

# Liquid – liquid – extraction with the MicroSISAK – system

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For studies of the chemical properties of the heaviest elements ( $Z > 103$ ), it is indispensable to use fast and efficient systems, because of their short half-lives and low production rates [1]. A promising possibility for liquid chemistry in this field is the liquid – liquid – extraction by using micro reaction technology [2]. Therefore the *Institut für Mikrotechnik Mainz* developed a device, that agitates two liquids via a static digital mixer and separates them again via a hydrophobic Teflon membrane. The past experiments have shown that the principal idea could be realised with this apparatus called *MicroSISAK*.

The most important parameters to look at, are the separation of both liquid phases and the extraction yield. Last year, we reported on an efficient apparatus, with that the separation was increased by setting a backpressure at the outlet of the aqueous phase of our device [3]. The higher the flow rate we use to put the liquids in the microreactor, the higher is the needed backpressure to separate them. The correlation of flow rate and back pressure is shown in Figure 1 for a yield of separation not less than 98%.

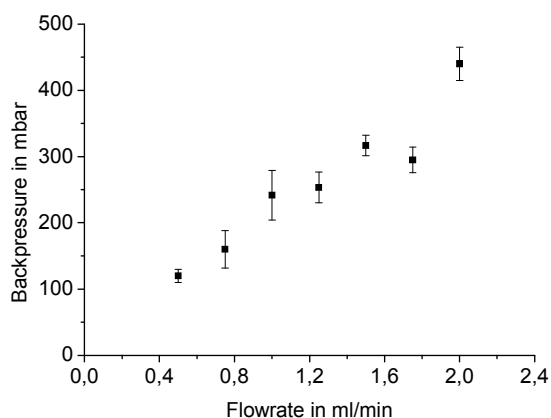


Figure 1. Required back pressure for a separation yield over 98% depending on the flow rate

The extraction yield has been studied in different phase systems (see Table 1):

Table 1: reviewed extraction systems

nuclid / amount	aqueous solution	extraction agent
Hf-181 $\sim 10^{-6}$ mol/l	H <sub>2</sub> SO <sub>4</sub> 0,5 mol/l	TOA 1 mol/l in toluene
Hf-181 $\sim 10^{-6}$ mol/l	HNO <sub>3</sub> 6 mol/l	DBP 0,25 mol/l in toluene
Tc-99m carrier-free	HNO <sub>3</sub> 0,01 mol/l	TPAC $10^{-4}$ mol/l in CHCl <sub>3</sub>

The calculation of the extraction yield results from the  $\gamma$ -decay of the used nuclide. The activity in the organic phase after mixing and separation is compared with the one in the aqueous phase before the latter is pumped in

the micro reactor. After some batch experiments, the three extraction systems were tested with different flow rates. The results of two systems are compared with the batch experiments in Figure 2 and 3.

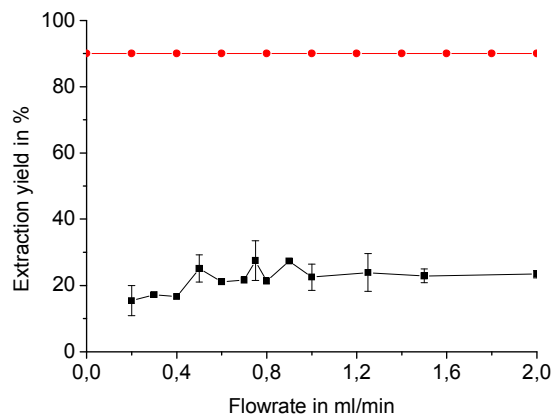


Figure 2. Extraction yield vs. flow rate for Hf with TOA, the red line shows the results of the batch experiments

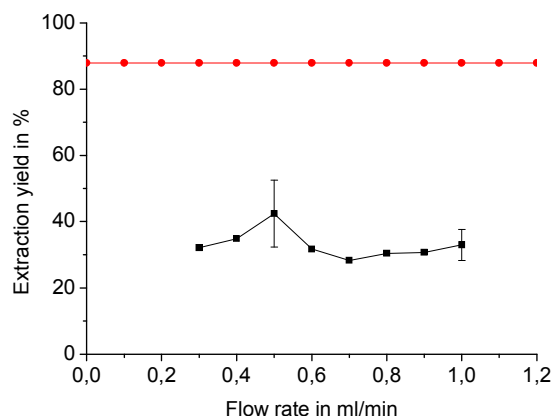


Figure 3. Extraction yield vs. flow rate for Tc with TPAC, the red line shows the results of the batch experiments

For these three extraction systems and the attempted flow rates, the extraction yield ranges between 15% and 45%. This is unsatisfactory.

To find out, why the extraction is not as good as expected, there are experiments running to explore the effects of the contact time of the emulsion. There are also plans to run the MicroSISAK with higher temperature to check out the influence of the diffusion between the two phases.

## References

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