

Supplementary information

Table S1 Percentage of REEs peak area (%) of different loading rates to peak area of 1.5 mL min⁻¹.

Rate/ mL min ⁻¹	Y	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
2	95.96	92.62	89.46	94.56	92.86	96.85	102.03	96.35	99.09	98.76	99.66	96.97	100.45	98.53	92.49
2.5	94.21	82.54	82.69	88.17	87.12	96.34	100.10	95.68	95.42	96.71	95.96	94.38	98.17	97.10	96.28
3	89.44	77.19	78.37	82.05	83.43	94.48	97.45	93.85	93.26	90.22	94.91	90.66	91.93	94.79	91.30
3.5	89.44	77.19	78.37	82.05	83.43	94.48	97.45	93.85	93.26	90.22	94.91	90.66	91.93	94.79	91.30
4	87.53	68.23	71.99	77.03	78.65	90.92	87.62	89.66	85.86	88.98	90.31	88.33	87.82	91.16	88.57

Table S2 Relative coefficients (R²) between REEs peak areas and loading times.

Time/ min	Y	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
4	0.9997	0.996	0.9997	0.9985	0.9965	0.997	0.9943	0.9985	0.9997	1	0.995	0.9991	0.9952	0.9991	0.9957
5	0.9999	0.9984	0.9997	0.9976	0.9934	0.9988	0.9977	0.999	0.9994	0.996	0.998	0.9995	0.9957	0.999	0.9972
6	0.9999	0.999	0.9999	0.9987	0.9958	0.9992	0.9952	0.9982	0.9996	0.9974	0.9989	0.9994	0.9978	0.9992	0.9986
7	1	0.9958	0.9998	0.9991	0.9973	0.9988	0.9965	0.999	0.9997	0.9979	0.9994	0.9996	0.9987	0.9992	0.9982
8	0.9998	0.997	0.9982	0.9993	0.9959	0.9984	0.9949	0.9993	0.9996	0.9987	0.9995	0.9995	0.999	0.9995	0.9981
9	0.9999	0.9963	0.9986	0.9995	0.9969	0.9984	0.9958	0.9995	0.9997	0.999	0.9989	0.9994	0.9991	0.9996	0.9981

Table S3 REEs concentrations measured by the presented method from samples collected in the Jiulong River Estuary (water samples were collected in April 2015)

Elements	Sample salinity							
	2.3	4.4	11.9	16.5	21.6	25.2	29.5	30.4
REEs concentration/ng kg ⁻¹								
Y	56.61	9.54	7.14	146.28	345.67	118.16	218.36	116.84
La	16.14	4.56	1.67	20	65.1	20.04	41.27	18.57
Ce	16.67	4.52	0.03	23.39	66.47	18.10	42.48	20.91
Pr	2.76	0.65	0.1	4.02	13.24	3.29	7.97	3.35
Nd	12.09	3.02	0.46	17.89	61.59	14.54	37.16	14.76
Sm	2.66	0.67	0.07	4.61	14.76	3.63	9.07	3.43
Eu	0.47	0.1	UD ^a	0.87	2.89	0.65	1.65	0.76
Gd	11.98	2.4	0.23	8.12	26.02	6.49	16.01	6.43
Tb	0.53	0.07	UD	1.13	3.6	0.87	2.16	0.92
Dy	4.79	0.78	0.14	9.56	27.56	7.53	16.9	8.07
Ho	1.13	0.18	0.03	2.5	6.96	2	4.29	2.04
Er	4.11	0.76	0.19	9.7	24.01	7.78	15.05	7.87
Tm	0.57	0.07	UD	1.51	3.34	1.17	2.36	1.21
Yb	4.94	1.1	0.31	11.87	23.47	9.17	17.61	9.65
Lu	1.05	0.19	0.01	1.99	3.77	1.46	2.77	1.58

^a UD=under detection limit.

Table S4 REEs concentrations measured by the presented method from samples collected in Taiwan Strait (seawaters were collected at the station C9, 22°07'13"N, 118°24'41"E, in April 2014.)

Elements	Sample depth/m										
	10	50	100	150	200	300	400	500	600	800	1000
REEs concentration/ng kg ⁻¹											
Y	10.48	9.87	9.38	9.46	10.78	13.98	15.43	16.93	19.39	21.94	26.49
La	1.57	1.21	1.12	1.85	2.56	3.12	3.03	3.59	4.14	4.74	7.33
Ce	2.54	0.66	0.63	0.51	0.74	0.58	0.29	1.27	0.94	0.59	11.49
Pr	0.31	0.24	0.23	0.2	0.3	0.37	0.42	0.48	0.53	0.66	0.94
Nd	1.24	1.26	1.03	0.91	1.41	1.74	2.05	2.16	2.78	2.8	4.24
Sm	0.29	0.31	0.22	0.26	0.29	0.34	0.35	0.51	0.44	0.59	0.75
Eu	0.11	0.09	0.07	0.09	0.08	0.11	0.11	0.13	0.12	0.16	0.21
Gd	0.49	0.47	0.41	0.43	0.44	0.69	0.63	0.78	0.81	0.99	1.27
Tb	0.09	0.07	0.06	0.06	0.08	0.1	0.12	0.11	0.14	0.14	0.19
Dy	0.63	0.64	0.53	0.53	0.58	0.7	0.79	0.87	1.05	1.13	1.56
Ho	0.13	0.14	0.12	0.12	0.14	0.19	0.2	0.23	0.27	0.3	0.34
Er	0.51	0.49	0.41	0.4	0.54	0.57	0.74	0.78	0.89	1.1	1.25
Tm	0.06	0.07	0.04	0.06	0.06	0.07	0.1	0.11	0.14	0.16	0.18
Yb	0.44	0.41	0.37	0.45	0.47	0.64	0.75	0.85	0.95	1.14	1.46
Lu	0.05	0.05	0.04	0.05	0.07	0.09	0.1	0.14	0.17	0.2	0.23