Promoting the circular economy through eco-friendly resource recovery from electronic waste

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The scientific advancements achieved during 2023 strongly contributed to improving resource recovery and circular economy practices. Using sorption-based methods for retrieving Technology-Critical Elements (TCEs) from electronic waste (e-waste) addresses the critical shortage of TCEs but also helps mitigate the environmental and health risks associated with conventional mining and e-waste disposal. The use of sorbents such as synthetic materials, biosorbents derived from plants, algae, or agricultural waste, coupled with recovery optimization through surface response methodology, can significantly reduce the EU's dependence on imports and promote resource recycling (Figure 1). In 2023, we have successfully published works on these topics in high-impact journals (IF > 14) [1, 2], demonstrating the relevance of this research. Studies on the recovery and recycling of natural resources, especially those whose supply chain is at risk (such as TCEs), represent a major contribution to sustainable management and development. Additionally, our work on the ecotoxicological impacts of e-waste and TCEs also provided relevant information for policy makers on the impacts of unregulated disposal of e-waste in aquatic systems, especially under the influence of other anthropogenic pressures such as climate change (in collaboration with Rosa Freitas from UAveiro's Department of Biology). These were also published in renowned specialist journals (IF > 10) [3]. Overall, these advances pave the way for a more sustainable approach to resource management, aligned with the UN's Sustainable Development Goals. Promising results have been achieved by our research group, which is now dedicated to improving the selectivity of these materials to facilitate post-sorption refinement procedures and improve the purity of the elements for reuse. Once achieved, sorption-based TCEs recovery will be an important factor in reducing constraints on the supply chain of these elements and lessen the reliance on primary ore mining.

References

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FIGURE 1
Potential for resource circularity of Technology-Critical Elements (TCEs) recovery through sorption-based methodologies (synthetic sorbents and biosorbents).