

Recovering Copper From Tailing and E-Waste to Create Copper Nanoparticles with Antimicrobial Properties

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Abstract : Tailings and electronic waste (e-waste) are an important source of global contamination. Chile is one of Organisation for Economic Co-operation and Development (OECD) member countries that least recycled this kind of industrial waste, reaching only 3% of the total. Tailings and e-waste recycling offers a valuable tool to minimize the increasing accumulation of waste, supplement the scarcity of some raw materials and to obtain economic benefits through the commercialization of these. It should be noted that this type of industrial waste is an important source of valuable metals, such as copper, which allow generating new business and added value through its transformation into new materials with advanced physical and biological properties. In this sense, the development of nanotechnology has led to the creation of nanomaterials with multiple applications given their unique physicochemical properties. Among others, copper nanoparticles (CuNPs) have gained great interest due to their optical, catalytic, conductive properties, and particularly because of their broad-spectrum antimicrobial activity. There are different synthesis methods of copper nanoparticles; however, green synthesis is one of the most promising methodologies, since it is simple, low-cost, ecological, and generates stable nanoparticles, which makes it a promising methodology for scaling up. Currently, there are few initiatives that involve the development of methods for the recovery and transformation of copper from waste to produce nanoparticles with new properties and better technological benefits. Thus, the objective of this work is to show preliminary data about the develop a sustainable transformation process of tailings and e-waste that allows obtaining a copper-based nanotechnological product with potential antimicrobial applications. For this, samples of tailings and e-waste collected from Tarapacá and Antofagasta region of northern Chile were used to recover copper through efficient, ecological, and low-cost alkaline hydrometallurgical treatments, which to allow obtaining copper with a high degree of purity. On the other hand, the transformation process from recycled copper to a nanomaterial was carried out through a green synthesis approach by using vegetal organic residue extracts that allows obtaining CuNPs following methodologies previously reported by authors. Initial physical characterization with UV-Vis, FTIR, AFM, and TEM methodologies will be reported for CuNPs synthesized.

Keywords : nanomaterials, industrial waste, chile, recycling

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