

Siderophore assisted recycling of gallium and germanium from their low concentrated wastewaters

Critical metals like gallium (Ga) and germanium (Ge) hold strategic importance in the development of modern technologies like optoelectronic devices, semiconductors, transistors, light-emitting diodes, and many more[1,2]. The supply of these metals is not assured due to many reasons. Therefore, new sources and efficient recovery techniques need to be identified. Thus, attention should be drawn to sources with very low concentrations of these metals which are usually neglected. The reason for such negligence is the presence of high concentrations of contaminant metals and very low concentrations of these critical metals. Thus, a highly specific, selective, economical, and sustainable process is needed to recover and recycle these metals.

Siderophore assisted technology “GaLIophore” could be a one-point solution. In GaLIophore siderophore Desferrioxamine B (DFOB) was used to selectively adsorb Ga from industrial wastewater[3]. DFOB is a highly selective molecule that forms a highly stable complex with Ga in an equimolar stoichiometric ratio. It was seen that the complexation of Ga with DFOB was independent of pH and background electrolyte. This technology was then extended to Ge and the complexation of Ge with DFOB was studied. However, with Ge, it was seen that complexation was preferred in acidic pH and was also affected by high-concentration anions like chloride. Moreover, to make the technology economical and sustainable, DFOB was re-generated by the addition of non-specific ligand ethylenediaminetetraacetic acid (EDTA). More than 90% of DFOB were re-generated by the addition of 6 times and 8 times excess of EDTA at pH of 3.5 for Ga and Ge respectively. This led to the recovery of more than 90% for both metals with DFOB complexation at the end of the process. Thus, this technology for the first time demonstrated a solution to recycling these critical metals from low concentrated systems in a sustainable and eco-friendly manner.

References

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Acknowledgement of financial support

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Session Classification: Session Sustainability and Circular Economy