proline; polysaccharides)	X65 steel	Wang et al., 2023a
	Streptomyces sp.	X65 steel	Wang et al., 2023b
	S. parvus strain BSB49 (eumelanin)	mild steel	Bayram et al., 2022
	S. fungicidicus (diketopiperazines)	Not used (methods without the use of construction materials)	Adetunji et al., 2021
	S. albidoflavus strain UST040711-291 (a group of simple butenolides)	polyvinyl chloride	Stainsby et al., 2022
	S. filamentosus strain R1 (requinomycin)	the glass slides	Xu et al., 2009
	Streptomyces sp. strain VITSDSB (the combination of cultural extract and zirconium oxide nanoparticles)	steel	Li et al., 2006
	Streptomyces sp. (tetracyclines, macrolides, lincosamides, aminoglycosides)	not specified	Gece, 2011
	S. lunalinharesii strain 235	not used (methods without the use of construction materials)	Pacheco da Rosa et al., 2013; Rosa et al., 2016
	S. naganishii strain MA7 (silver nanoparticles)	not specified	Shanmugasundaram et al., 2013

CONCLUSION

It is shown that representatives of the genus *Streptomyces* can influence the process of biodamage of structural materials in 4 possible ways. At the same time, the mechanisms of streptomycetes involvement in the processes of microbial damage to metals and their consequences (intensification or weakening of corrosion) are ambiguous and are determined by the peculiarities of the physiology of the studied species or strains and the presence of microorganisms of other species. Further studies on streptomycetes as participants in the corrosion process with special attention to their production of secondary metabolites and nanoparticles with antimicrobial and inhibitory properties are necessary, which will contribute to the expansion of the list of "green" biocides/inhibitors.