CIVIL AND ENVIRONMENTAL ENGINEERING

PNRR - Biobased solution for critical metals recovery from waste resources

Funded By	MINISTERO DELL'UNIVERSITA' E DELLA RICERCA [P.iva/CF:97429780584] Politecnico di TORINO [P.iva/CF:00518460019]
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Context of the research activity	Global economic development has raised the consumption of e-materials, i.e., electric and electronic equipment, which includes a wide range of products with circuity or electrical components with a power or battery supply. In order to follow the principles of Circular Economy, the exploration and development of alternative sources and technologies is fundamental for the manufacturing industry. However, the replacement of technologies based on oil and gas resources by renewable energy sources (RES) and the electrification of earlier power sources eventually implies the leveraging of raw materials. Among raw materials, several are listed as critical (CRMs) due to the rising of their demand and source availability worldwide. Hence, it is mandatory to find a strategy to support a more sustainable supply chain of raw materials, particularly critical metals (e.g., magnesium, cobalt, nickel, and lithium). Due to the rich content of these metals, e-waste (e.g., printed circuit boards, end-of-life smartphones and computers) and batteries (e.g., dismissed lithium ions batteries, LIBs) can be considered an urban mine to exploit and valorize). Common metal extraction and processing is performed by pyro- and hydro-metallurgy techniques requiring energy-intensive steps frequently based on the use of fossil fuel. On the contrary, biometallurgy is based on biological routes belonging to specialized microorganisms directly or indirectly able to leach metal sources. Because of the physiology of these microorganisms, microbial leaching can be economically feasible, besides being an environmentally sustainable process. Progetto finanziato nell'ambito del PNRR - PNRR M4C2, Investimento 3.1 - Avviso n. 3264 del 28/12/2021 - IR0000027 Infrastructure for ENergy TRAnsition aNd Circular Economy @ EuroNanoLab (iENTRANCE@ENL) - CUP B33C22000710006
	The main research objectives of this PhD thesis include (not necessarily all): • Adaptation, enrichment, isolation and identification of microbial consortia on

Objectives	different e-waste resources • Selection of CO_2 utilizing consortia, specifically methanogenic consortia • Assessment of extraction/recovery efficiency of adapted methanogenic consortia (lab-scale experiments) • Identification of process limits and possible solutions. Other goals possibly include the interaction with cross-cutting disciplines, involving the techno-economic assessment of critical metals biobased recovery from e-waste also considering the impact of the upstream and downstream required treatments.

Skills and competencies for the development of the activity	The candidate should have a strong background in bioprocesses. The candidate should particularly be familiar with the gas fermenting process, anaerobic culture, basic biomolecular techniques (DNA extraction techniques, PCR methods).