Electronic supplementary material

Environmental Science: Water Research & Technology

Present status of hybrid material for potable water decontamination: A Review

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Effect of pH and zeta potential on uptake of uranium using TiO2 microspheres:

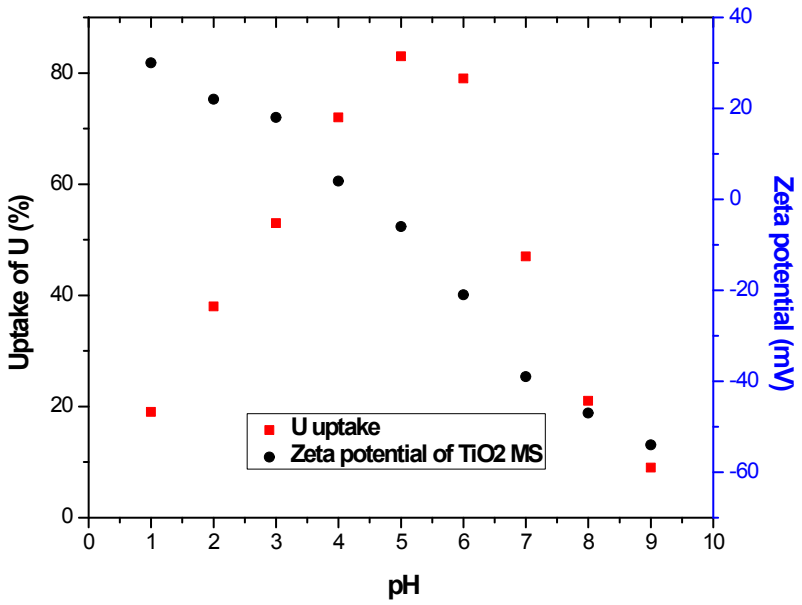

Fig. S1: % Uptake of U as a function of pH and zeta potential (Reprinted with permission from Ref. no. 302, Copyright 2020 Royal Society of Chemistry)

Percentage uptake of uranium was studied at different pH (1-10), keeping contact time 24 h; uranium concentration 100 µg mL-1 and Cal-Alg-TiO2 MS beads as 10 mg mL-1. Experimental findings showed that uranium removal is highly dependent on pH (Fig. S1) with maximum sorption occurring around pH 5.0. The phenomenon can be explained based on the zeta potential of TiO2 microspheres and species of uranium present at a particular pH. The zeta

potential which is the measure of surface charge on TiO2 microspheres is positive below pH 4 (point of zero charge or PZC) and negative above pH 4. Now uranium is present as UO_2^{2+} (uranyl ion) in acidic medium (pH 2-5). As pH increases beyond 5, uranyl ions get hydrolyzed. At higher pH>5 Hydrolyzed species of uranium like $[(UO_2)_3(OH)_5]^+$, $[(UO_2)_2(OH)_2]^{2+}$ and their polymeric species are predominant. Many of these species are negatively charged, some positive and few are neutral. At extreme pH vales (pH 8-10) negatively charged species of uranium will dominate. pH 5-6 was therefore the favourable window where TiO2 microspheres and uranium species are oppositely charged to get sorbed onto the surface making sorption favourable at pH 5-6. At highly acidic pH (1-2) there will be a competition between hydronium (H_3O^+) and uranyl (UO_2^{2+}) ions.

Water quality parameters:

This table (Table S1) provides the maximum allowable limits of various water quality parameters in drinking water as prescribed by WHO.

Table S1: Limit of water quality parameters in potable water as per WHO guidelines

Sl. No	Parameter	Maximum allowable concentration
1	Colour	15 True Colour Units
2	Turbidity	5.0 NTU
3	pH	6.5-8.5
4	Total Hardness (as $CaCO_3$)	500 mg L^{-1}
5	Chlorides (as Cl)	250 mg L^{-1}
6	Dissolved Solids	1000 mg L^{-1}
7	Sulphate (as SO_4^{2-})	400 mg L^{-1}
8	Nitrate (as NO_3^+)	10 mg L^{-1}
9	Flouride (as F^-)	1.5 mg L^{-1}
Micro Pollutants (Heavy Metals & Pesticides)		
10	Zinc (as Zn)	5.0 mg L^{-1}
11	Iron (as Fe)	0.3 mg L^{-1}
12	Manganese (as Mn)	0.1 mg L^{-1}
13	Copper (as Cu)	1.0 mg L^{-1}
14	Arsenic (as As)	0.01 mg L^{-1}
15	Cyanide (as CN)	0.1 mg L^{-1}
16	Lead (as Pb)	0.05 mg L^{-1}

17	Chromium (as Cr^{6+})	0.05 mg L^{-1}
18	Aluminium (as Al)	0.2 mg L^{-1}
19	Cadmium (as Cd)	0.005 mg L^{-1}
20	Selenium (as Se)	0.01 mg L^{-1}
21	Mercury (as Hg)	0.001 mg L^{-1}
22	Sodium (as Na)	200 µg L^{-1}
23	Uranium	17 µg L^{-1}
24	Aldrin & dieldrin	0.03 µg L^{-1}
25	DDT	1.0 µg L^{-1}
26	Benzene	10.0 µg L^{-1}
27	Hexachlorobenzene	0.01 µg L^{-1}
28	Pentachlorophenol	10.0 µg L^{-1}
Radionuclides		
29	Alpha emitters	0.1 Bq L^{-1}
30	Beta emitters	1.0 Bq L^{-1}