Supporting Information

Impact of sodium humate coating on collector surfaces on deposition of polymer-coated nano-iron particles

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Table S 1. Properties of U.S. EPA moderately hard synthetic standard water. The anion content was determined by IC (ICS-1000, Dionex), except for the HCO_3^- content which was determined by titration with 0.1 N HCl to pH 4.3 (Appelo and Postma, 2004). The cation content was determined by ICP-OES (Optima 5300 DV, PerkinElmer). The pH was measured using a pH meter equipped with a pre-calibrated micro combination electrode (WTW GmbH); EC was measured using a standard conductivity cell (Tetracon®325, WTW GmbH).

Ca^{2+}	Mg^{2+}	Na^+	K^+	Cl^-	SO_4^{2-}	NO_3^-	HCO_3^-	pH	EC	IS
(mM)	(mM)	(mM)	(mM)	(mM)	(mM)	(mM)	(mM)	(-)	(µS/cm)	(mM)
0.3	0.5	1.1	0.1	0.1	0.8	1.1	1.0	7.7	297	4.8[†]/4.9[‡]

[†]calculated as: $IS\ (M)\ =\ 1.6 \times 10^{-5} \times EC\ (\mu S/cm)$ (McCleskey et al. 2012)

[‡]calculated as: $IS\ (M)\ =\ \frac{1}{2}\sum_i z_i^2\ c_i(M)$ (Laxen 1977).

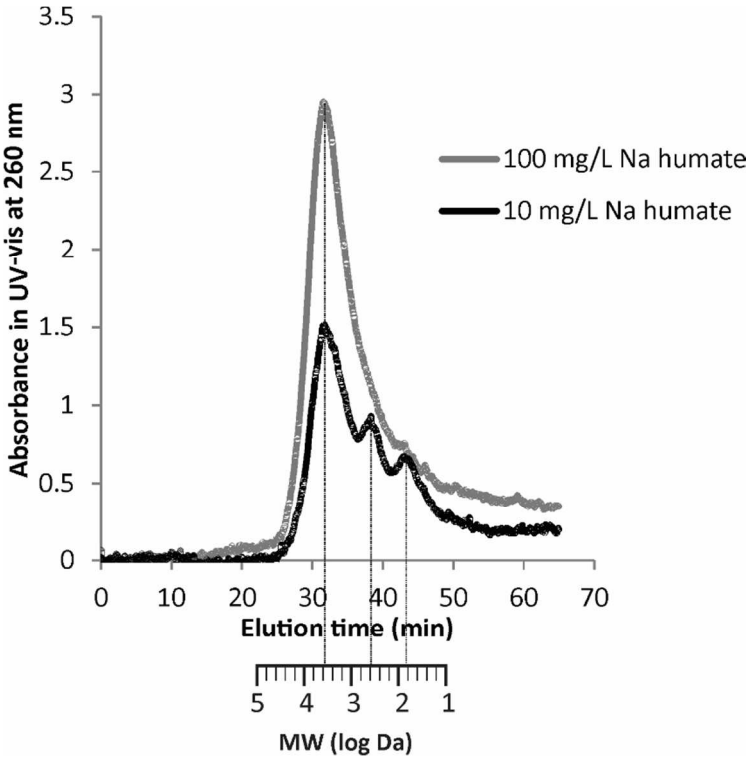

Figure S 1. SEC chromatograms showing molecular weight (MW) distributions in < 0.1 µm filtrates of 10 and 100 mg/L Na humate solutions in synthetic water at pH 7.5; 3.6 log Da ≈ 3,980 Da; 2.6 log Da ≈ 400 Da; 1.8 log Da ≈ 63 Da. The MW scale is based on the retention time of MW standards as described in the Materials and Methods section.

Table S 2. TOC content and chemical composition of the collectors.

	Glass beads*	Ottawa sand†	Dorsilit®8 sand a.w.	Dorsilit®8 sand	Site 1	Site 2
TOC (%)	n.d.	n.d.	n.d.	n.d.	n.d.	0.042
SiO_2 (%)	100	99.8	98.11	98.45	48.10	69.74
Al_2O_3 (%)		0.06	0.38	0.46	3.50	10.23
Fe_2O_3 (%)		0.02	0.03	0.18	1.59	5.95
CaO (%)		0.01	< 0.02	0.02	20.68	2.26
MgO (%)		0.01	0.04	0.03	3.57	1.52
Na_2O (%)		0.01	0.02	0.03	0.70	1.85
K_2O (%)		0.01	0.13	0.10	0.76	3.45
MnO (%)		n.d.	< 0.002	< 0.002	0.04	0.11
TiO_2 (%)		0.01	0.04	0.08	0.14	0.73
P_2O_5 (%)		n.d.	0.01	0.01	0.06	0.16
L.O.I. (%)		n.a.	0.18	0.23	19.71	2.72

* manufacturer's specification; † from Ojuri and Fijabi (2012); n.d. = not detected, < 0.005%; L.O.I. = loss on ignition; n.a. = not available; a.w. = acid-washed. L.O.I. was determined after drying 2 g of sample for one hour at 105°C, followed by the "ignition" of samples at 1,000°C and cooling down in an exsiccator.

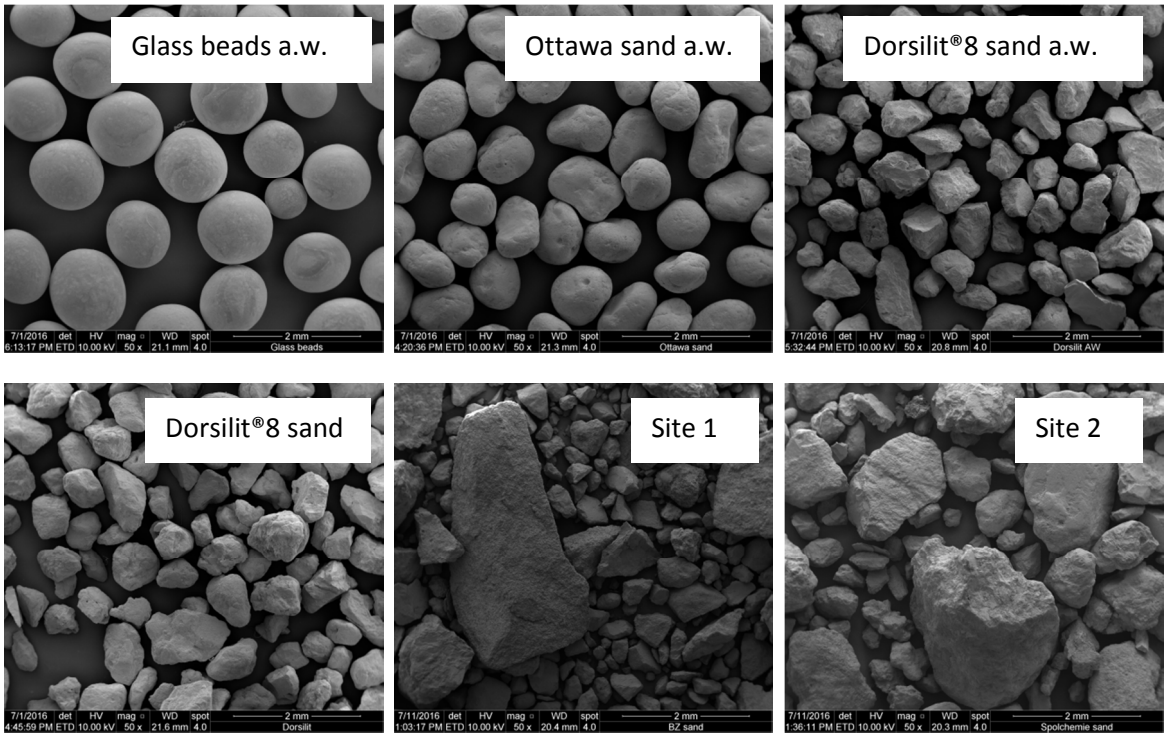

Figure S 2. Scanning electron micrographs of the collectors. Magnification 50 x; a.w. = acid-washed.

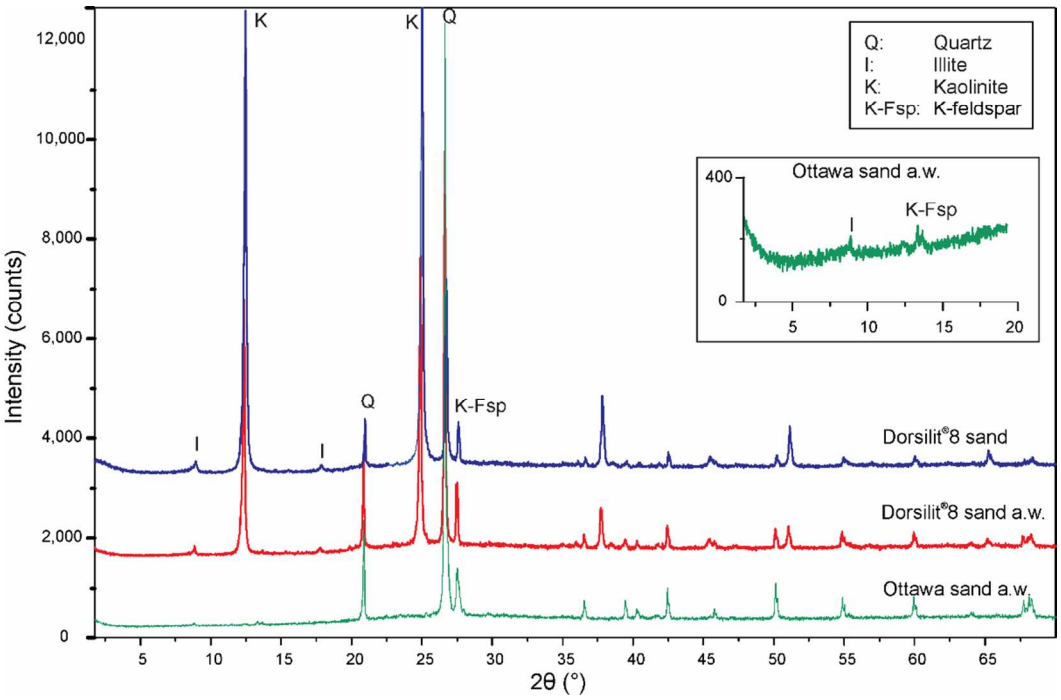

Figure S 3. X-ray diffractograms of the fine collector material, with an insert showing a detail from the diffractogram of the fines in Ottawa sand (a.w. = acid-washed). The fine fraction was isolated from the bulk suspension in deionized water by directly collecting the supernatant after 6 minutes of ultrasonication in a Branson Ultrasonics Sonifier™ 450 (400 W indicated power).

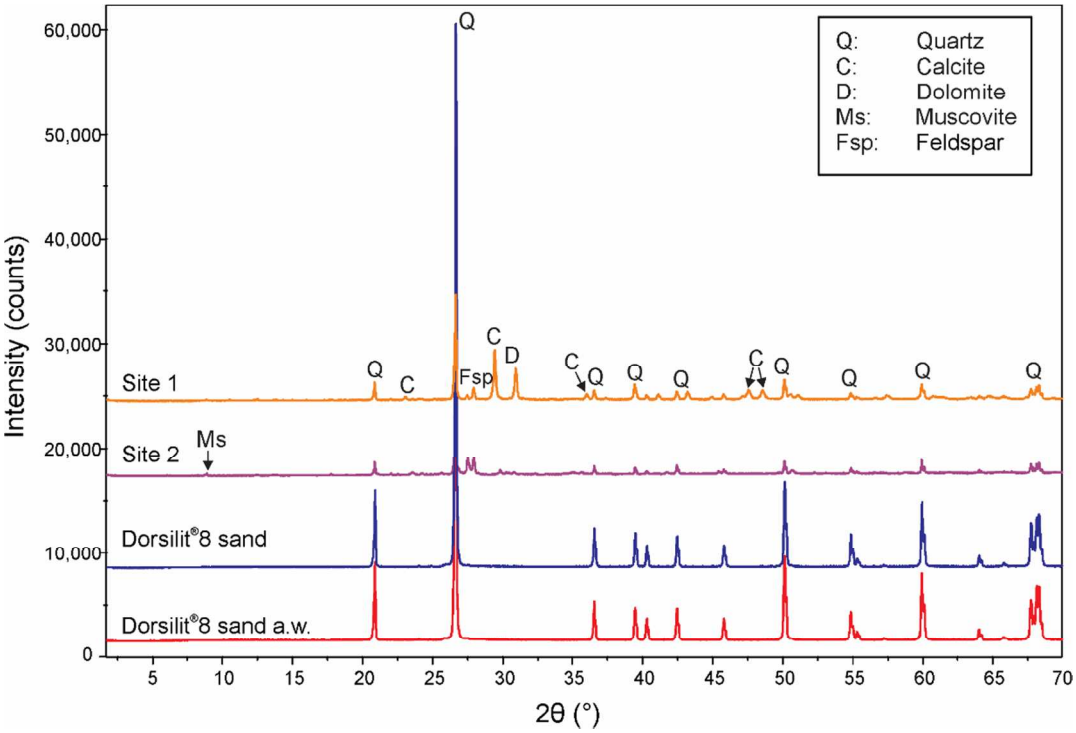

Figure S 4. X-ray diffractograms of the bulk pulverized collector material (a.w. = acid-washed).

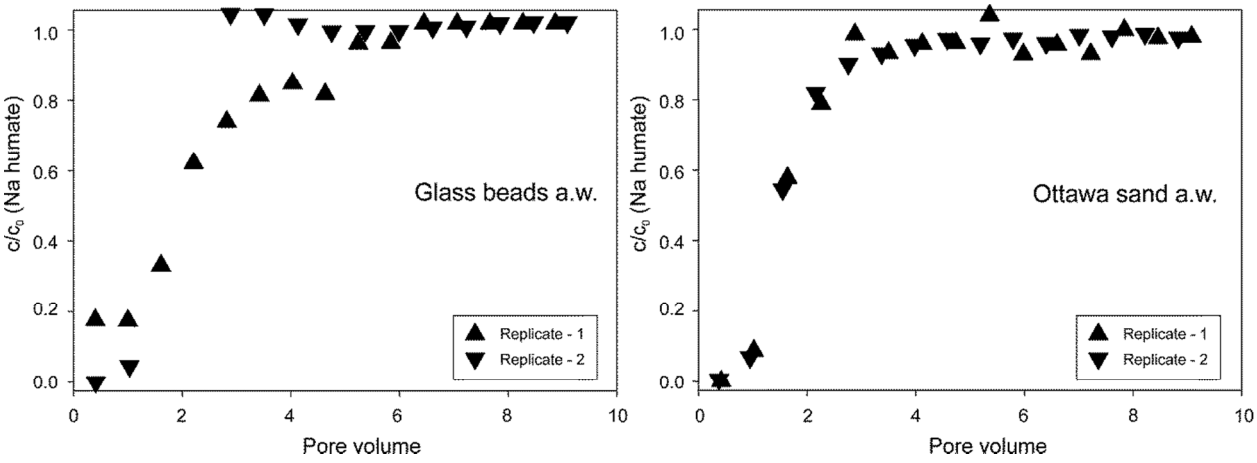

Figure S 5. Duplicate breakthrough curves for 10 mg/L Na humate in acid-washed glass beads (left) and acid-washed Ottawa sand (right); a.w. = acid-washed.

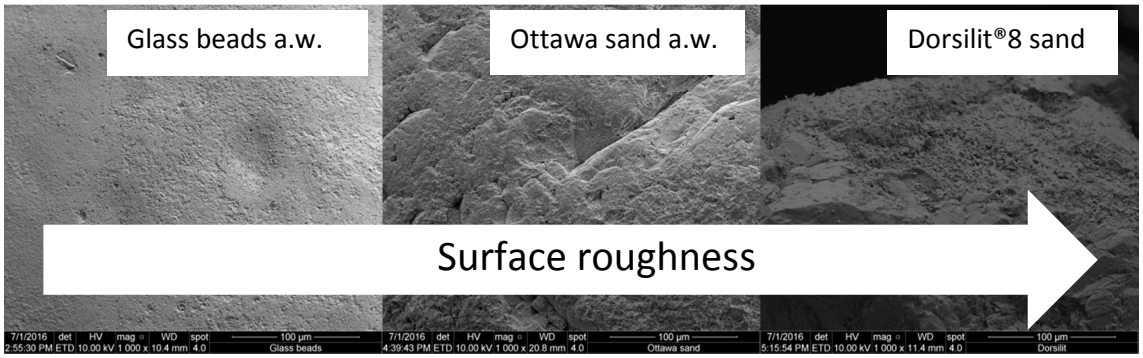

Figure S 6. Scanning electron micrographs of the collector surfaces, with the arrow indicating the trend towards increasing surface roughness. Magnification 1,000 x; a.w. = acid-washed.

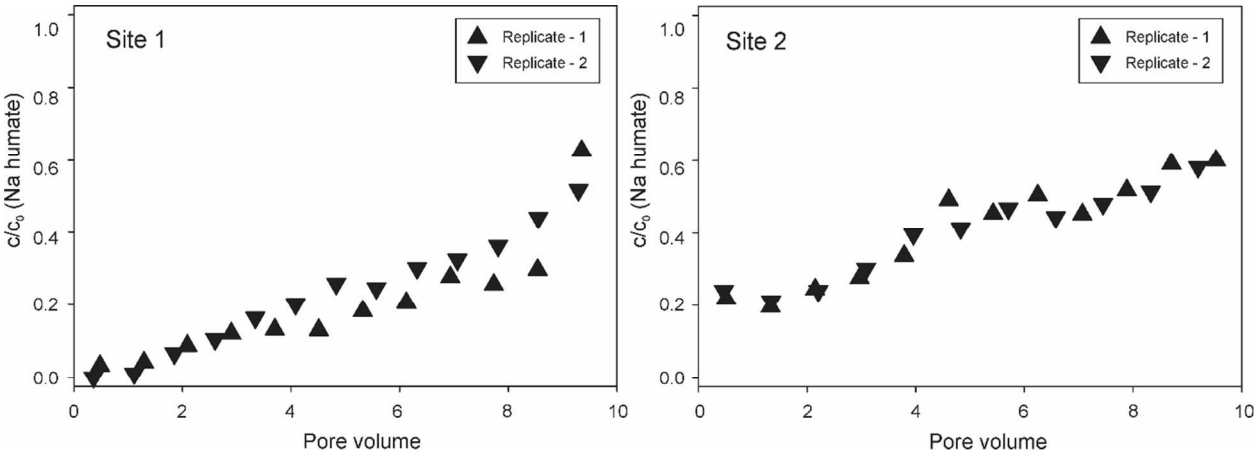

Figure S 7. Duplicate breakthrough curves for 10 mg/L Na humate in the collectors from Site 1(left) and Site 2(right).

References

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