


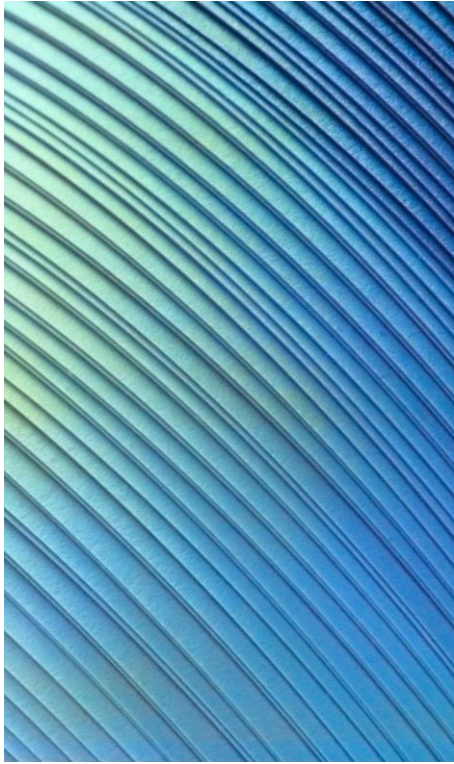


**LUT**  
**University**



# Municipal sludge as a water treatment solution

A part of sludge treatment by  
chemical and electro-chemical  
treatment for alternative  
usage



# At a glance

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Sludge is a semi-solid slurry that can be produced from wastewater treatment

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Daily sludge production: 8000 kg dry SS/Day,  
Daily volume : 267 m<sup>3</sup>

Production in Finland 146,000 tonnes (2015)

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Alternative uses : land reclamation, compost and soil production, landfill, incineration, and energy and resource recovery

## Rare earth elements (REEs) adsorption: current research trend

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- ❖ REEs are widely used in different sectors such as nuclear energy, metallurgy, medicine, chemical engineering sector etc.
- ❖ There are many methods to recover REEs such as precipitation, filtration, solvent extraction etc. but these are not economically attractive.
- ❖ Adsorption has gained wider attention because of its simplicity, high efficiency and low cost.
- ❖ Biomaterials application as adsorbent suggested a long before but lower surface area with sorption part limit its usage in large scale application.





# Introduction

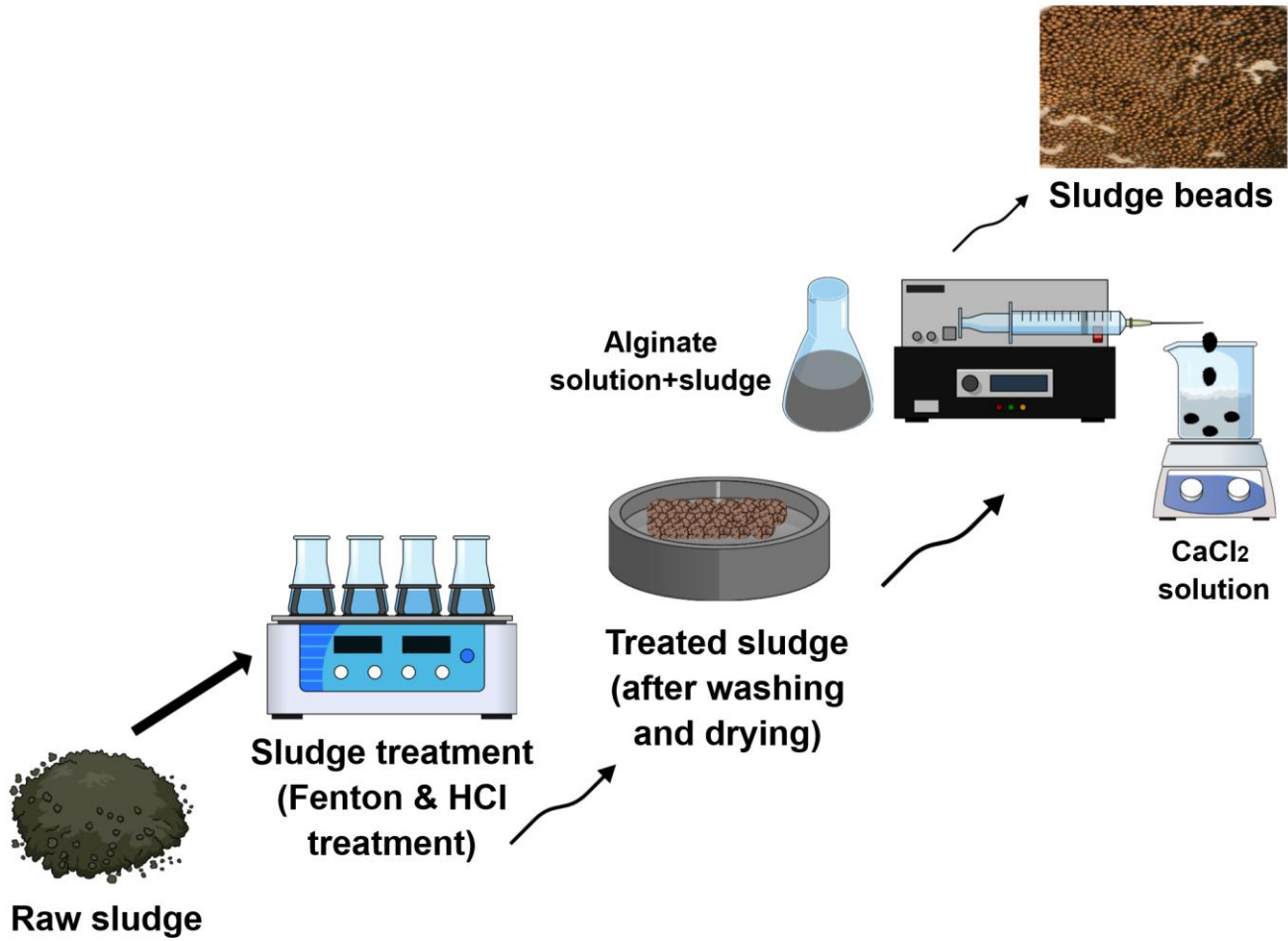
The safe disposal of sludge becoming as the most emerging concern to the WWTPs.

In many countries, traditional methods like landfilling, ocean dumping, incineration, conversion to fertilizer became restricted nowadays due to environmental concern.

Sludge are considered as waste containing metals, microplastics with nutrients as well.

Here, we tried to prepare sludge beads after Fenton and HCl treatment to recover REEs from aqueous solution.

# Beads Preparation

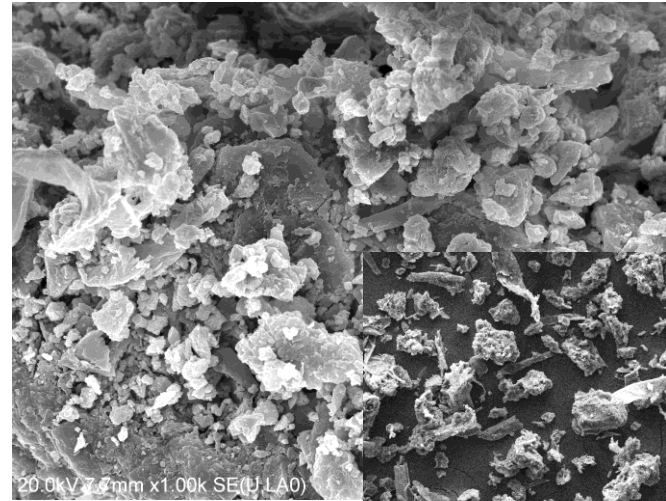


# Characterization of sludge

## Element analysis (CHN) results for sludge adsorbent

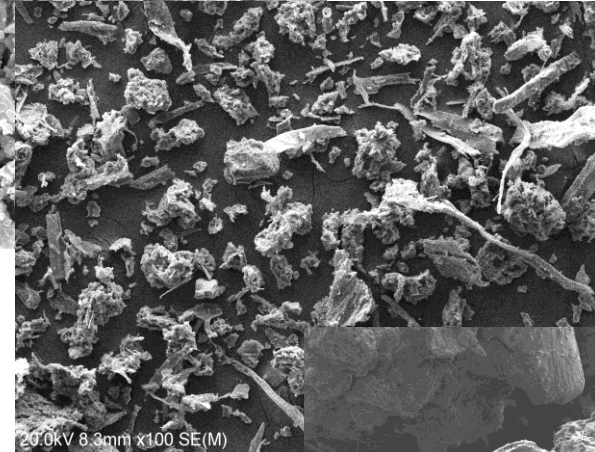
		HT sludge beads	FT sludge beads
Dry weight percentage	Nitrogen (N)	5.87	3.61
	Carbon (C)	39.56	34.03
	Hydrogen (H)	5.54	4.51

# SEM images

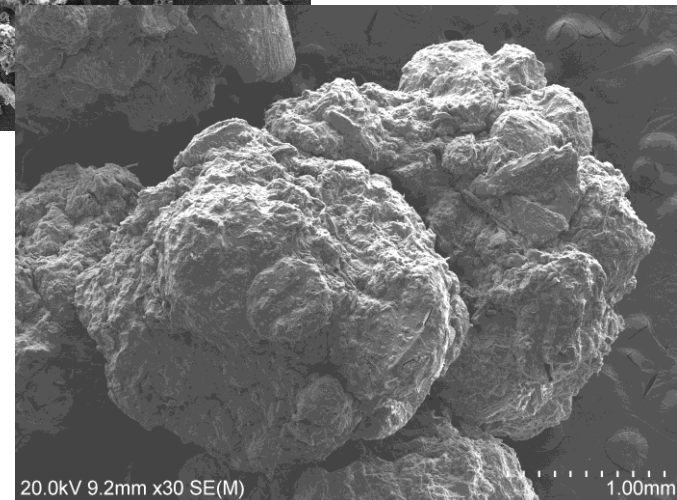


Raw sludge

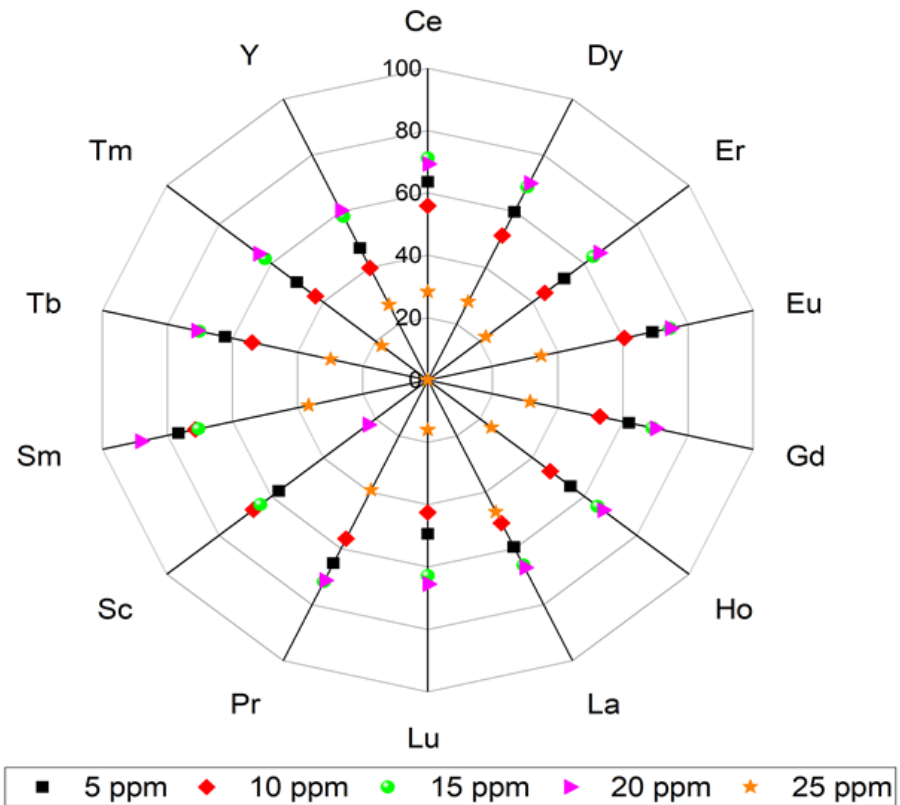
Sludge after treatment



Sludge beads



# Results: REEs recovery by HCl treated sludge beads

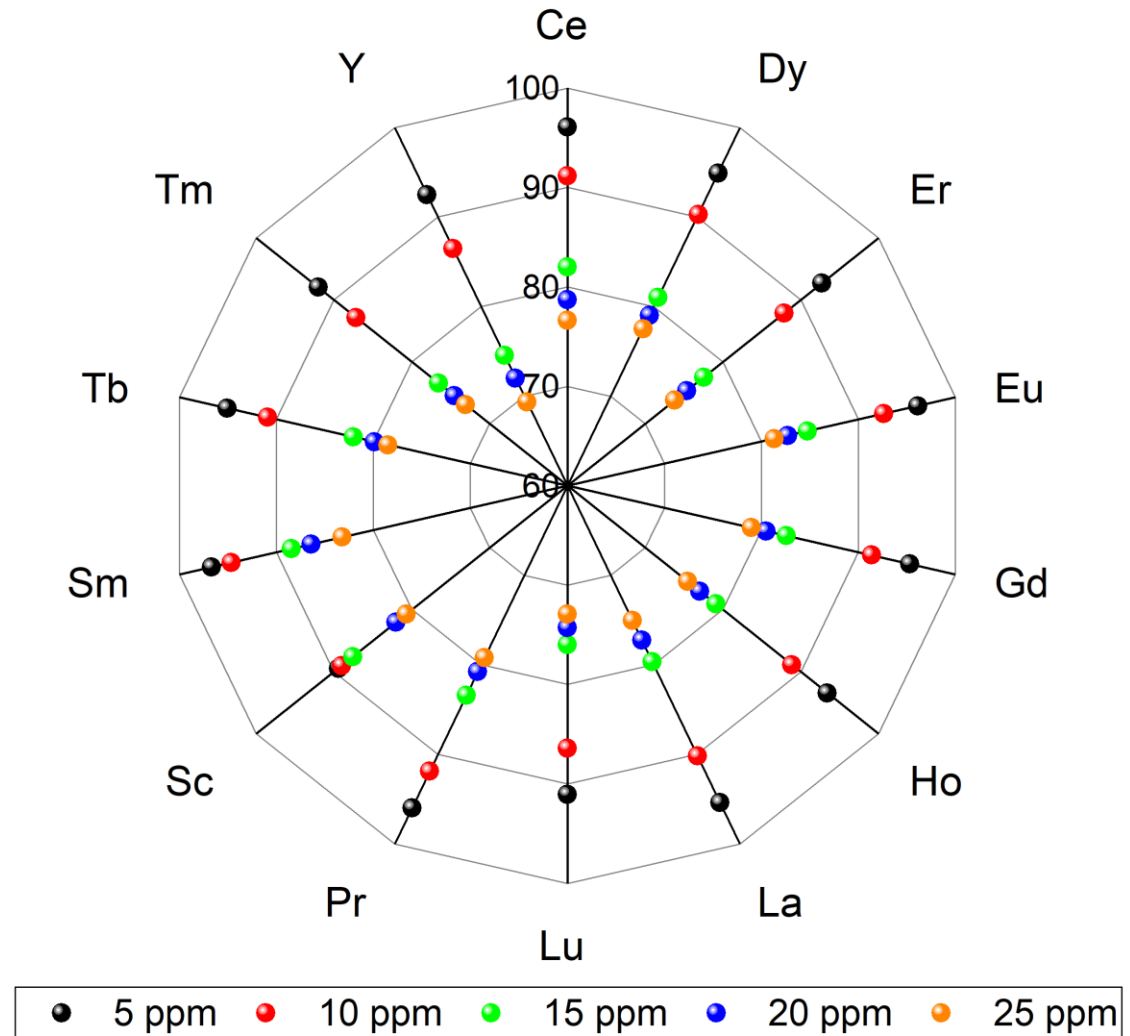


- Adsorption of rare earth elements (REEs containing seventeen elements including fifteen lanthanides plus Sc and Y) studied.
- 70% recovery done by HT sludge for 15 ppm of REEs solution (24h).
- Lower pH digestion can solubilize the available metal from the sludge by enhancing cell lysis and chemical breakdown of extracellular polymeric substances.



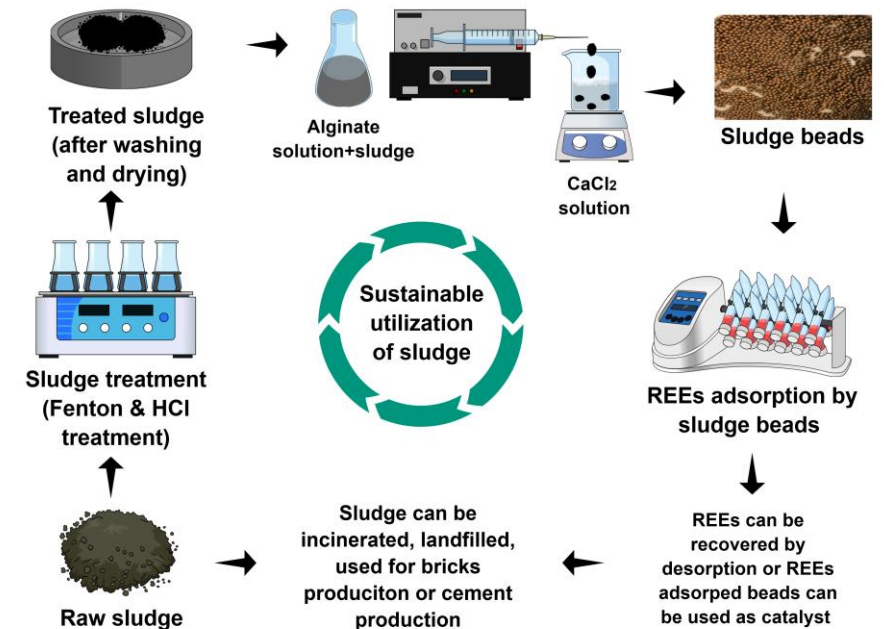
## Results: REEs recovery by Fenton treated sludge beads

- Recovery of REEs (containing seventeen elements including fifteen lanthanides plus Sc and Y) investigated here.
- >80% recovery done by Fenton treated sludge for 15 ppm of REEs solution (24h).
- Fenton process can digest metal along with bound water (EPS breakdown) removal from sludge, Even this digestion can work as activators to enhance adsorption by changing surface chemical properties.



# Future perspectives with final usage

- Adsorption process became popular due to low operational costs, high level of efficiency, and a minimal degree of toxicity or low-cost adsorbents.
- REEs can be recovered by desorption from sludge or REEs loaded adsorbent can be also used as catalyst.
- REEs loaded adsorbent used for phenol or bisphenol demineralization and for even tetracycline degradation. So, sludge adsorbent can be considered as a promising material by considering their reusability or converting waste to resources.





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