Mechanisms of Hexavalent Chromium Reduction by *Rhodococcus qingshengii* strain SC26

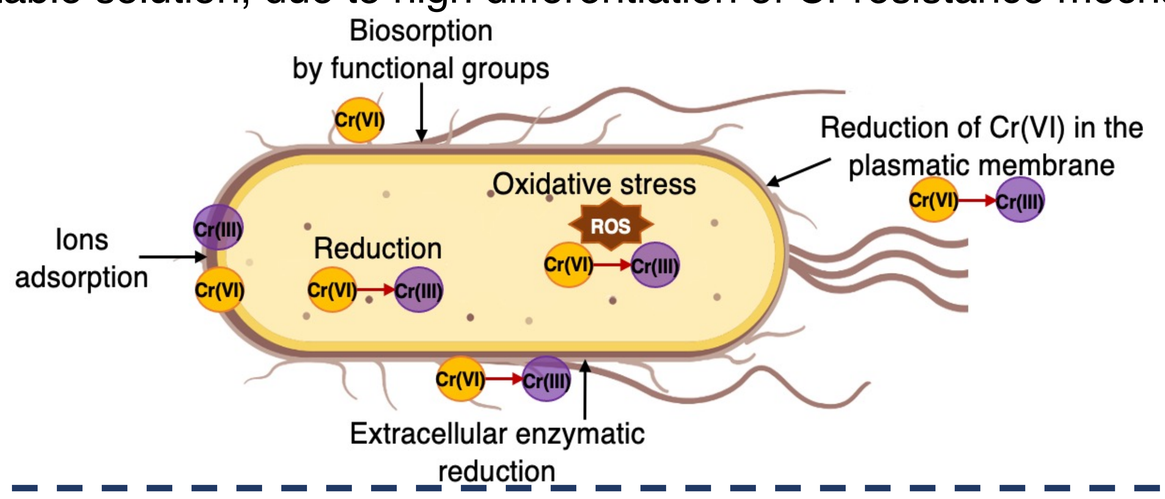
A. Melzi, M. Colombo and L. Cavalca
Department of Food, Environmental and Nutritional Sciences (DeFENS), Università degli Studi di Milano, Italy
Contacts: alice.melzi@unimi.it; lucia.cavalca@unimi.it; https://sites.unimi.it/lcavalca/

1. INTRODUCTION

- Chromium (Cr) is known for its widespread utility in various industrial processes
- It is mainly present in the environment in two inorganic stable forms:
  - trivalent Cr(III)
  - hexavalent Cr(VI)

Cr(VI) resistance mechanisms

Among possible water treatment strategies, the use of microorganisms represents a suitable solution, due to high differentiation of Cr resistance mechanisms.

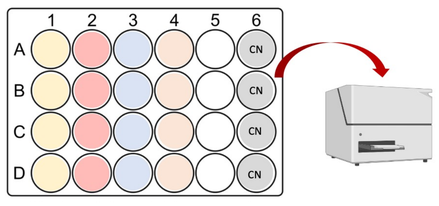


The **aim** of the present study is to characterize Cr(VI) reduction and Cr adsorption mechanisms in *Rhodococcus qingshengii* bacterial strain SC26, in order to envisage the most promising set-up for the development of a biological system useful to reduce Cr pollution in wastewaters.

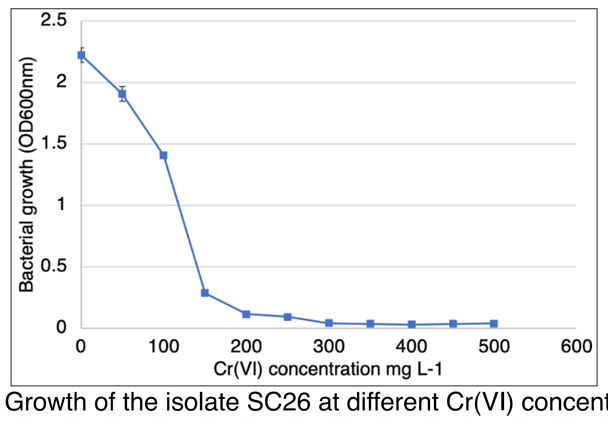
2. WORKFLOW

Determination of Cr(VI) Minimum inhibitory concentration (MIC)

- Three minimum media (M9, DF, TMM)
- Cr(VI) concentrations between 25 and 500 mg L^{-1}
- Spectrophotometric analysis (OD_{600nm})
- 24 well plates



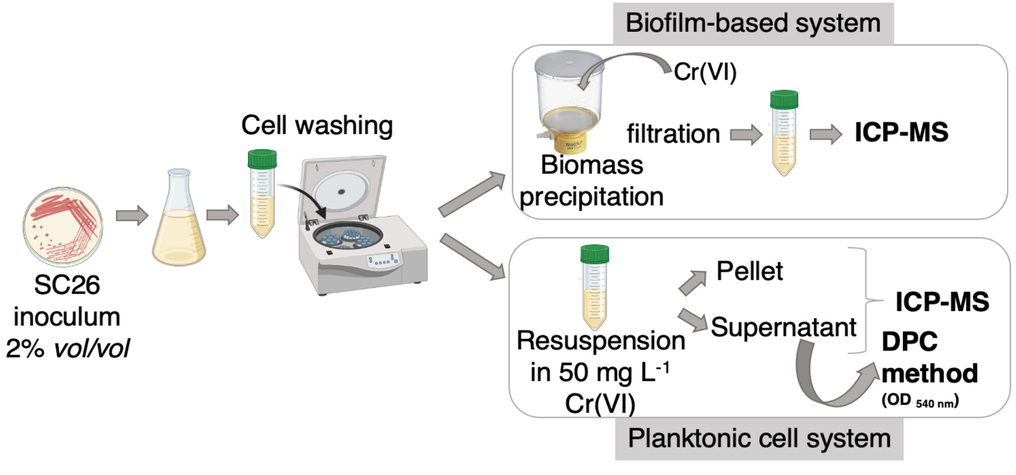
RESULTS



Growth of the isolate SC26 at different Cr(VI) concentrations.

R. qingshengii strain SC26 showed a MIC of 300 mg L^{-1}

Non-proliferating cell experiment in the presence of Cr(VI)

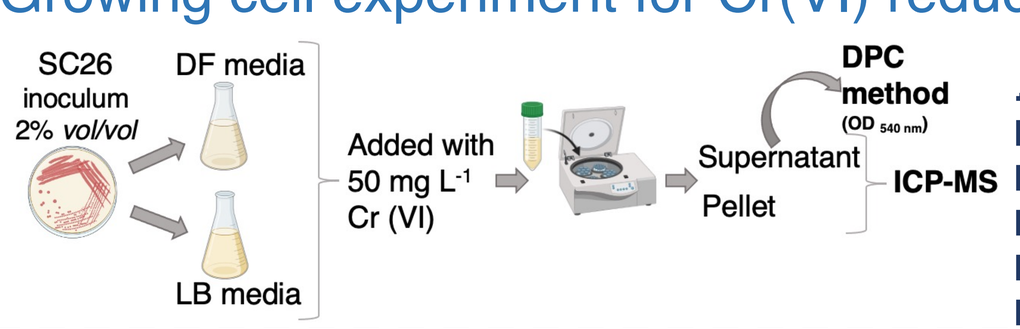


RESULTS

	SC26 biofilm		SC26 planktonic			
	OD_{600nm}=2	OD_{600nm}=4	0 h	4 h	72 h	168 h
Cr(VI) (mg L^{-1})	49.55 ± 1.01	49.88 ± 0.64	50.706 ± 3.737	51.065 ± 5.457	51.245 ± 4.609	49.807 ± 2.549

Non-proliferating cells – no Cr removal or Cr(VI) reduction/adsorption in biofilm-based and planktonic cell experiments.

Growing cell experiment for Cr(VI) reduction to Cr(III)



RESULTS

At increasing incubation time in the presence of 50 mg L^{-1} Cr(VI) *R. qingshengii* strain SC26 reduction of the metal was parallel by cell growth.

Increasing metal concentrations exerted cell toxicity affecting SC26 growth and ability to reduce Cr(VI).

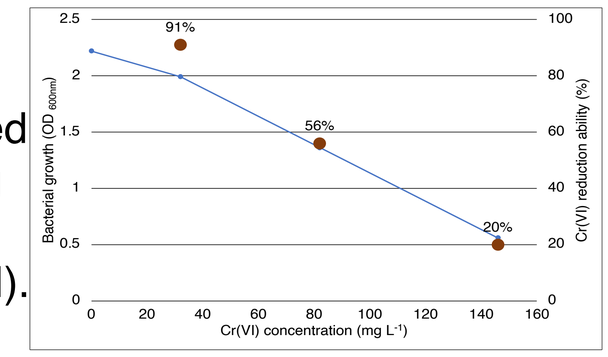


Figure 1. Cr(VI) reduction ability (%) ● of strain SC26 in growing cell experiment —●— at increasing Cr(VI) concentrations (32, 82 and 146 mg L^{-1}).

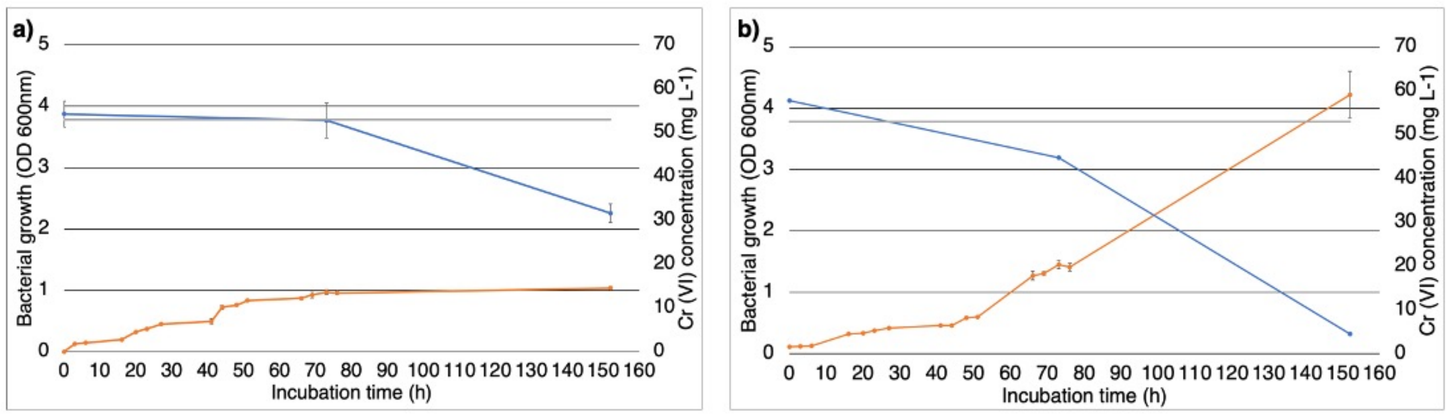


Figure 2. Cr(VI) reduction in *R. qingshengii* strain SC26 growing cell experiment performed in DF mineral minimal medium (a) and LB rich medium (b), in the presence of 50 mg L^{-1} Cr(VI) OD600nm —●— Cr(VI) —●— and total Cr concentrations —— over seven days (152 h) of incubation.

3. CONCLUSIONS

R. qingshengii strain SC26 lowers Cr toxicity by reducing Cr(VI) to Cr(III). Further analysis will determine the adsorbed Cr form.

AgEMlab Agricultural and Environmental Microbiology lab — agem_lab

Research supported by Fondazione CARIPLO—Circular Economy 2020 project num. 1069 2020 "Heavy Metal Bio-recovery and Valorization-HMBV" https://sites.unimi.it/hmbv/. A. Melzi was awarded of a PhD fellowship by the University of Milan - Food System PhD Program.

HMBV PROJECT Fondazione CARIPLO