Electronic Supplementary Material (ESI) for Environmental Science: Nano.

Appendix A. Supplementary data

The Properties and Efficacy of S-nZVI as Remediation Agent in response to its Preparation Process and Reaction Conditions: A Truth from Meta-Analysis

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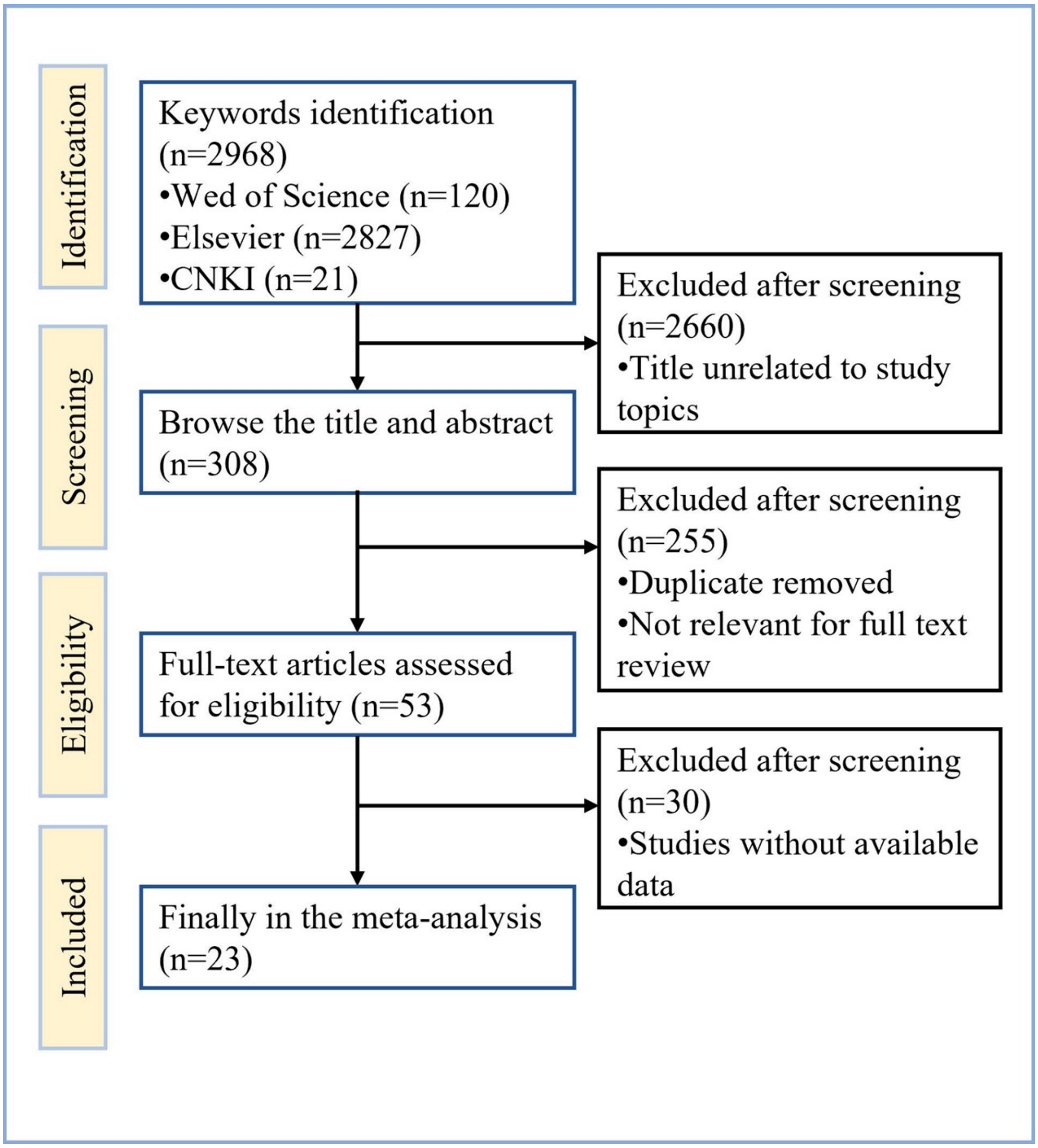

Fig. S1. The flowchart of physical and chemical properties study screening process.

Table S1. List of articles selected for the meta-analysis about efficiency

ID	Contaminants	Group	Synthesis	Sulfur reagent	Guild	Temperature	S/Fe	pH	Control mean	Treatment mean	Reference
1	Cefotaxime (CFX)	Organic	Two step synthesis	Na_2S	removal rate	25	0.75	NA	11.52	22.28	1
2	Cefotaxime (CFX)	Organic	Two step synthesis	Na_2S	removal rate	25	0.875	NA	11.52	32.48	
3	Cefotaxime (CFX)	Organic	Two step synthesis	Na_2S	removal rate	25	1.16	NA	11.52	23.64	
4	Cefotaxime (CFX)	Organic	Two step synthesis	Na_2S	removal rate	25	0.875	6	11.52	31.24	
5	Cefotaxime (CFX)	Organic	Two step synthesis	Na_2S	removal rate	25	0.875	7	11.52	31.71	
6	Cefotaxime (CFX)	Organic	Two step synthesis	Na_2S	removal rate	25	0.875	8	11.52	32.94	
7	Cefotaxime (CFX)	Organic	Two step synthesis	Na2S	removal rate	25	0.875	9	11.52	29.24	
8	Pentachlorophenol (PCP)	Organic	One-step synthesis	$Na_2S_2O_4$	removal rate	NA	0.01	NA	2.68	4.41	2
9	Pentachlorophenol (PCP)	Organic	One-step synthesis	$Na_2S_2O_4$	removal rate	NA	0.017	NA	2.68	5.43	
10	Pentachlorophenol (PCP)	Organic	One-step synthesis	$Na_2S_2O_4$	removal rate	NA	0.1	NA	2.68	4.36	
11	Pentachlorophenol (PCP)	Organic	One-step synthesis	$Na_2S_2O_4$	removal rate	NA	0.02	5.08	2.68	5.25	
12	Pentachlorophenol (PCP)	Organic	One-step synthesis	$Na_2S_2O_4$	removal rate	NA	0.02	7.21	2.68	5.69	
13	Pentachlorophenol (PCP)	Organic	One-step synthesis	$Na_2S_2O_4$	removal rate	NA	0.02	8.42	2.68	5.98	
14	Polychlorinated Biphenyls (PCB153)	Organic	One-step synthesis	$Na_2S_2O_4$	removal rate	25	0.1	7	0.19	0.14	3
15	Polychlorinated Biphenyls (PCB153)	Organic	One-step synthesis	$Na_2S_2O_4$	removal rate	25	0.1	4	0.19	0.08	
16	Polychlorinated Biphenyls (PCB153)	Organic	One-step synthesis	$Na_2S_2O_4$	removal rate	25	0.1	6	0.19	0.1	
17	Polychlorinated Biphenyls (PCB153)	Organic	One-step synthesis	$Na_2S_2O_4$	removal rate	25	0.1	7	0.19	0.12	
18	Polychlorinated Biphenyls (PCB153)	Organic	One-step synthesis	$Na_2S_2O_4$	removal rate	25	0.1	8	0.19	0.13	
19	Polychlorinated Biphenyls (PCB153)	Organic	One-step synthesis	$Na_2S_2O_4$	removal rate	25	0.1	10	0.19	0.16	
20	Cr(VI)	Heavy Metal	Two step synthesis	Na_2S	removal rate	20	0.1	NA	29.23	33.97	4

21	Cr(VI)	Heavy Metal	Two step synthesis	Na_2S	removal rate	20	0.2	NA	29.23	36.01	
22	Cr(VI)	Heavy Metal	Two step synthesis	Na_2S	removal rate	20	0.3	NA	29.23	31.28	
23	Cr(VI)	Heavy Metal	Two step synthesis	Na_2S	removal rate	20	0.5	NA	29.23	29.33	
24	Cu (II)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	removal rate	25	0.103	5	20	20	5
25	Cu (II)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	removal rate	25	0.103	3	20	19.98	
26	Cu (II)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	removal rate	25	0.103	4	20	19.98	
27	Cu (II)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	removal rate	25	0.103	5	20	19.98	
28	Ni (II)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	removal rate	25	0.103	6	19.83	19.94	
29	Ni (II)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	removal rate	25	0.103	5	19.83	20	
30	Ni (II)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	removal rate	25	0.103	6	19.83	20	
31	Ni (II)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	removal rate	25	0.103	7	19.83	20	
32	Cr(VI)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	C/C_0	30	0.5	5	23.69	54.3	6
33	Cd (II)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	removal rate	30	0.1	7	26.03	31.58	7
34	Cd (II)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	removal rate	30	0.2	7	26.03	80	
35	Cd (II)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	removal rate	30	0.3	7	26.03	80	
36	Cd (II)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	removal rate	30	0.4	7	26.03	80	
37	Cd (II)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	removal rate	30	0.5	7	26.03	80	
38	Cd (II)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	removal rate	30	0.3	3	26.03	77.85	
39	Cd (II)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	removal rate	30	0.3	4	26.03	71.74	
40	Cd (II)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	removal rate	30	0.3	5	26.03	79.94	
41	Cd (II)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	removal rate	30	0.3	6	26.03	80	
42	Cd (II)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	removal rate	30	0.3	7	26.03	80	

43	Cd (II)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	removal rate	20	0.3	7	26.03	66.1	
44	Cd (II)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	removal rate	25	0.3	7	26.03	70.38	
45	Cd (II)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	removal rate	30	0.3	7	26.03	80	
46	Cd (II)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	removal rate	35	0.3	7	26.03	80	
47	Trichloroethylene (TCE)	Organic	One-step synthesis	$Na_2S_2O_4$	removal rate	20	0.1	5.57	3.13	5.25	8
48	Trichloroethylene (TCE)	Organic	One-step synthesis	$Na_2S_2O_4$	removal rate	20	0.025	5.57	3.13	6	
49	Trichloroethylene (TCE)	Organic	One-step synthesis	$Na_2S_2O_4$	removal rate	20	0.017	5.57	3.13	6	
50	Trichloroethylene (TCE)	Organic	One-step synthesis	$Na_2S_2O_4$	removal rate	20	0.013	5.57	3.13	5.99	
51	Trichloroethylene (TCE)	Organic	One-step synthesis	$Na_2S_2O_4$	removal rate	20	0.01	5.57	3.13	5.63	
52	Trichloroethylene (TCE)	Organic	One-step synthesis	$Na_2S_2O_4$	removal rate	20	0.017	5.57	3.13	5.83	
53	Trichloroethylene (TCE)	Organic	One-step synthesis	$Na_2S_2O_4$	removal rate	20	0.017	7.1	3.13	5.42	
54	Trichloroethylene (TCE)	Organic	One-step synthesis	$Na_2S_2O_4$	removal rate	20	0.017	8.02	3.13	5.85	
55	Carbon Tetrachloride (CCl4)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	30	0.138	7	2.91	5.484	9
56	Carbon Tetrachloride (CCl4)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	30	0.138	3	2.91	5.0286	
57	Carbon Tetrachloride (CCl4)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	30	0.138	6	2.91	5.4666	
58	Carbon Tetrachloride (CCl4)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	30	0.138	7	2.91	5.562	
59	Carbon Tetrachloride (CCl4)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	30	0.138	8	2.91	5.5998	
60	Carbon Tetrachloride (CCl4)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	30	0.138	9	2.91	5.676	
61	Carbon Tetrachloride (CCl4)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	10	0.138	7	2.91	3.8844	
62	Carbon Tetrachloride (CCl4)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	20	0.138	7	2.91	4.7502	
63	Carbon Tetrachloride (CCl4)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	30	0.138	7	2.91	5.481	
64	Carbon Tetrachloride (CCl4)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	40	0.138	7	2.91	5.8272	

65	Diclofenac (DCF)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.1	6.5	0.71	1.42	10
66	Diclofenac (DCF)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.2	6.5	0.71	1.93	
67	Diclofenac (DCF)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.3	6.5	0.71	2.45	
68	Diclofenac (DCF)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.4	6.5	0.71	1.72	
69	Diclofenac (DCF)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.3	3.5	0.71	2.6	
70	Diclofenac (DCF)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.3	4.5	0.71	2.86	
71	Diclofenac (DCF)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.3	5.5	0.71	2.47	
72	Diclofenac (DCF)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.3	6.5	0.71	2.44	
73	Diclofenac (DCF)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.3	7.5	0.71	1.45	
74	Diclofenac (DCF)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.3	8.5	0.71	0.96	
75	Florfenicol (FF)	Organic	Two step synthesis	$Na_2S_2O_4$	$\ln(C/C_0)$	25	0.07	7	28.03	100.3	11
76	Florfenicol (FF)	Organic	Two step synthesis	$Na_2S_2O_4$	$\ln(C/C_0)$	25	0.14	7	28.03	100.3	
77	Florfenicol (FF)	Organic	Two step synthesis	$Na_2S_2O_4$	$\ln(C/C_0)$	25	0.21	7	28.03	100.3	
78	Florfenicol (FF)	Organic	Two step synthesis	$Na_2S_2O_4$	$\ln(C/C_0)$	25	0.28	7	28.03	100.3	
79	Florfenicol (FF)	Organic	Two step synthesis	$Na_2S_2O_4$	$\ln(C/C_0)$	25	0.07	7	28.31	100.3	
80	Florfenicol (FF)	Organic	Two step synthesis	$Na_2S_2O_4$	$\ln(C/C_0)$	25	0.14	7	28.31	100.3	
81	Florfenicol (FF)	Organic	Two step synthesis	$Na_2S_2O_4$	$\ln(C/C_0)$	25	0.21	7	28.31	98.44	
82	Florfenicol (FF)	Organic	Two step synthesis	$Na_2S_2O_4$	$\ln(C/C_0)$	25	0.28	7	28.31	99.62	
83	Florfenicol (FF)	Organic	Two step synthesis	Na_2S	$\ln(C/C_0)$	25	0.07	7	28.15	100.13	
84	Florfenicol (FF)	Organic	Two step synthesis	Na_2S	$\ln(C/C_0)$	25	0.14	7	28.15	100.13	
85	Florfenicol (FF)	Organic	Two step synthesis	Na_2S	$\ln(C/C_0)$	25	0.21	7	28.15	100.13	
86	Florfenicol (FF)	Organic	Two step synthesis	Na_2S	$\ln(C/C_0)$	25	0.28	7	28.15	100.13	

87	Florfenicol (FF)	Organic	One-step synthesis	$Na_2S_2O_4$	$\ln(C/C_0)$	25	0.07	7	28.26	100.24	
88	Florfenicol (FF)	Organic	One-step synthesis	$Na_2S_2O_4$	$\ln(C/C_0)$	25	0.14	7	28.26	100.13	
89	Florfenicol (FF)	Organic	One-step synthesis	$Na_2S_2O_4$	$\ln(C/C_0)$	25	0.21	7	28.26	100.13	
90	Florfenicol (FF)	Organic	One-step synthesis	$Na_2S_2O_4$	$\ln(C/C_0)$	25	0.28	7	28.26	100.3	
91	Pb (II)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.05	6	3.97	4.21	12
92	Pb (II)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.1	6	3.97	5.04	
93	Pb (II)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.2	6	3.97	5.16	
94	Pb (II)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.3	6	3.97	5.18	
95	Pb (II)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.2	5	3.97	10.36	
96	Pb (II)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.2	6	3.97	10.36	
97	Pb (II)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.2	7.2	3.97	10.36	
98	Pb (II)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.2	8	3.97	10.36	
99	Decabromodiphenyl Ether (BDE-209)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.05	7.2	0.55	0.57	
100	Decabromodiphenyl Ether (BDE-209)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.1	7.2	0.55	0.78	
101	Decabromodiphenyl Ether (BDE-209)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.2	7.2	0.55	1	
102	Decabromodiphenyl Ether (BDE-209)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.3	7.2	0.55	0.93	
103	Trichloroethylene (TCE)	Organic	Two step synthesis	Na_2S	C/C_0	25	0.0038	NA	13.02	19.97	13
104	Trichloroethylene (TCE)	Organic	Two step synthesis	Na_2S	C/C_0	25	0.0164	NA	13.02	19.9	
105	Trichloroethylene (TCE)	Organic	Two step synthesis	Na_2S	C/C_0	25	0.339	NA	13.02	20	
106	Trichloroethylene (TCE)	Organic	Two step synthesis	Na_2S	C/C_0	25	0.0555	NA	13.02	19.97	
107	Trichloroethylene (TCE)	Organic	Two step synthesis	Na_2S	C/C_0	25	0.1094	NA	13.02	19.9	
108	Trichloroethylene (TCE)	Organic	One-step synthesis	Na_2S	C/C_0	22	1	7	6.25	29.78	14

109	Trichloroethylene (TCE)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.05	NA	0.8	1.07	15
110	Trichloroethylene (TCE)	Organic	Two step synthesis	Na_2S	C/C_0	25	0.05	NA	0.8	5.19	
111	Cd (II)	Heavy Metal	Two step synthesis	Na_2S	C/C_0	ambient temperature	0.75	6.2	39.56	385.08	16
112	Trichloroethylene (TCE)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	35	0.05	9	8.38	14.94	17
113	Decabromodiphenyl Ether (BDE-209)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.2	7.2	0.2774	0.5	18
114	Decabromodiphenyl Ether (BDE-209)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.2	3	0.2774	0.11	
115	Decabromodiphenyl Ether (BDE-209)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.2	5	0.2774	0.47	
116	Decabromodiphenyl Ether (BDE-209)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.2	6.5	0.2774	0.49	
117	Decabromodiphenyl Ether (BDE-209)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.2	7.2	0.2774	0.5	
118	Decabromodiphenyl Ether (BDE-209)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.2	8	0.2774	0.5	
119	Trichloroethylene (TCE)	Organic	One-step synthesis	Na_2S	Post-reaction content	NA	0.035	NA	14.85	124.05	19
120	Trichloroethylene (TCE)	Organic	One-step synthesis	Na_2S	Post-reaction content	NA	0.05	NA	14.85	367.75	
121	Trichloroethylene (TCE)	Organic	One-step synthesis	Na_2S	Post-reaction content	NA	0.07	NA	14.85	387.88	
122	Trichloroethylene (TCE)	Organic	One-step synthesis	Na_2S	Post-reaction content	NA	0.1	NA	14.85	433.62	
123	Trichloroethylene (TCE)	Organic	One-step synthesis	Na_2S	Post-reaction content	NA	0.2	NA	14.85	423.74	
124	Trichloroethylene (TCE)	Organic	One-step synthesis	Na_2S	Post-reaction content	NA	0.3	NA	14.85	275.9	
125	Trichloroethylene (TCE)	Organic	One-step synthesis	Na_2S	Post-reaction content	NA	0.4	NA	14.85	247.73	
126	Trichloroethylene (TCE)	Organic	Two step synthesis	Na_2S	Post-reaction content	NA	0.035	NA	14.85	142.1	

127	Trichloroethylene (TCE)	Organic	Two step synthesis	Na_2S	Post-reaction content	NA	0.05	NA	14.85	169.57	
128	Trichloroethylene (TCE)	Organic	Two step synthesis	Na_2S	Post-reaction content	NA	0.07	NA	14.85	244.65	
129	Trichloroethylene (TCE)	Organic	Two step synthesis	Na_2S	Post-reaction content	NA	0.1	NA	14.85	309.48	
130	Trichloroethylene (TCE)	Organic	Two step synthesis	Na_2S	Post-reaction content	NA	0.2	NA	14.85	376.5	
131	Trichloroethylene (TCE)	Organic	Two step synthesis	Na_2S	Post-reaction content	NA	0.3	NA	14.85	416	
132	Trichloroethylene (TCE)	Organic	Two step synthesis	Na_2S	Post-reaction content	NA	0.4	NA	14.85	475.03	
133	Cr(VI)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.07	5	51.21	31.52	20
134	Cr(VI)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.138	5	51.21	15.76	
135	Cr(VI)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.207	5	51.21	68.48	
136	Cr(VI)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.207	3.5	51.21	74.08	
137	Cr(VI)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.207	5	51.21	68.42	
138	Cr(VI)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.207	7.1	51.21	36.27	
139	Cr(VI)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.207	9	51.21	28.29	
140	Hexabromocyclododecane (HBCD)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	30	0.2	7	30.19	39.75	21
141	Hexabromocyclododecane (HBCD)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	30	0.2	3	30.19	24.26	
142	Hexabromocyclododecane (HBCD)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	30	0.2	5	30.19	39.55	
143	Hexabromocyclododecane (HBCD)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	30	0.2	7	30.19	40	
144	Hexabromocyclododecane (HBCD)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	30	0.2	9	30.19	31.96	
145	Hexabromocyclododecane (HBCD)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	10	0.2	7	30.19	17.13	

146	Hexabromocyclododecane (HBCD)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	20	0.2	7	30.19	26.9	
147	Hexabromocyclododecane (HBCD)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	30	0.2	7	30.19	39.77	
148	Hexabromocyclododecane (HBCD)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	40	0.2	7	30.19	39.77	
149	P-nitrophenol (PNP)	Organic	Two step synthesis	Na_2S	C/C_0	25	0.0484	NA	74.27	221.82	22
150	P-nitrophenol (PNP)	Organic	Two step synthesis	Na_2S	C/C_0	25	0.0967	NA	74.27	243.32	
151	P-nitrophenol (PNP)	Organic	Two step synthesis	Na_2S	C/C_0	25	0.1449	NA	74.27	304.8	
152	P-nitrophenol (PNP)	Organic	Two step synthesis	Na_2S	C/C_0	25	0.1934	NA	74.27	293.53	
153	P-nitrophenol (PNP)	Organic	Two step synthesis	Na_2S	C/C_0	25	0.1449	6.77	74.27	308.05	
154	P-nitrophenol (PNP)	Organic	Two step synthesis	Na_2S	C/C_0	25	0.1449	7.6	74.27	311.93	
155	P-nitrophenol (PNP)	Organic	Two step synthesis	Na_2S	C/C_0	25	0.1449	8.41	74.27	311.75	
156	P-nitrophenol (PNP)	Organic	Two step synthesis	Na_2S	C/C_0	25	0.1449	9.11	74.27	311.75	
157	Trichloroethylene (TCE)	Organic	Two step synthesis	Na_2S	C/C_0	22	0.05	8	0.25	4.43	23
158	Trichloroethylene (TCE)	Organic	Two step synthesis	$Na_2S_2O_4$	C/C_0	22	0.05	8	0.25	3.79	
159	Trichloroethylene (TCE)	Organic	Two step synthesis	$Na_2S_2O_3$	C/C_0	22	0.05	8	0.25	4.03	
160	Trichloroethylene (TCE)	Organic	One-step synthesis	$Na_2S_2O_3$	C/C_0	22	0.05	8	0.25	4.2	
161	Tetrabromobisphenol A (TBBPA)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.51	NA	4.7345	8.6209	24
162	Trichloroethylene (TCE)	Organic	Two step synthesis	Na_2S	C/C_0	22	0.02	NA	9.78	6.14	25
163	Trichloroethylene (TCE)	Organic	Two step synthesis	Na_2S	C/C_0	22	0.03	NA	9.78	6.5	
164	Trichloroethylene (TCE)	Organic	Two step synthesis	Na_2S	C/C_0	22	0.045	NA	9.78	7.23	
165	Trichloroethylene (TCE)	Organic	Two step synthesis	Na_2S	C/C_0	22	0.071	NA	9.78	6.79	
166	Trichloroethylene (TCE)	Organic	Two step synthesis	Na_2S	C/C_0	22	0.091	NA	9.78	5.93	
167	Trichloroethylene (TCE)	Organic	Two step synthesis	Na_2S	C/C_0	22	0.005	NA	9.78	23.13	

168	Trichloroethylene (TCE)	Organic	Two step synthesis	Na_2S	C/C_0	22	0.025	NA	9.78	23.52	
169	Trichloroethylene (TCE)	Organic	Two step synthesis	Na_2S	C/C_0	22	0.05	NA	9.78	23.11	
170	Trichloroethylene (TCE)	Organic	Two step synthesis	Na_2S	C/C_0	22	0.1	NA	9.78	19.66	
171	Trichloroethylene (TCE)	Organic	Two step synthesis	Na_2S	C/C_0	22	0.252	NA	9.78	20.64	
172	Trichloroethylene (TCE)	Organic	Two step synthesis	Na_2S	C/C_0	22	0.505	NA	9.78	6.46	
173	Cd (II)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	removal rate	22	0.035	NA	42.64	32.24	
174	Cd (II)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	removal rate	22	0.07	NA	42.64	16.11	
175	Cd (II)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	removal rate	22	0.14	NA	42.64	25.2	
176	Cd (II)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	removal rate	22	0.21	NA	42.64	57.73	
177	Cd (II)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	removal rate	22	0.28	NA	42.64	81.76	
178	Cd (II)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	removal rate	22	0.28	4	42.64	32	26
179	Cd (II)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	removal rate	22	0.28	5	42.64	76.37	
180	Cd (II)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	removal rate	22	0.28	6	42.64	79.51	
181	Cd (II)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	removal rate	22	0.28	7	42.64	79.67	
182	Cd (II)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	removal rate	22	0.28	8	42.64	79.84	
183	Cd (II)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	removal rate	22	0.28	9	42.64	79.84	
184	Zn (II)	Heavy Metal	One-step synthesis	Na_2S	C/C_0	NA	0.75	NA	300	216.97	27
185	Ni (II)	Heavy Metal	One-step synthesis	Na_2S	C/C_0	NA	0.75	NA	287.70492	150.9	
186	Tetrabromobisphenol A (TBBPA)	Organic	Two step synthesis	S^0	C/C_0	30	0.015	NA	5.73	8.1	
187	Tetrabromobisphenol A (TBBPA)	Organic	Two step synthesis	S^0	C/C_0	30	0.025	NA	5.73	8.7	28
188	Tetrabromobisphenol A (TBBPA)	Organic	Two step synthesis	S^0	C/C_0	30	0.05	NA	5.73	8.7	
189	Tetrabromobisphenol A (TBBPA)	Organic	Two step synthesis	S^0	C/C_0	30	0.1	NA	5.73	8.7	

190	Tetrabromobisphenol A (TBBPA)	Organic	Two step synthesis	S^0	C/C_0	30	0.25	NA	5.73	1.26	
191	Tetrabromobisphenol A (TBBPA)	Organic	Two step synthesis	$Na_2S_2O_4$	C/C_0	30	0.75	NA	5.73	8.7	
192	Tetrabromobisphenol A (TBBPA)	Organic	Two step synthesis	$Na_2S_2O_4$	C/C_0	30	0.5	NA	5.73	8.63	
193	Tetrabromobisphenol A (TBBPA)	Organic	Two step synthesis	$Na_2S_2O_4$	C/C_0	30	0.1	NA	5.73	1.77	
194	Tetrabromobisphenol A (TBBPA)	Organic	Two step synthesis	$Na_2S_2O_4$	C/C_0	30	0.05	NA	5.73	0.7	
195	Tetrabromobisphenol A (TBBPA)	Organic	Two step synthesis	$Na_2S_2O_4$	C/C_0	30	0.025	NA	5.73	3.82	
196	Tetrabromobisphenol A (TBBPA)	Organic	Two step synthesis	$Na_2S_2O_4$	C/C_0	30	0.015	NA	5.73	4.57	
197	Tetrabromobisphenol A (TBBPA)	Organic	Two step synthesis	Na_2S	C/C_0	30	0.5	NA	5.73	0.83	
198	Tetrabromobisphenol A (TBBPA)	Organic	Two step synthesis	Na_2S	C/C_0	30	0.3	NA	5.73	3.31	
199	Tetrabromobisphenol A (TBBPA)	Organic	Two step synthesis	Na_2S	C/C_0	30	0.1	NA	5.73	3.62	
200	Tetrabromobisphenol A (TBBPA)	Organic	Two step synthesis	Na_2S	C/C_0	30	0.05	NA	5.73	6.86	
201	Tetrabromobisphenol A (TBBPA)	Organic	Two step synthesis	Na_2S	C/C_0	30	0.025	NA	5.73	6.77	
202	Tetrabromobisphenol A (TBBPA)	Organic	Two step synthesis	Na_2S	C/C_0	30	0.015	NA	5.73	5.12	
203	Mo (VI)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.1	7	12.3	67.62	
204	Mo (VI)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.5	7	12.3	87.3	
205	Mo (VI)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	1	7	12.3	68.85	
206	Mo (VI)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.5	4	12.3	91.11	
207	Mo (VI)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.5	5	12.3	93.65	29
208	Mo (VI)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.5	6	12.3	84.76	
209	Mo (VI)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.5	7	12.3	77.78	
210	Mo (VI)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.5	8	12.3	9.84	
211	Mo (VI)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.5	9	12.3	3.17	

212	Polybrominated Diphenyl Ethers (BDE-209)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.517	6	0.23	0.88	30
213	Polybrominated Diphenyl Ethers (BDE-47)	Organic	One-step synthesis	$Na_2S_2O_4$	C/C_0	25	0.517	6	0.07	0.09	
214	As (III)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	$\ln(C/C_0)$	NA	0.025	7	19.65	19.9	31
215	As (III)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	$\ln(C/C_0)$	NA	0.05	7	19.65	19.93	
216	As (III)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	$\ln(C/C_0)$	NA	0.1	7	19.65	19.98	
217	As (III)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	$\ln(C/C_0)$	NA	0.15	7	19.65	19.84	
218	As (III)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	$\ln(C/C_0)$	NA	0.2	7	19.65	18.98	
219	As (V)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	$\ln(C/C_0)$	NA	0.025	7	19.49	19.83	
220	As (V)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	$\ln(C/C_0)$	NA	0.05	7	19.49	19.92	
221	As (V)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	$\ln(C/C_0)$	NA	0.1	7	19.49	19.94	
222	As (V)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	$\ln(C/C_0)$	NA	0.15	7	19.49	19.78	
223	As (V)	Heavy Metal	One-step synthesis	$Na_2S_2O_4$	$\ln(C/C_0)$	NA	0.2	7	19.49	19.65	

Table S2. List of articles selected for the meta-analysis about characterization

ID	Synthesis	Sulfur reagent	S/Fe	Size Distribution	mean	minSe	maxSe	Reference
1	One-step synthesis	$Na_2S_2O_4$	0	50-80 nm	65	15	15	32
2	Two-step synthesis	Na_2S	0	50nm	50	0	0	33
3	Two-step synthesis	Na_2S	0.1	100nm	100	0	0	
4	Two-step synthesis	Na_2S	0.0000	74.5±27.3	75	27.3	27.3	13
5	Two-step synthesis	Na_2S	0.0057	72.6±24.9	73	24.9	24.9	
6	Two-step synthesis	Na_2S	0.0286	72.3±24.8	72	24.8	24.8	
7	Two-step synthesis	Na_2S	0.1429	75.4±26.2	75	26.2	26.2	
8	One-step synthesis	$Na_2S_2O_4$	0.0000	80~100	90	10	10	5
9	One-step synthesis	$Na_2S_2O_4$	0.1030	100~200	150	50	50	
10	One-step synthesis	$Na_2S{\cdot}9H_2O$	0.0833	20 and 427	224	203	203	34
11	One-step synthesis	Na_2S	0.75	50-100	75	0	0	16
12	Two-step synthesis	Na_2S	0	251.9	252	0	0	18
13	Two-step synthesis	Na_2S	0.2	236.8	237	0	0	
14	Two-step synthesis	Na_2S	0	30	30	0	0	35
15	Two-step synthesis	Na_2S	0.3	20	20	0	0	
16	One-step synthesis	$Na_2S_2O_4$	0	80-100	90	10	10	36
17	One-step synthesis	$Na_2S_2O_4$	0.103	100-200	150	50	50	

18	Two-step synthesis	Na_2S	0	30-80	55	25	25	37
19	One-step synthesis	$Na_2S_2O_4$	0	50-70	60	10	10	38
20	One-step synthesis	$Na_2S_2O_4$	0.5	100	100	0	0	
21	One-step synthesis	$Na_2S_2O_4$	0	70-110	90	20	20	7
22	One-step synthesis	$Na_2S_2O_4$	0.3	100	100	0	0	
23	One-step synthesis	$Na_2S_2O_4$	0.000	10-20	15	5	5	8
24	One-step synthesis	$Na_2S_2O_4$	0.001	50.000	50	0	0	
25	One-step synthesis	$Na_2S_2O_4$	0.017	100.000	100	0	0	
26	One-step synthesis	$Na_2S_2O_4$	0.100	200.000	200	0	0	
27	One-step synthesis	$Na_2S_2O_4$	0.000	100.000	100	0	0	39
28	One-step synthesis	$Na_2S_2O_4$	0.210	200.000	200	0	0	
29	One-step synthesis	$Na_2S_2O_4$	0	60	60	0	0	10
30	One-step synthesis	$Na_2S_2O_4$	0.3	270	270	0	0	
31	Two-step synthesis	Na_2S	0.0000	50.0000	50	0	0	22
32	Two-step synthesis	Na_2S	0.1449	50.0000	50	0	0	
33	One-step synthesis	$Na_2S_2O_3$	0.05	100	100	0	0	23
34	Two-step synthesis	$Na_2S_2O_3$	0.05	50	50	0	0	
35	Two-step synthesis	Na_2S	0	20-80	50	30	30	25
36	Two-step synthesis	Na_2S	0.040	150.000	150	0	0	

37	Two-step synthesis	Na_2S	0.067	201.000	201	0	0	
38	One-step synthesis	$Na_2S_2O_4$	0.28	200	200	0	0	26
39	One-step synthesis	$Na_2S_2O_4$	0	70-110	90	20	20	40
40	One-step synthesis	$Na_2S_2O_4$	0.3	120-320	220	100	100	
41	One-step synthesis	$Na_2S_2O_3$	0	54.5-67.7	61	6.5	6.5	41
42	One-step synthesis	$Na_2S_2O_3$	0.25	89.9-94.5	92	2.1	2.1	
43	One-step synthesis	$Na_2S_2O_4$	0.00	50-100	75	25	25	42
44	One-step synthesis	$Na_2S_2O_4$	0.03	50	50	0	0	
45	One-step synthesis	$Na_2S_2O_4$	0	80 ～ 100	90	10	10	3
46	One-step synthesis	$Na_2S_2O_4$	0.103	100 ～ 200	150	50	50	

Table S3. Turn R into percentage of increased decontamination capacity

Fig.	R			Percentage %		
	Mean	95% CI		Mean	95% CI	
2b	0.45	0.28	0.62	56.83	32.31	85.89
	0.78	0.62	0.94	118.15	85.89	156.00
2c	0.00	-0.64	0.65	0.00	-47.27	91.55
	0.02	-0.63	0.66	2.02	-46.74	93.48
	0.43	0.00	0.87	53.73	0.00	138.69
	0.59	0.13	1.04	80.40	13.88	182.92
	0.73	0.44	1.01	107.51	55.27	174.56
	0.92	0.37	1.46	150.93	44.77	330.60
	-0.03	-0.45	0.39	-2.96	-36.24	47.70
	0.00	-0.72	0.72	0.00	-51.32	105.44
	1.00	0.54	1.46	171.83	71.60	330.60
	1.27	0.88	1.66	256.09	141.09	425.93
	0.06	-0.42	0.54	6.18	-34.30	71.60
	1.29	0.81	1.78	263.28	124.79	492.99
	-0.12	-0.76	0.52	-11.31	-53.23	68.20
	0.58	0.08	1.09	78.60	8.33	197.43
	-0.47	-1.06	0.12	-37.50	-65.35	12.75
	0.65	0.07	1.24	91.55	7.25	245.56
	1.35	0.84	1.86	285.74	131.64	542.37
	-0.27	-0.61	0.07	-23.66	-45.66	7.25
	1.30	1.08	1.52	266.93	194.47	357.22
3a	0.45	0.26	0.63	56.83	29.69	87.76
	0.54	-0.14	1.21	71.60	-13.06	235.35
	0.73	0.51	0.96	107.51	66.53	161.17
	0.83	0.60	1.06	129.33	82.21	188.64
3b	0.24	-0.32	0.81	27.12	-27.39	124.79

	0.47	0.29	0.66	60.00	33.64	93.48
	1.16	0.92	1.40	218.99	150.93	305.52
	0.51	0.31	0.71	66.53	36.34	103.40
	0.02	-0.77	0.81	2.02	-53.70	124.79
3c	-0.19	-0.66	0.28	-17.30	-48.31	32.31
	0.25	0.04	0.46	28.40	4.08	58.41
	0.94	0.58	1.30	156.00	78.60	266.93
	0.94	0.59	1.29	156.00	80.40	263.28
	0.84	0.57	1.11	131.64	76.83	203.44
	0.65	0.41	0.89	91.55	50.68	143.51
	1.35	0.85	1.85	285.74	133.96	535.98
	0.58	0.08	1.07	78.60	8.33	191.54
4a	0.55	0.28	0.82	73.33	32.31	127.05
	0.69	0.40	0.98	99.37	49.18	166.45
	0.08	-0.44	0.61	8.33	-35.60	84.04
	0.62	0.36	0.88	85.89	43.33	141.09
	0.77	0.51	1.02	115.98	66.53	177.32
	0.91	0.65	1.17	148.43	91.55	222.20
4b	0.27	-0.40	0.94	31.00	-32.97	156.00
	0.19	-0.28	0.65	20.92	-24.42	91.55
	0.53	0.27	0.79	69.89	31.00	120.34
	1.01	0.58	1.44	174.56	78.60	322.07
	0.52	0.06	0.98	68.20	6.18	166.45
	0.86	0.5	1.23	136.32	64.87	242.12
	0.80	0.62	0.98	122.55	85.89	166.45
	0.00	-0.27	0.26	0.00	-23.66	29.69
5b	0.90	-0.08	1.88	145.96	-7.69	555.35
	0.86	0.18	1.54	136.32	19.72	366.46
	0.76	-0.07	1.58	113.83	-6.76	385.50

	0.53	-0.13	1.19	69.89	-12.19	228.71
	0.19	-0.24	0.61	20.92	-21.34	84.04
	-0.41	-1.19	0.38	-33.63	-69.58	46.23

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