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Addressing the scientific aspects of a circular economy: insight into secondary resource management

Circular economy constitutes a recently developed strategy which addresses the availability of resources, its consumption and waste generation. According to circular economy assumptions the reduction of wastes and sustainable resource recovery from secondary resources are prioritised. In this regard, scientific contribution to development of sustainable processes dedicated to resource processing is crucial. Metallurgical sector is a key branch supplying metal on a global market. However, apart from economic advantages, this sector also generates wastes such as smelting slags. Such materials however may be efficiently processed provided that appropriate process configuration is defined and designed. Biohydrometallurgical approach is a method which uses microorganisms to extract metals from slags. Such a process is proven efficient provided that metal extraction yield is high and the processing time is as short as possible. This work focused on optimisation of biohydrometallurgical processes applying metallurgical slags of different texture and chemical/phase composition. Various types of bacterial strains were implemented in the leaching process. This strategy aimed to provide a deep insight into behaviour of various slags and to analyse the biotic mechanisms contributing most to metal extraction. Geochemical methods included tracking elements concentration using Inductively coupled plasma mass spectrometry and direct surface observations using scanning electron microscopy. Results demonstrated a direct link between solution chemistry and dissolution features occurring on the slag surface which was crucial for understanding what component (phase) is the most susceptible to dissolution under specific biotic conditions. The knowledge acquired from this experimental study allowed to indicate optimal conditions for slag processing. This study highlights that interdisciplinary approaches involving mineralogy, microbiology and geochemistry make a foundation to develop well-designed metal recovery reactors.

References

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