Bioleaching of rare earth elements from fluorescent phosphor with the tea fungus Kombucha

S. HOPFE[1*], S. KUTSCHKE[1*], R. MÖCKEL[2] AND K. POLLMANN[1]

[12]Helmholtz Institute Freiberg for Resource Technology, Department Processing[1] and Analytics[2], Halsbrücker Straße 34, 09599 Freiberg, Germany (*correspondence: s.hopfe@hzdr.de; s.kutschke@hzdr.de)

Rare earth elements (REE) are used in mostly all new technologies and until now, there is nearly no recycling of REE containing end-of-life products [1]. Furthermore, only poor information is available regarding interactions of microorganisms with REE and there are almost no studies describing the bioleaching of REE. However, it can be assumed that microorganisms play an important role in the biogeochemistry of REE. This study investigates the potential of organic acid producing microbes to extract REE from technical waste.

During recycling of energy-saving bulbs fluorescent phosphor (FP) is collected as a distinct fraction. It contains about 10% REE-oxides bound in the hardly water-soluble triband dyes as oxides, phosphates and aluminates [2]. In the present, the feasibility of the mixed culture Kombucha to dissolve the REE-compounds from FP was examined. Kombucha is a symbiosis of acetic bacteria and yeasts that grows on green tea with sucrose producing organic acids. Besides batch- and fed-batch approaches with the whole culture, also experiments with single Kombucha-organisms and culture supernatant were performed. The concentrations of the solubilised metal ions in the supernatant were measured with ICP-MS and the produced organic acids were analysed by HPLC. Futhermore, we tried to determine the microbial diversity trough DNA-analysis.

It could be shown, that the production of organic acids by the microoganisms of Kombucha lead to considerable higher concentrations of REE in the supernatant than in the control. These results show that it is possible to dissolve the REE-compounds of FP by the help of microbial processes. Moreover, it provides the basis for the development of an eco-friendly alternative to the currently applied methods.

[1] European Commission (2014) *On the review of the list of critical raw materials for the EU and the implementation of the Raw Materials Initiative*, Brüssel. [2] Haucke *et al.* (2011) *Verfahren zur Rückgewinnung seltener Erden aus Leuchtstofflampen*, Osram AG.