Supporting Information Cover Sheet

Iron(III) Modification of Bacillus subtilis Membranes Provides Record Sorption Capacity for Arsenic and Endows Unusual Selectivity for As(V)

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Submitted to *Environmental Science & Technology*

Number of pages: 13

Number of figures: 8

Number of tables: 2

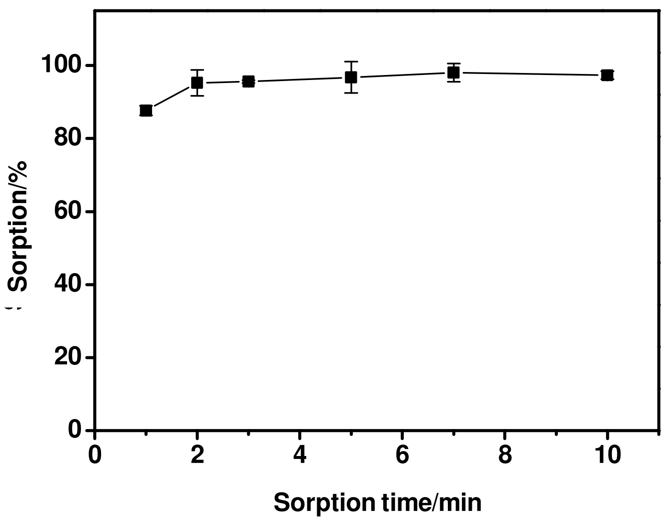

Figure S1. The dependence of sorption efficiency of As(V) on the sorption time. Sample volume: 200 µL, 20 µg L^{-1} As(V); Biomass weight: 2.2 mg; Eluent (0.8 mol L^{-1} HNO_3): 100 µL; Elution time: 2 min.

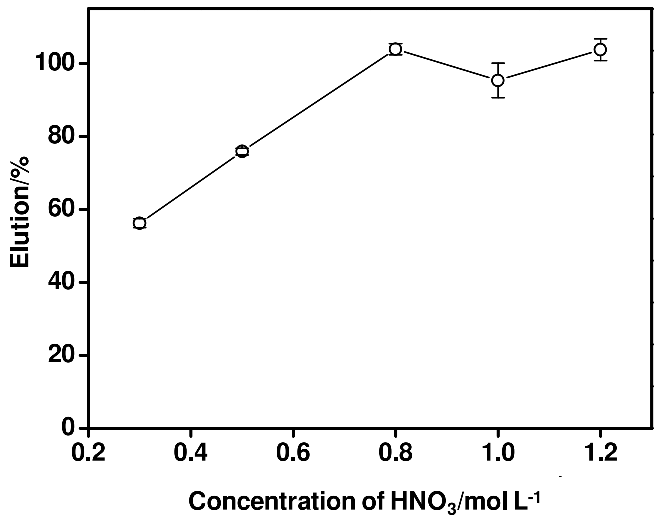

Figure S2. The dependence of elution efficiency of As(V) on the concentration of eluent (HNO_3). Sample volume: 200 µL, 20 µg L^{-1} As(V); Biomass weight: 2.2 mg; Sorption time: 3 min; Eluent (HNO_3 with various concentrations): 100 µL; Elution time: 2 min. Note that the % elution refers to the original amount of As(V) taken, 96% is retained in the preconcentration process.

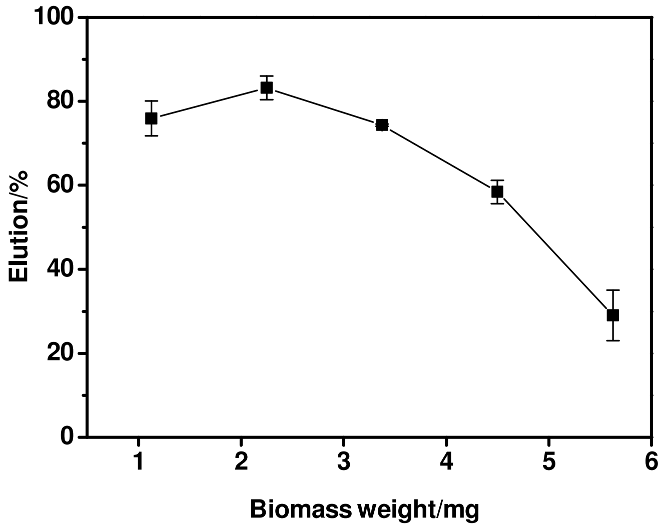

Figure S3. The dependence of elution efficiency of As(V) on the biomass weight. Sample volume: 1000 μL, 1.0 μg L^{-1} As(V); Sorption time: 3 min; Eluent (0.8 mol L^{-1} HNO_3): 100 μL; Elution time: 2 min. Note that the elution/% refers to the original amount of As(V) taken, 96% is retained in the preconcentration process.

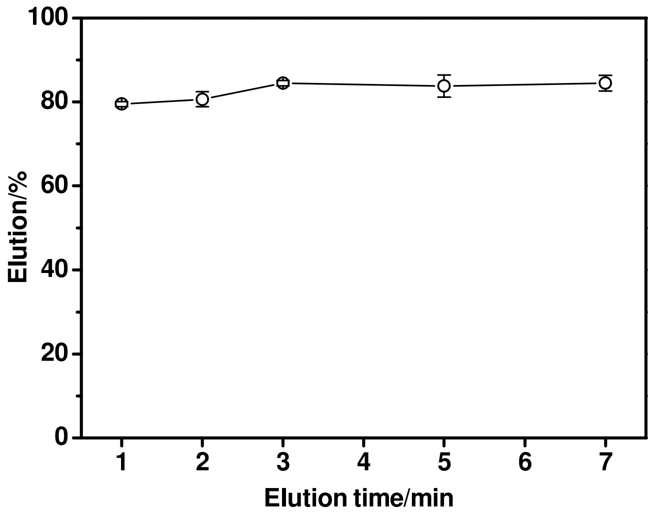

Figure S4. The dependence of elution efficiency of As(V) on the elution time. Sample volume: 1000 µL, 1.0 µg L^{-1} As(V); Biomass weight: 2.2 mg; Sorption time: 3 min; Eluent (0.8 mol L^{-1} HNO_3): 100 µL. Note that the elution/% refers to the original amount of As(V) taken, 96% is retained in the preconcentration process.

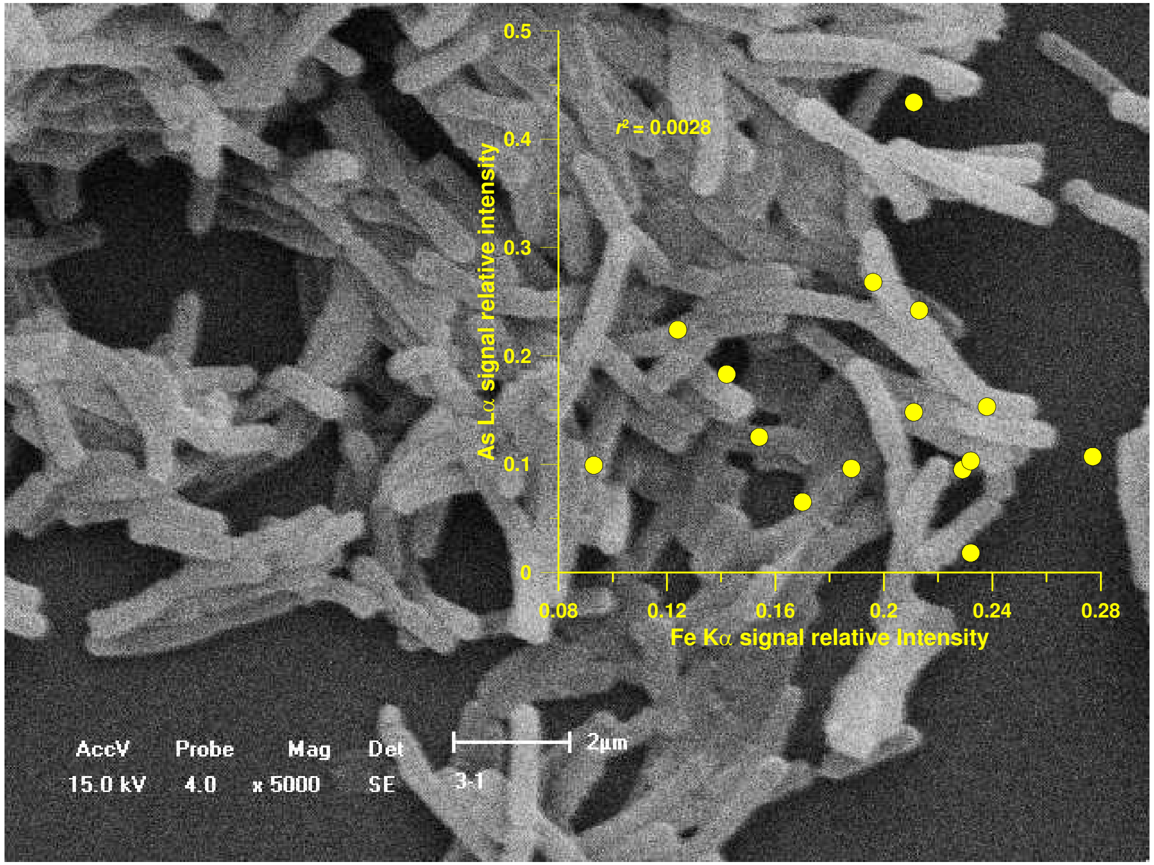

Figure S5. Fe and As X-ray intensities were measured in randomly chosen 30×40 µm viewing frames (each frame containing hundreds of bacteria); the As and Fe signals showed no correlation whatsoever (r^2 =0.0028, n = 15). As a reference, the background micrograph has a frame size of 30 x 40 µm

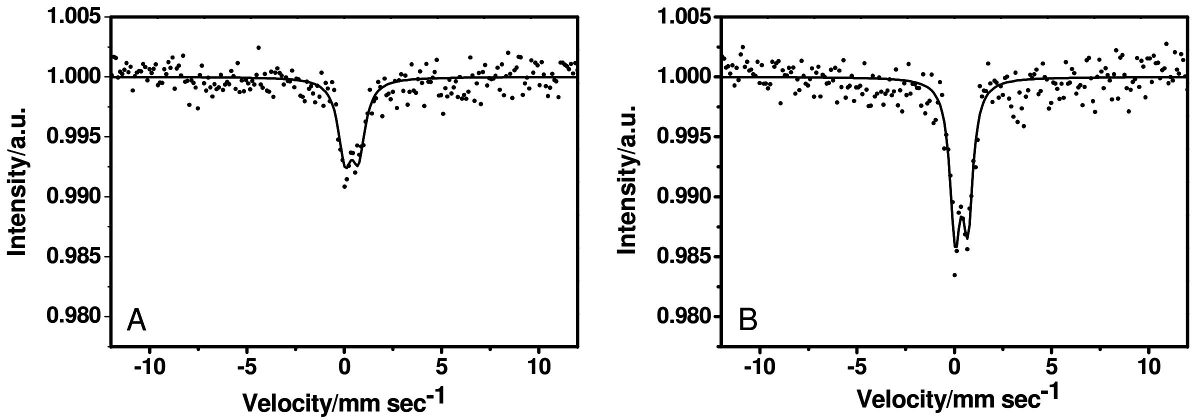

Figure S6. Room temperature ^{57}Fe Mössbauer spectra. (A) Fe(III) loaded *Bacillus subtilis* (*Fe-bac*); (B) *Fe-bac-As(V).* For (A), the Fe(III) concentration is 8 mM. For (B), the *Fe-bac* is pre-treated with 200 mg L^{-1} As(V) solution (pH 3.0) under vigorous agitation for 60 min to facilitate adsorption. The parameters for Fe-bac related to α-Fe are an isomer shift (IS) of 0.3854 mm s^{-1}, a quadrupole split (QS) of 0.7007 mm s^{-1}, with a half-line width of the spectra of 0.4188 mm s^{-1}. On the other hand, the corresponding parameters for *Fe-bac-As(V)* are: IS of 0.3715 mm s^{-1}, QS of 0.6501 mm s^{-1} with a half-line width of 0.3250 mm s^{-1}. The error limits of IS and QS are 0.001 mm s^{-1} and 0.002 mm s^{-1}, respectively.

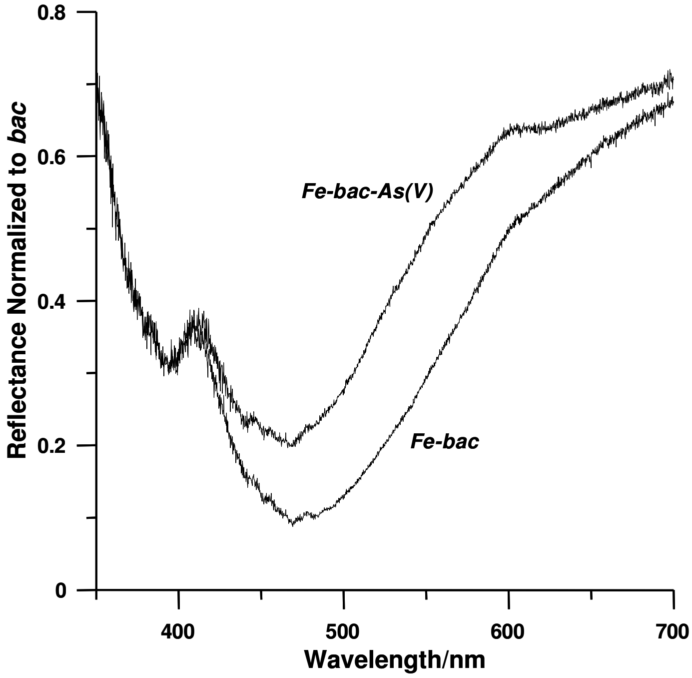

Figure S7. Reflectance spectra of *Fe-bac* and *Fe-bac-As(V)* referenced to *native Bacillus subtilis.* Upon binding of arsenic, the color is similar but there is a decrease in visible absorption. This is also observed in solution. See Figure S8.

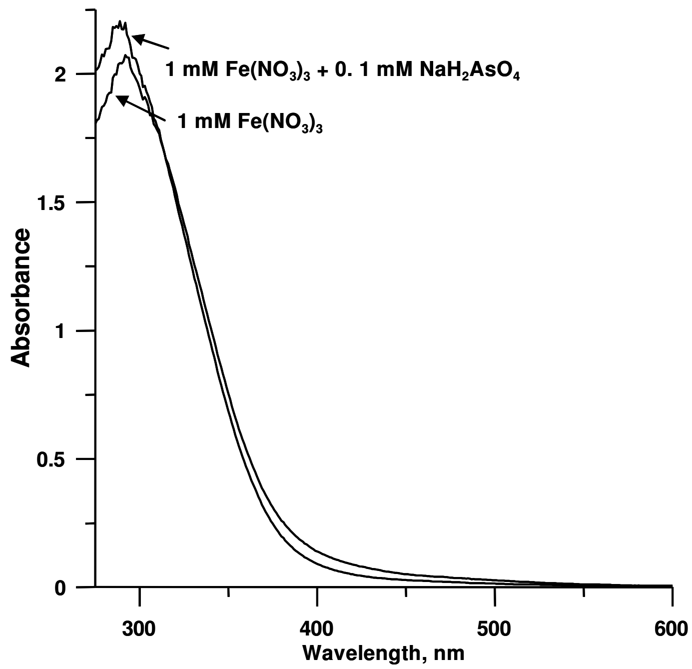

Figure S8. When small amounts of arsenate (not sufficient to cause precipitation) is added to ferric nitrate solution, the UV absorption increases slightly and the absorption maximum blue shifts slightly. More importantly the visible absorption decreases, very slightly but perceptibly. These spectra were obtained on an Agilent 8453 diode array spectrometer.

Table S1. Arsenic sorption/removal capacities of different iron-bearing sorbents per unit iron content.

Sorbent	Sorption capacity mol As/mol Fe		Ref.	Sorbent	Sorption capacity mol As/mol Fe		Ref.
	As(III)	As(V)			As(III)	As(V)	
Iron oxide coated cement	0.002		1	HFO on granular activated carbon		0.2	9
Goethite	0.016	0.016	2	Fe(III) loaded sponge	0.24	1.83	10
Goethite	0.026	0.005	3	HFO	0.31	0.24	2
Goethite		0.0059	4	Fe modified activated carbon	0.26	0.3	11
$Cr(OH)_3/Fe(OH)_3$		0.028	5	$Fe(OH)_3$ on polyacrylamide		0.34	12
HFO	0.041	0.01	3	Iron oxide loaded melted slag	0.35	1.04	13
Crystal $FePO_4$	0.032	0.018	6	Fe(III) loaded chelating resin	0.88	0.78	14
Amorphous $FePO_4$	0.042	0.02	6	Ferrihydrite	0.6	0.25	15
Iron oxide coated cement		0.02	7	HFO loaded fibrous		0.94	16
HFO on cellulose	0.16	0.053	8	Fe loaded *Bacillus subtilis*	1.4	1.9	This work

Table S2. Assignments of the IR bands (refs. 17-20).

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Wavenumber (cm^{-1})			IR band assignment
Bacillus subtilis bacteria	*Fe-bac*	As loaded *Fe-bac*	
1640	1640	1641	C=O stretching in amide (amide I)
1538	1517	1516	N-H bending and C-N stretching in amide (amide II)
1455	1451	1455	CH_2 scissoring
1398	1386	1386	COO^- symmetric stretching
1217	1212	1211	P=O stretching (phosphate)
1054	1058	1042	Asymmetric/symmetric stretching of PO_2^- and $P(OH)_2$ in phosphate; vibrations of C-OH and C-C in polysaccharides.
--	--	818	As-O stretching vibration of Fe-O-As groups

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