

Advances in physiochemical and biotechnological approaches for sustainable metal recovery from e-waste: A critical review

ABSTRACT

A large amount of waste printed circuit boards (WPCBs) has been generated due to the tenacious scientific development and therefore, the improvement of expectations for everyday comforts. The unprecedented acceleration of electronic waste (e-waste) and informal disposal at end-of-life display the adverse impact of digitalization. Recently, home teleworking has increased a wide range of sectors and occupations which may eventually lead to increase the generation of e-waste. Effective management of e-waste is urgently required for protecting environment as well as human well-being's. In view of the precious metal content and rare earth elements, WPCBs could become a sustainable source of precious metals. Appropriate eco-friendly strategies to recover metals from WPCBs are therefore imperative and crucial for e-waste management. Recent progress in metal recovery through gravity, density, electrostatic and integrated approaches were investigated dependent on previous contribution to provide an overview of present recycling status. The mechanism and factors influencing the metal recovery efficiency in a countercurrent operation were critically reviewed. The application of biotechnological approach for metal recovery was discussed from the theoretical and experimental views. The hazardous impact on human health and environment due to the toxic substances released from e-waste were highlighted. Finally, the limitations and perspectives towards the sustainable process for recovery of metals from e-waste were discussed.