

# Extraction systems for SISAK-BGS transactinide experiments: A new look at selectivity and extraction yields

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Recently the fast automated liquid-liquid extraction system SISAK was successfully used to study the chemical behavior of element 104, rutherfordium [1]. This was made possible by coupling the SISAK system to the Berkeley Gas filled Separator (BGS). The BGS was used to achieve a physical pre-separation from unwanted reaction products and the beam. This pre-separation method allows the use of a different class of extraction systems in future SISAK experiments.

The first goal of experiments to study the chemical behavior of transactinide elements is always to establish the place of these elements in the periodic table. The next step is to systematically compare the properties of the transactinides with those of their lighter homologues to gain further insights into the periodicities along a group of the periodic table and evidence for influence of relativistic effects. This requires differentiating between elements belonging to the same group.

In the past it was necessary to choose extraction systems that removed all interfering reaction products and left only the element of interest. Consequently a very high extraction yield had to be favored over selectivity between the different homologues within the group being studied.

Fig. 1 shows the yields for the extraction of Zr and Hf with trioctyl amine in toluene from oxalic acid together with the ratio of the yields [2]. In this system the extraction yield for both elements is very high. But if only a few atoms of each element are present, it is impossible to see differences in the extraction behavior of Zr and Hf. This means the system is not suitable for study of selectivity in experiments in which elements are produced only one atom at a time.

Fig. 2 shows the extraction yields and the yield ratio for a different system, the extraction of Zr and Hf from hydrochloric acid into 0.25 M tributyl phosphate in toluene. The yield changes drastically in the concentration range from 6 to 10

M HCl. The separation efficiency is not as high as in the oxalic acid/TOA system. But this system is an example of an extraction system that shows a higher selectivity between Zr and Hf.

Due to the success of pre-separation, selectivity between the members of the same group of the periodic table can be favored over efficient separation from elements belonging to other groups when designing extraction systems for future experiments.

## Footnotes and References

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1. J.P. Omtvedt et al., LBNL-47549 (2001)
2. L.A. Omtvedt et al., LBNL-47549 (2001)

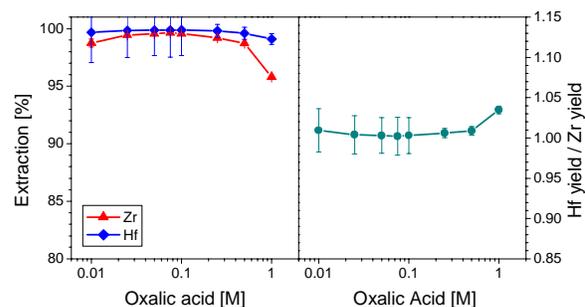


Fig. 1. Zr/Hf extraction yields and yield ratio for extraction from oxalic acid into 0.1 M TBP in toluene

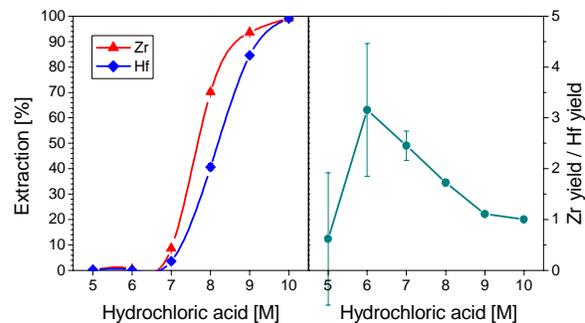


Fig. 2. Zr/Hf extraction yields and yield ratio for extraction from hydrochloric acid into 0.25 M TBP in toluene