



“Gheorghe Asachi” Technical University of Iasi, Romania



AN INTEGRATED AND ECO-EFFICIENT PROCESS FOR MATTER RECOVERING BY WEEE RECYCLING: PINECOR PROJECT

Maria Chiara Canu¹, Roberto Giovanardi¹, Fernanda Andreola¹, Isabella Lancellotti¹,
Cristina Leonelli¹, Paolo Pozzi¹, Teresa Sessa², Bibiana Ferrari², Arturo Sommariva³,
Giovanni Modica³, Luca De Benedittis³, Giovanna Ferraroli⁴, Sergio Ferraroli⁴,
Laura Borghino³, Andrea Gubiani³, Luisa Barbieri^{1*}

¹Department of Engineering “Enzo Ferrari”, University of Modena and Reggio Emilia, via Vivarelli, 10, 41125 Modena, Italy

²Treee srl, Via Zona Industriale IX Str., 115, 30030 Fossò (VE), Italy

³External Consultants in PINECOR

⁴Tre Effe Forniture Idrauliche Industriali srl, via Zanica, 17, 24050 Grassobbio (BG), Italy

Abstract

The scarcity and supply difficulties of strategic elements for industrial ecosystems make the development of processes/technologies for their recovery from existing resources crucial. In this perspective, the recycling and collection of WEEE (Waste from Electrical and Electronic Equipment) are essential for the circular economy. In Italy, the e-waste stream is divided into two channels (domestic and professional) and five groupings. In 2023, 72% of the waste managed by recycling companies (around 367 ktons) came from the domestic sector, while 28% (around 144 ktons) came from the professional sector. From 2018 to 2023, the sequence of WEEE collected from the highest to the lowest is represented by groupings: R2 (Large Household Appliances), R1 (Cooling and Freezing Appliances), R4 (Consumer Equipment), R3 (Screen and Monitors) and R5 (Lighting equipment). R1, R2 and R4, which seem to represent the categories that would bring more environmental benefits (i.e., tons of CO₂ equivalent avoided) if properly processed and recycled, are the target secondary sources for the PINECOR project. The aim of such a project is to develop an integrated system, based on innovative, multifunctional and eco-efficient technologies for the recovery of glass, siliceous fraction, plastic and metal from WEEE. This paper presents the first results obtained in the project both in terms of separation processes developed to obtain high-purity recycled fractions, and in terms of techniques for the extraction and recovery of secondary raw materials, with particular attention to their application in the most common sectors and those in growth.

Key words: elutriation, glass, metals, plastics, secondary materials, separation procedures, WEEE

Received: May, 2024; *Revised final:* September, 2024; *Accepted:* October, 2024; *Published in final edited form:* October, 2024

* Author to whom all correspondence should be addressed: e-mail: luisa.barbieri@unimore.it; Phone: +390592056231