PigWasteBiorefinery – A mobile approach for animal waste biorefining

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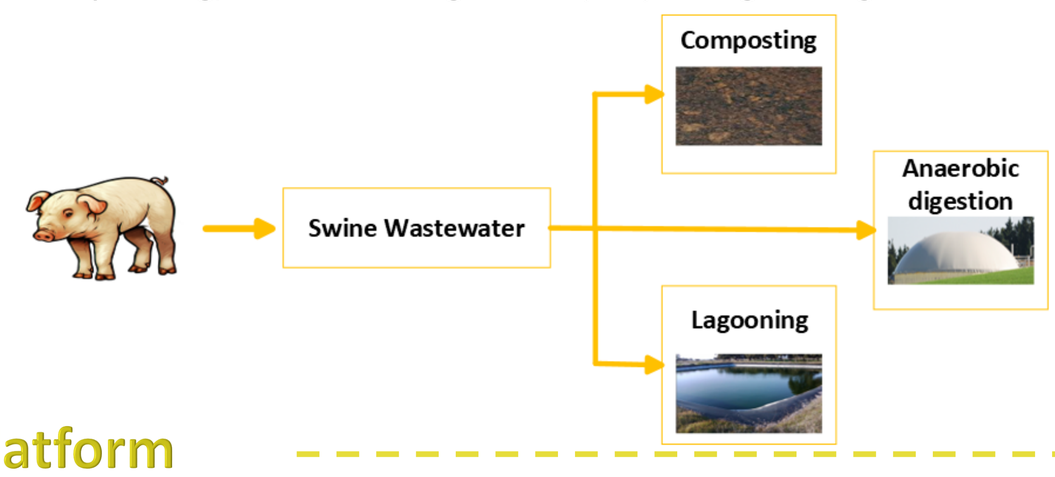
Motivation

Waste management in pig farms, one of the most traditional agroindustries in Portugal and Europe, is a serious environmental problem. These **industries produce large quantities of effluents** with high organic and inorganic loads, with some compounds being highly refractory. **Traditionally, the treatment** of these effluents consists of **biological methods**, like **composting**, **anaerobic digestion (AD)** or **lagooning**.

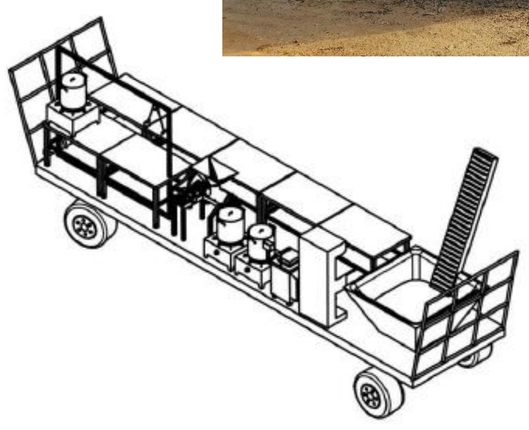
However, biological techniques do not represent a complete solution for the treatment of these effluents due to the existence of significant efficiency losses and low biodegradability, with the treated effluent not achieving the required purification levels.

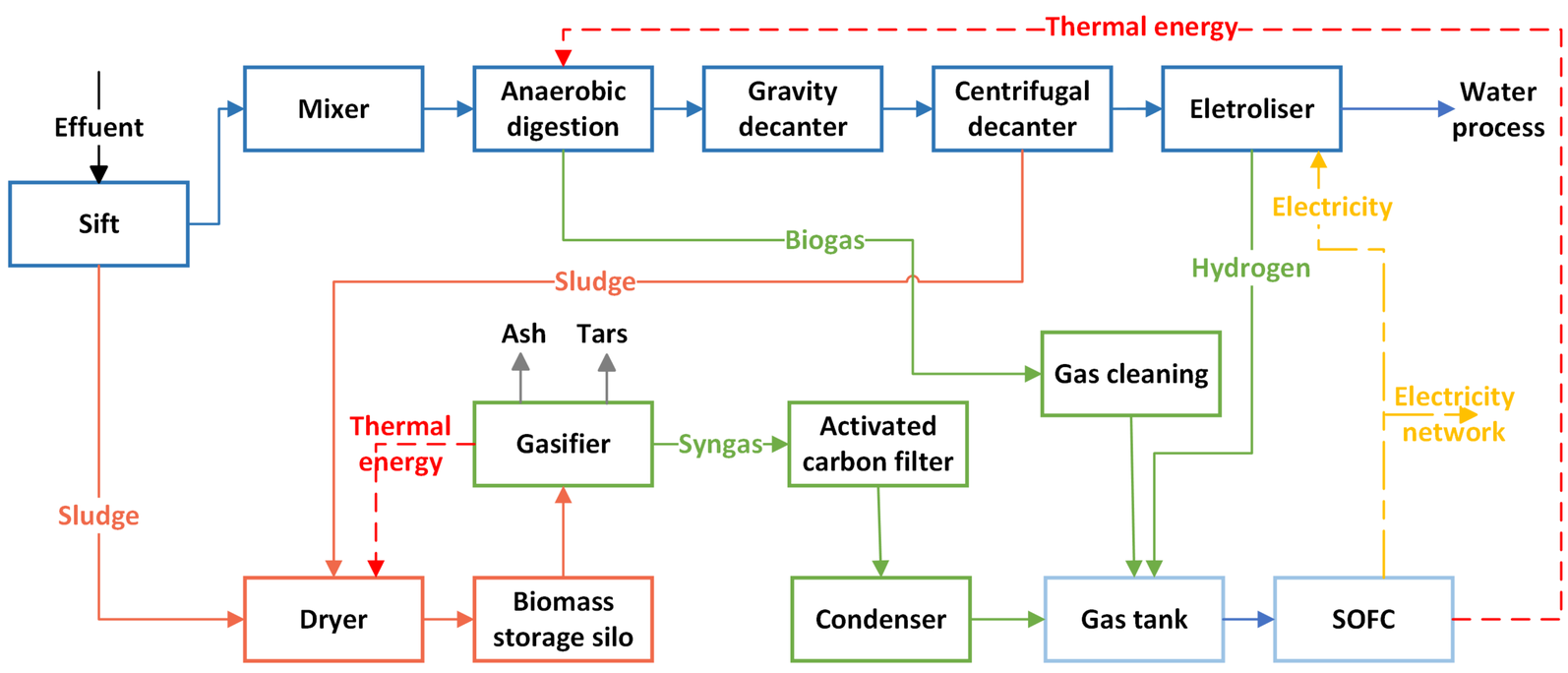


Project – mobile platform

Project PigWasteBiorefinery consists of a **mobile demonstrator** unit that uses pig farm effluents as feedstock. The unit is based on the combination of AD and electrooxidation to produce biogas and hydrogen, respectively. After production, the **gases are converted** into **thermal energy and electricity in a solid oxide fuel cell (SOFC)** at a minimum temperature of 500°C. The sludge digestate from AD is further used in a gasification process to yield syngas. This approach intends to overcome the limitations of **exclusively using biological methods for wastewater remediation** through an integrated and circular approach that deals with the contaminated effluents, as well as the by-products from the treatments.

After on-site collection, the effluent enters the system through a **mechanical pre-treatment** zone where non-organic solids are removed, before being pumped to the **AD reactor**. The **digestion process** takes place in **continuous mode** in a single-stage reactor under **mesophilic conditions (35 °C).** The **produced biogas** is removed from the system, **cleaned**, and forwarded to the **SOFC**. The liquid effluent exiting the digester is fed into a settling tank and pumped to the **electrooxidation reactor for post-treatment** of the **non-biologically degradable fraction and hydrogen production**. On the other hand, the **solid digestate** leaving the reactor is controlled by a worm screw. This screw moves the generated solids through a **drying system**, with the possibility of excess water re-entering the system and the **sludge** advancing to a **gasifier for syngas production**. Both **the hydrogen and the syngas** are used to enrich the gas mixture that will feed the **SOFC**.





Perspective

Overall, the development of a biorefinery concept for **pig farms based on effluents** generated on-farm is an **important contribution to effective natural resource management.** The results from this **project are intended to contribute to the development and demonstration of an integrated process** chain that relieves the impact of pig farms on the environment. **Using wastes for biofuel production** is increasingly viewed as a sustainable alternative to dedicated crops with soil occupation, with additional benefits such as the **production of biofertilizers, soil conditioners, and other added value products resides pig farming**, this concept has the potential to be applied in other traditional agroindustrial sectors in Europe, namely wine or olive oil.

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