METAL SEPARATOR AND REFINER in SOLID state
FROM ORGANIC MATRICES SUCH AS SEWAGE SLUDGE

MACHINARY FOR THE SEPARATION AND REFINING OF METALS

- **CRITICAL ISSUE / PROBLEM**

Heavy metals constitute a critical (toxicity) issue in wastewater and sludge processing and their final use. Sewage sludges are an important source of organic matter and nutrients to recycle into the soil for crop harvesting and as a measure for C storage in soils. Their application is under EU regulation and is limited because they concentrate heavy metals such as Cd, Cr, Cu, Hg, Ni, Pb, Zn (New *Draft*).

Conversely, there are difficulties in the supply of metals that are included in "critical materials", according to EU *Study on the EU's list on critical raw materials (2023*[1]*).* Examples are Co, Ga, In, … V, which can accumulate in sewage sludge or other organic matrices from which they can be extracted.

ADA innovative techniques are finalized to overcome these difficulties, to transform recycling (recycled matter) into a new resource for critical metals. ADA has developed a new working system to provide an effective solution to the recovery of metals (e.g. Cu, Fe, Mo, Mn, Pb, Zn) from sewage sludges and by-products and recycle these high level of purity metals on the market. Application for critical materials. The provisional name/acronym of this system is ME-RE.

We are looking for companies which want to develop the technique up to the industrial application.

- **INNOVATIVE ASPECTS AND RELATED BENEFITS (with reference to the most common technologies)**

Usually, the separation of heavy metals occurs either in the liquid phase or through electromagnetic fields. The technique enables the separation of heavy metals (including not electromagnetic) from solid state powders and subsequently refines individual metals. The innovation consists in solid phase separation technology.
The technique and its operation are based on **physical principles**, using electro-mechanical machineries. Machineries can be automated, so that to assure safety conditions both for workers and the environment.
Product innovation and process innovation, which can become a circular economy technique; for example, in the case of sewage sludge it also becomes a technique that removes critical issues from/for their use. The recovery of by-products can give rise to a new product sector, encouraging the creation of new jobs.

Expected benefits are connected to the concept that technologies **do not create waste**:

- separating the selected metals and water from sewage sludge, **"clean/refined" sludge** is obtained and can be reused in different and safer ways, e.g. for agriculture; refined sludge can be used safely and at higher dosage in agriculture (thus increasing Organic matter amount distributed per hectare);

[1] European Commission, Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, Grohol, M., Veeh, C., *Study on the critical raw materials for the EU 2023 – Final report*, Publications Office of the European Union, 2023, **https://data.europa.eu/doi/10.2873/725585**

- refining the separated mixture of metals in the solid phase, it is possible reintroduce the separated elements back into the economic circle, with a view to "zero waste".

The outputs are non-polluted products - simply because they are not mixed together.

The technologies are suitable for recovery of "**critical materials**" (e.g. Gallium, Indium, ...).

The technique can become an Industrial Symbiosis Practice.

The machineries must be characterized by:

• Easy use (loading, unloading purified powders, metals) and maintenance,
• Removal effectiveness,
• Long life of the machinery (consolidated techniques, there is no wear)
• Easy maintenance - it can only be operated dry
• Automation and modularity
• Possibility of using it both "stationary" and on a mobile vehicle, for example to transfer it to wastewater treatment plants.

- **APPLICATION/USE**

The separation and refining technique can be applied and tailored to the following organic matrices:

- **SLUDGE** (**Sewage sludge** (EER 190805), with anaerobic sludge treatment and subsequent thickening, municipal and/or industrial wastewater purification sludge, Sludge from tanneries (from the treatment of wastewater from tanneries, even at centralized plants), Sludge streams in the ceramic industries,
- **SOILS** (soils contaminated by metals),
- **ANIMAL MANURE** and slurries, such as e.g. pig faeces, after separation from the liquid phase,
- Foreseeable application to the **TEXTILE** sector (decontamination from heavy metals).

We are used to "*landfill mining*", where elements, metals are recovered from exhausted landfills or old storage areas. In these cases, we intervene on material streams before they final disposal, to obtain new material streams with proper composition.

- **ACTIVITIES**

The technique has allowed the creation of the first laboratory-scale devices for the separation of metals from sewage sludge.

- **TRL (1 ÷ 9) = 3**