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Extraction behavior of Mo(VI), Mo(V), W(VI), and W(V) from HCl solutions by Aliquat 336

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It is expected that the element 106 seaborgium (Sg) is redox active, because molybdenum (Mo) and tungsten (W), the homologues of Sg, have various oxidation states. Electrochemistry of superheavy elements (SHEs), including Sg, with atomic numbers ≥ 104 is very interesting, because valence electron structure of SHE would be influenced by strong relativistic effect. However, the voltammetry for measurement of redox potential cannot be applied to SHE chemistry, because the SHE nuclides can only be produced as one atom at a time and have short half-lives. Therefore, the investigation of reduction potential of Sg ion should be combined with chemical separation to obtain reduction ratio of Sg. We are planning to study the reduction behavior of Sg by the electrochemical method combined with solvent extraction.
We carried out solvent extraction of Mo(VI), Mo(V), W(VI), and W(V) in 0.01–0.36 M Aliquat 336 / 0.1–11 M HCl system as model experiments for Sg. The HCl solutions of Na2[MoO4]•2H2O, [MoCl5], and Na2[WO4]•2H2O were used for extraction of Mo(VI), Mo(V), and W(VI), respectively. The HCl solutions for Mo(V) and W(V) were prepared by electrochemical method and SnCl2•2H2O as reductant, respectively. Extraction behaviors of mononuclear Mo and W were investigated using carrier-free radiotracers 99Mo and 181W, which were produced as 235U(n, f) and 181Ta (p, n) reaction, respectively.
The distribution ratios (D) of Mo(V) and W(V) were higher than those of Mo(VI) and W(VI), respectively. The D values for Mo(V) obtained by the reduction of Mo(VI) were in good agreement with those obtained with [MoCl5], suggesting that reduction behavior of the group-6 elements can be observed by solvent extraction. The D values of carrier-free Mo(VI) and W(VI) are almost the same as those with macro amounts in 6–11 M HCl. This condition would be suitable for the Sg experiments.

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