

## (Bio)leaching behavior of chromite tailings

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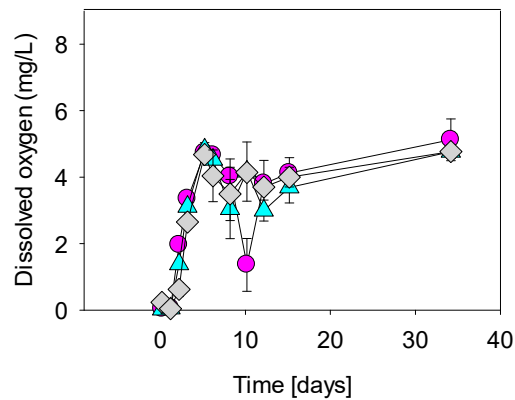
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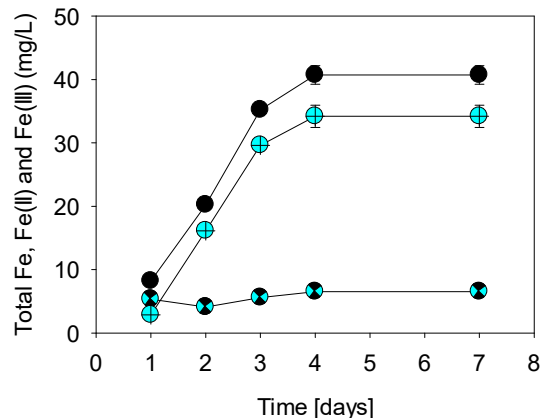
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**Figure S1.** Dissolved oxygen evolution throughout the incubation of the fresh tailing sample with *P. putida* at different pulp densities: 5 g/L (●), 10 g/L (▲) and 30 g/L (◆).



**Figure S2.** Total Fe (●), Fe(II) (●) and Fe(III) (●) evolution throughout the leaching of the fresh tailing sample with acidified (H<sub>2</sub>SO<sub>4</sub>) MQ water for a pulp density of 30 g/L.

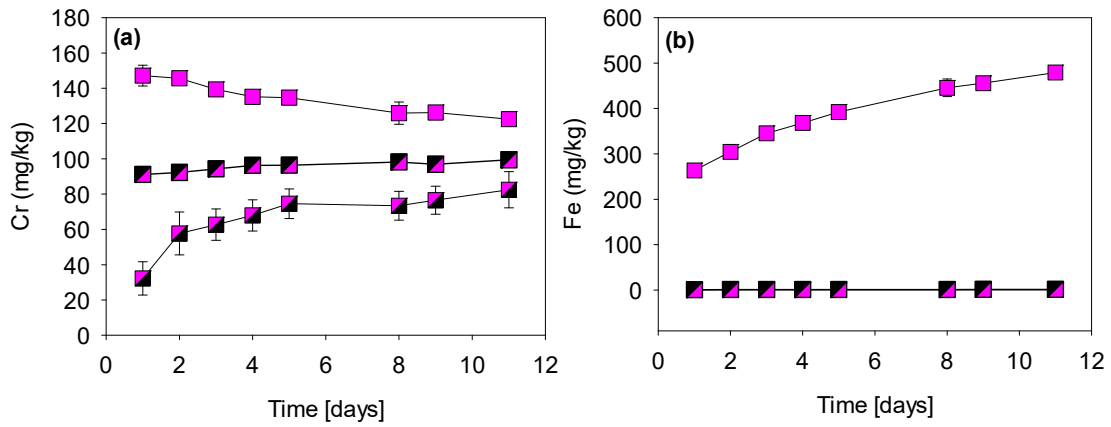


Figure S3. Cr (a) and Fe (b) extracted from the fresh tailing sample, after leaching with MQ water at pH 7 (—■—), pH 2 with H<sub>2</sub>SO<sub>4</sub> (—■—) and at pH 9 with NaOH (—■—).

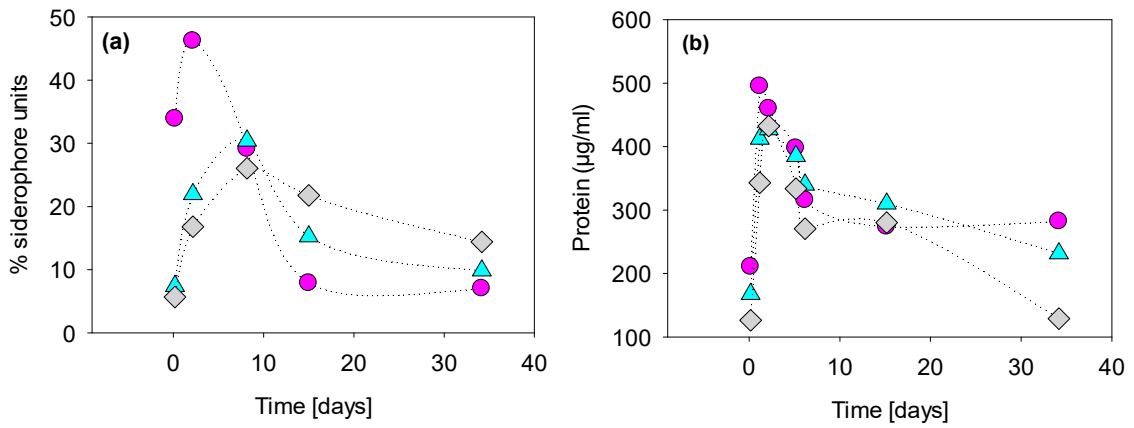
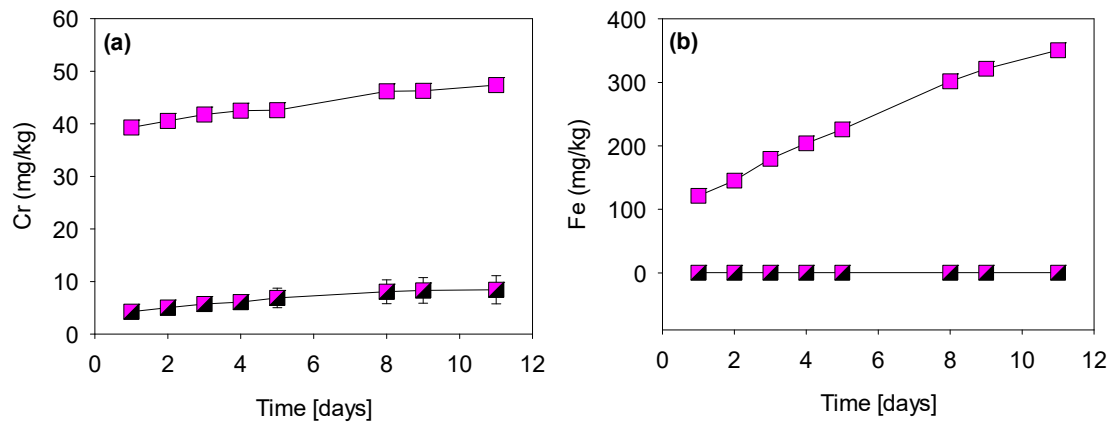


Figure S4. Siderophores content under incubation of the fresh tailing sample with *P. putida* (a) and protein content in the leached (b). The medium were *P. putida* was grown did not contain Fe in order to stimulate the production of siderophores. Three pulp densities were evaluated: 5 g/L (—●—), 10 g/L (—▲—) and 30 g/L (—◆—).



**Figure S5.** Cr (a) and Fe (b) extracted from the concentrated ores sample, after leaching with MQ water at pH 7 (—■—) and pH 2 with H<sub>2</sub>SO<sub>4</sub> (—■—).

**Table S1.** Species distribution obtained in visual MINTEQ simulation, for the control and the leaching of the tailing sample with *A. thiooxidans* for a pulp density of 5 g/L.

Component	Species	Control A.	Batch A.
		<i>Thiooxidans</i>	<i>Thiooxidans</i>
% of Total Concentration			
Al(III)	Al <sup>3+</sup>	1.71	10.67
	AlOH <sup>2+</sup>	0.30	
	Al(OH) <sub>2</sub> <sup>+</sup>	0.04	
	AlSO <sub>4</sub> <sup>+</sup>	24.76	66.14
	Al(SO <sub>4</sub> ) <sub>2</sub> <sup>-</sup>	22.12	23.16
	AlHPO <sub>4</sub> <sup>+</sup>	51.02	0.03
	Al <sub>2</sub> PO <sub>4</sub> <sup>3+</sup>	0.05	
Cr(VI)	CrO <sub>4</sub> <sup>2-</sup>	3.98	
	CrO <sub>3</sub> HPO <sub>4</sub> <sup>2-</sup>	1.09	0.18
	CrO <sub>3</sub> H <sub>2</sub> PO <sub>4</sub> <sup>-</sup>		1.64
	KCrO <sub>4</sub> <sup>-</sup>	0.01	
	HCrO <sub>4</sub> <sup>-</sup>	94.62	82.93
	H <sub>2</sub> CrO <sub>4</sub> (aq)		1.59
	Cr <sub>2</sub> O <sub>7</sub> <sup>2-</sup>	0.26	0.21
	NH <sub>4</sub> Cr <sub>2</sub> O <sub>7</sub> <sup>-</sup>	0.02	0.02
	CrO <sub>3</sub> SO <sub>4</sub> <sup>2-</sup>	0.02	13.40
	CrO <sub>3</sub> Cl <sup>-</sup>		0.02
Fe(II)	Fe <sup>2+</sup>	36.81	61.11
	FeCl <sup>+</sup>	0.01	0.02
	FeSO <sub>4</sub> (aq)	51.41	35.05
	FeH <sub>2</sub> PO <sub>4</sub> <sup>+</sup>	11.49	3.82
	FeHPO <sub>4</sub> (aq)	0.28	
Ni(II)	Ni <sup>2+</sup>	46.63	68.13
	NiCl <sup>+</sup>		0.01
	NiSO <sub>4</sub> (aq)	52.93	31.76
	Ni(SO <sub>4</sub> ) <sub>2</sub> <sup>2-</sup>	0.08	0.02
	NiNH <sub>3</sub> <sup>2+</sup>	0.02	
	NiH <sub>2</sub> PO <sub>4</sub> <sup>+</sup>	0.25	0.07
	NiHPO <sub>4</sub> (aq)	0.08	

**Table S2.** Species distribution obtained in visual MINTEQ simulation, for the blank, the control and the leaching of the tailing sample with *P. putida*. Results are presented for a pulp density of 5 g/L and three subsamples collected at 0, 5 and 34 days in the batch with *P. putida*.

Component	Species	Blank	Control <i>P. Putida</i>	Batch <i>P. Putida</i>			
			% of Total Concentration				
			Day	0	0	5	34
Al(III)	AlOH <sup>2+</sup>	0.28	0.02	0.02			
	Al(OH) <sub>2</sub> <sup>+</sup>	8.79	0.20	0.64			
	Al(OH) <sub>3</sub> (aq)	22.10	0.34	3.43	0.17	0.03	
	Al(OH) <sub>4</sub> <sup>-</sup>	68.83	1.53	49.37	99.83	99.97	
	AlHPO <sub>4</sub> <sup>+</sup>		97.90	46.54			
Cr(VI)	CrO <sub>4</sub> <sup>2-</sup>	66.45	71.78	86.89	93.49	93.62	
	CrO <sub>3</sub> HPO <sub>4</sub> <sup>2-</sup>		8.31	1.48			
	KCrO <sub>4</sub> <sup>-</sup>		5.33	6.12	6.36	6.35	
	HCrO <sub>4</sub> <sup>-</sup>	33.55	14.54	5.50	0.15	0.03	
	CaCrO <sub>4</sub> (aq)		0.04				
Fe(II)	Fe <sup>2+</sup>		2.71	2.42	2.19	2.16	
	FeOH <sup>+</sup>				0.27	1.33	
	Fe(OH) <sub>2</sub> (aq)					0.03	
	FeSO <sub>4</sub> (aq)		1.20	1.03	0.93	0.93	
	Fe(NH <sub>3</sub> ) <sub>2</sub> <sup>2+</sup>					0.06	
	FeNH <sub>3</sub> <sup>2+</sup>				0.26	0.68	
	FeH <sub>2</sub> PO <sub>4</sub> <sup>+</sup>		30.22	12.42	0.36	0.07	
	FeHPO <sub>4</sub> (aq)		65.87	84.12	95.99	94.73	
Ni(II)	Ni <sup>2+</sup>	99.92	14.11	10.64	6.31	2.62	
	NiOH <sup>+</sup>	0.08		0.01	0.25	0.51	
	Ni(OH) <sub>2</sub> (aq)				0.10	1.07	
	Ni(OH) <sub>3</sub> <sup>-</sup>					0.06	
	NiSO <sub>4</sub> (aq)		5.07	3.68	2.18	0.92	
	Ni(NH <sub>3</sub> ) <sub>5</sub> <sup>2+</sup>					0.17	
	Ni(NH <sub>3</sub> ) <sub>4</sub> <sup>2+</sup>				0.14	2.93	
	Ni(NH <sub>3</sub> ) <sub>3</sub> <sup>2+</sup>			0.84	2.25	17.65	
	NiNH <sub>3</sub> <sup>2+</sup>		0.36		15.64	17.30	
	Ni(NH <sub>3</sub> ) <sub>2</sub> <sup>2+</sup>			0.02	10.42	30.72	
	NiHPO <sub>4</sub> (aq)		77.80	83.88	62.69	26.04	
	NiH <sub>2</sub> PO <sub>4</sub> <sup>+</sup>		2.66	0.92	0.02		

**Table S3.** Ion Activity Product (IAP) and saturation index (SI) of  $\text{MnHPO}_4$  and variscite, obtained in visual MINTEQ simulation, for the control and the leaching of the tailing sample with *A. thiooxidans*. Results are presented for two pulp densities (5 and 10 g/L) and three subsamples collected at 0, 5 and 34 days.

Pulp density		5 g/L						10 g/L					
Time [days]		0		5		34		0		5		34	
Experiment type	Mineral	log IAP	SI	log IAP	SI	log IAP	SI	log IAP	SI	log IAP	SI	log IAP	SI
Control <i>A. thiooxidans</i>	<b>MnHPO<sub>4</sub>(s)</b>	-24.44	0.96	-24.18	1.22	-24.06	1.34	-24.36	1.04	-24.18	1.22	-24.12	1.28
	<b>Variscite</b>	-20.82	1.25	-21.00	1.07	-21.20	0.87	-21.35	0.72	-21.74	0.32	-22.16	-0.09
Incubation with <i>A. thiooxidans</i>	<b>MnHPO<sub>4</sub>(s)</b>	-27.77	-2.37	-27.30	-1.90	-26.76	-1.36	-27.07	-1.68	-27.17	-1.77	-26.96	-1.56
	<b>Variscite</b>	-26.52	-4.45	-26.05	-3.98	-25.35	-3.28	-25.86	-3.79	-25.77	-3.70	-25.45	-3.38

