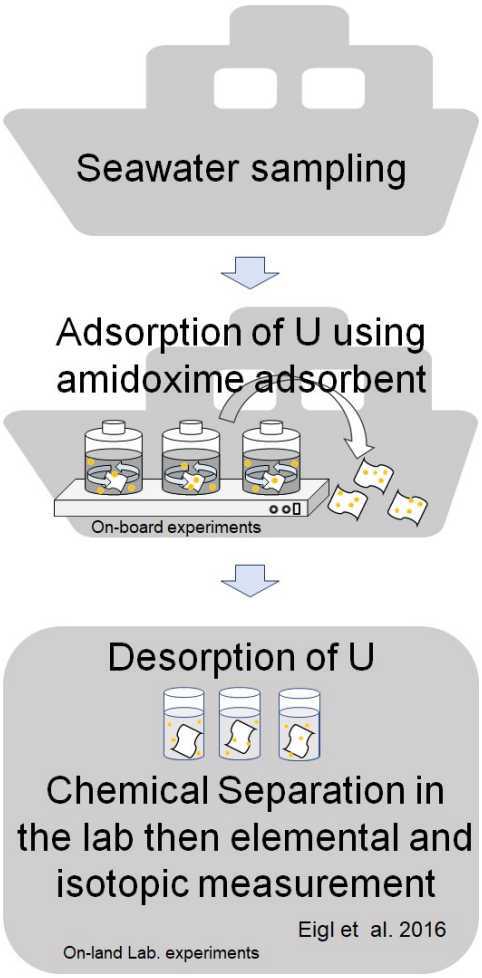
Electronic Supplementary Material (ESI) for Analytical Methods.

Supplementary information

1. The concept of U measurement in large volume seawater sample using the new adsorbent



2. Homogeneity assessment for the density of the amidoxime group in the adsorbent

To check the homogeneity of the adsorbent synthesized by the method described in section 2-2, the density of the amidoxime group in the adsorbent was calculated in each subsample (~20 cm^2), the subsamples (N = 20) being derived from a single master batch (4300 cm^2). The synthesis procedure was conducted at typical laboratory scale at the beginning of the study. Table S1 shows the densities of the subsamples containing the amidoxime groups. The average density for the batch was found to be 3.55±0.13 mmol/g (0.0183±0.0008 mmol/cm^2). The variation in density for the subsamples was 4.53%. The variation in the percentage grafting for a large-scale experiment was 5% as reported by Hoshina et al. (2012). The percentage grafting, which can be used to evaluate the quality of the synthesis, was considered to be relatively consistent even in the case of the large-scale grafting experiment (see Figure 3 in the main body of Hoshina et al.

2012). Therefore, it can be concluded that the quality of the adsorbent used in the present study was fit for purpose.

Table S1. The amidoxime group densities in subsamples (~20㎠)

No.	Amidoxime group density	
	[mmol/g]	[mmol/cm^2]
1	3.525	0.01738
2	3.502	0.01901
3	3.566	0.01910
4	3.591	0.01955
5	3.500	0.01811
6	3.556	0.01811
7	3.572	0.01842
8	3.358	0.01734
9	3.501	0.01843
10	3.574	0.01805
11	3.092	0.01572
12	3.686	0.01919
13	3.621	0.01879
14	3.665	0.01841
15	3.595	0.01862
16	3.653	0.01843
17	3.574	0.01865
18	3.619	0.01821
19	3.641	0.01819
20	3.654	0.01902
Average	3.552 ± 0.132	0.01834 ± 0.00083

3. U extraction from the adsorbent - calcination method

The adsorbent was removed from the seawater sample after the adsorption of the U and rinsed with MQ water. The rinsed adsorbent was placed in a 50 ml quartz beaker. For the calcination of the adsorbent, the temperature of the muffle oven was changed sequentially as follows:

Step 1 Raise gradually from room temperature to 100°C (over 1 hour)

Step 2 Maintain 100°C for 1 hour

Step 3 Raise gradually from 100°C to 450°C (over 1 hour)

Step 4 Maintain 450°C for 3 hours

Step 5 Let cool to room temperature

The uranium in the ash was extracted by adding 5 g of 3 mol/dm^3 HNO_3 to the beaker and allowing to stand for about 1 h. The leached solution was then filtered (0.45 μm filter). This solution is treated as the "recovered solution" in the case of the calcination experiment.

Reference

R. Eigl, P. Steier, K. Sakata and A. Sakaguchi, *J. Environ. Radioact.* 2017, **169-170**, 70-78.

H. Hoshina, N. Kasai, T. Shibata, Y. Aketagawa, M. Takahashi, A. Yoshii, Y. Tsunoda and N. Seko, *Radiat. Phys. Chem*., 2012, **81**, 1033-1035.