

BIOREFINE: RECOVERY OF NUTRIENTS FROM SEWAGE SLUDGE, MANURE AND DIGESTATE BY A COMBINATION OF CHEMICAL AND BIOCHEMICAL UNIT OPERATIONS



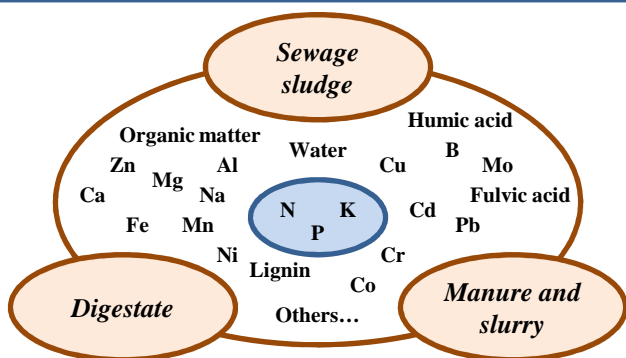
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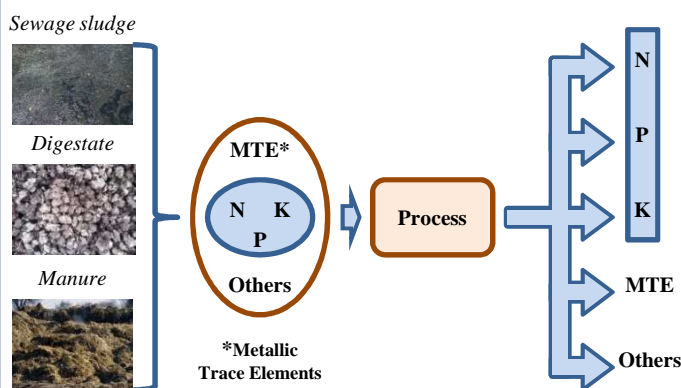
Summary

At this time, many wastes are exploited through processes that do not really consider applications potentially more profitable. Such wastes contain reusable components, such as **nitrogen, phosphorus** and **potassium**, whereas **heavy metals** may also be considered. Their composition depends on input materials, and considerable heterogeneities must be highlighted. **Sewage sludge** is usually exploited as a fertilizer in agriculture, in energy production or in the field of construction. The main application of **manure** is agriculture, although considerable amounts of nutrients are lost and cause pollution. **Digestate** is also used in agriculture, but other alternatives have been proposed, such as combustion. The use of waste in agriculture must respect many legal constraints. Another problematic point is the concentration of heavy metals that is found in those wastes. Consequently, recovery of nutrients and trace elements may be a key solution. Chemical and biochemical engineering propose many unit operations (mechanical operations on fluids, solids, mass and heat transfers, chemical reactions, etc.) that may be used to reach an efficient recovery yield of capital nutrients and trace elements. Here, we propose a methodology which consists in considering the unit operations separately with their own input and output flows, energy and heat consumption, investment, etc. and combining them to simulate industrial processes. The element concentrations and their forms will also be considered using a classification matrix. Combinations of unit operations will lead to reliable processes that should be applied on an industrial scale. This work is supported by the **BioRefine Project**, a European project in which various member states focus on recovery of inorganics from organic waste streams. We gratefully acknowledge the **INTERREG IVB NWE** programme, which financed the **BioRefine Project** (ref. 320J-BIOREFINE).

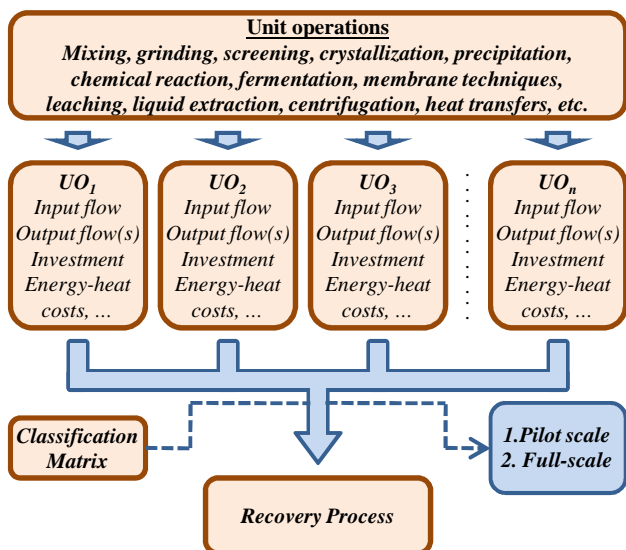
Sewage sludge, digestate and animal wastes contain many interesting components



The industrial processes are applied to recover nutrients and MTE from wastes



Unit operations are combined to create processes, taking important parameters into account



The partners of the BioRefine Project



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