

Analysis of Cr(VI) Bioremediation by *Citrobacter freundii* Using Synchrotron Soft X-ray Scanning Transmission X-ray Microscopy

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Bacterial Strain and Culture Medium Preparation

Pure strain of *Citrobacter freundii* (MTCC No. 8128) was obtained from Institute of Microbial Technology (IMTECH), Chandigarh, India. pH 7 nutrient broth (NB) medium was used for culturing of the cells. NB medium was prepared as follows: 2 g yeast extract, 1 g beef extract, 5 g peptone and 5 g sodium chloride (NaCl) were homogenised in 900 mL of deionised water. 100 mL of freshly inoculated cells were added to the medium. The pH of the mixture was adjusted to 7 using 0.5 M HCl and 0.5 M NaOH. The culture medium was incubated at 30 °C in an Orbitek orbital shaker for 24 h. The bacterial cells were then centrifuged out of the medium at 10,000 rpm for 10 min. The pelletised cells were then washed thoroughly with deionized water and air dried before use.

STXM-NEXAFS Absorption Features of Samples and References

Table S1. X-ray absorption features of biosorbed cells and standard samples.

Sample	X-ray Absorption (eV)				FWHM of π^* peak (eV)	FWHM of L3 peak (eV)	
	O K-Edge		Cr L-Edge				
	π^*	σ^*	L3	L2			
Biosorbed Cell	531.59	534.58, 536.53	575.06, 576.11, 577.32, 578.37, 580.17	582.58, 585.29, 587.09	1.36	3.17	
Pristine Cell	531.7	535, 538.8, 546	N.A.	N.A.	1.12	N.A.	
K ₂ Cr ₂ O ₇ [Cr(VI)]	528, 530	536.4, 537.6, 540.37	577.29, 580.05	586.73, 588.64	1.55 (528eV)	1.43	
Cr(OH) ₃	532.4	541.36, 543.34	575.15, 576.18, 577.21, 578.24	585.3, 587.21	1.86	3.64	
Cr ₂ O ₃	531.2		533.2, 538, 542.35, 545.31	575.15, 575.92, 576.96, 578.24	584.94, 586.26, 587.21	1.74	6.03

Table S2. Intensity ratio of L3 and L2 peak for samples and references. (Ratio taken at L3:577 eV and L2: 585 eV).

Sample	L3/L2 Ratio
Cr(OH) ₃	1.6
Cr ₂ O ₃	1.2
200ppm	1.7
400ppm	1.8
600ppm	1.8

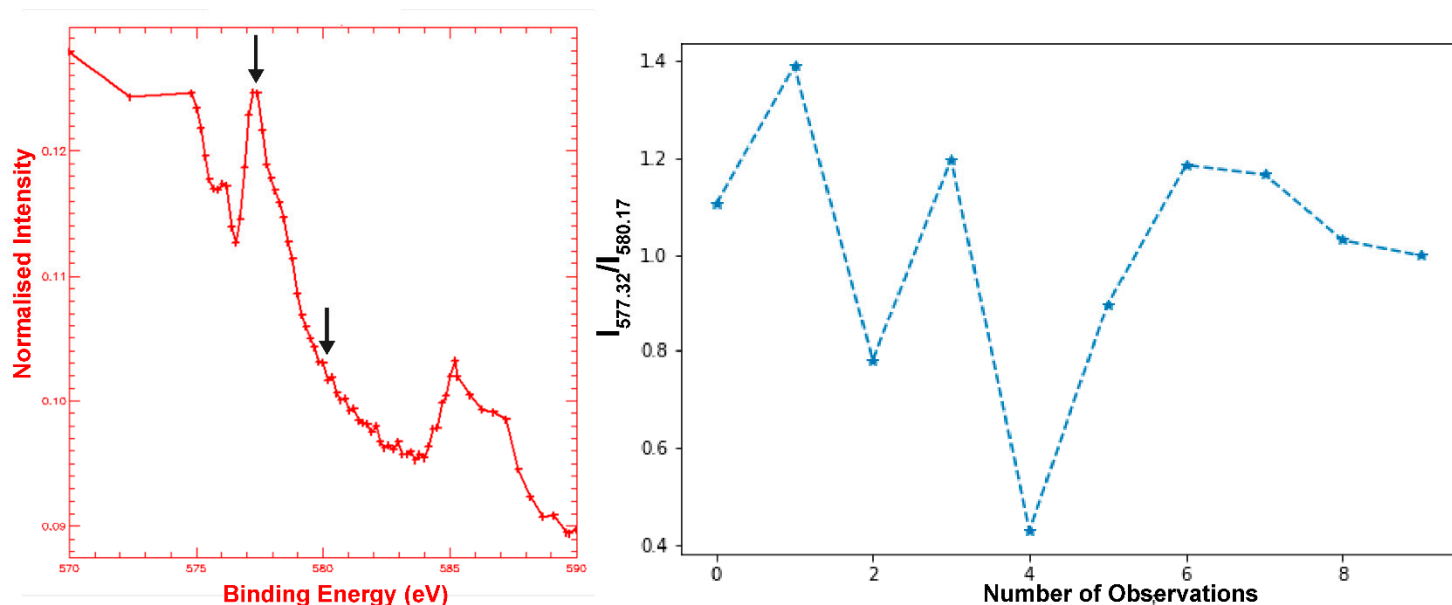


Figure S1. Ratio of absorption intensity at 577.3 eV [Cr(III)] and 580.2 eV [Cr(VI)] at various regions of 400 ppm sample.

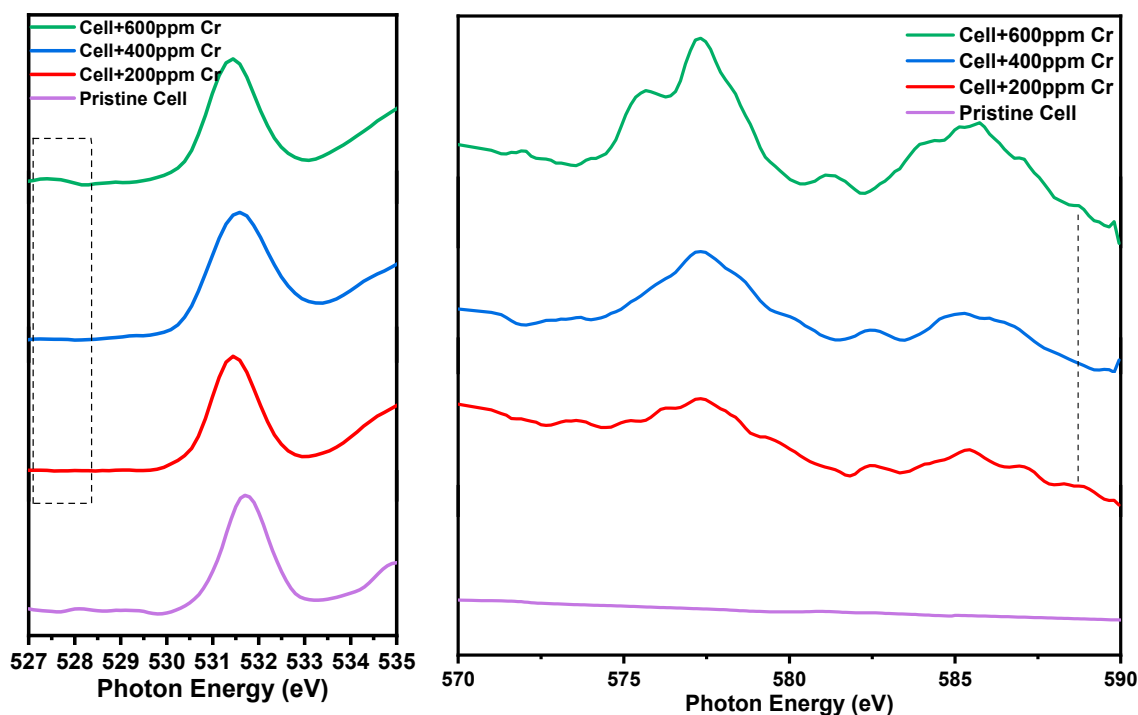


Figure S2. Zoomed in spectra of O Kedge and Cr Ledge absorption of biosorbed cells. The low energy bump around 527 eV and high energy bump at 588 eV corresponding to Cr(VI) is seen in 400 ppm and 600 ppm sample.