

Water reuse and sewage sludge reduction from wastewater by Circular Economy Approach



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Sewage sludge reduction and wastewater treatment

Concept

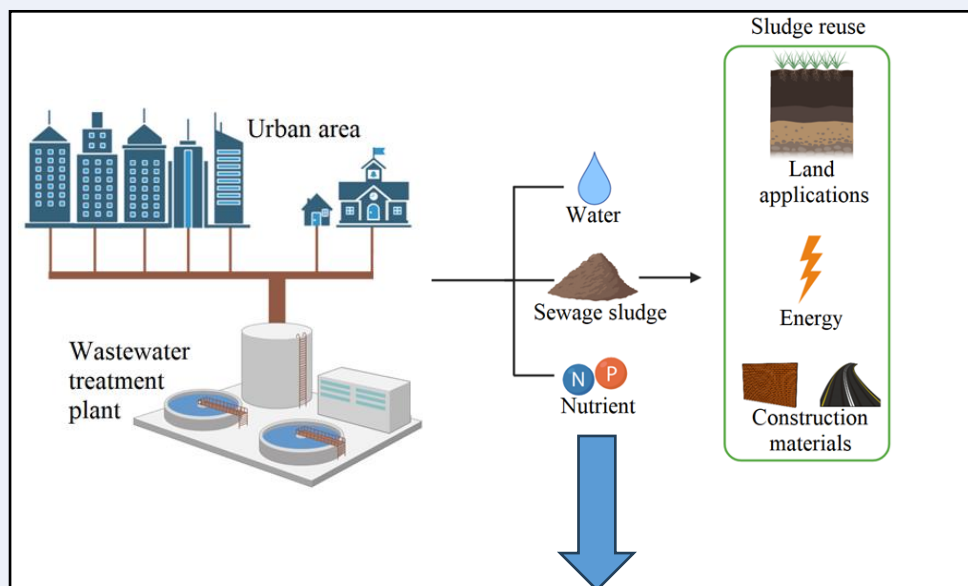
The wastewater treatment plants (WWTPs) have originally been designed with the aim of obtaining good effluent quality and remove pollutants and nutrients such as nitrogen (N) and phosphorus (P) in view of protecting the quality of receiving water bodies (Roots et al., 2020). The current challenges in WWTPs aim to reduce energy consumption, excess sewage sludge production, and greenhouse gas (GHG) emissions (Mannina et al., 2016). In view of the above, this research project is focused on the evaluation of different pilot plant configurations, to find a trade-off between sludge production, GHG emissions and effluent quality. This project is part of the project "Achieving wider uptake of water-smart solutions - WIDER UPTAKE" financed by the European Union's Horizon 2020 Research and Innovation Program, and the activities carried out during this PhD course also fall within the activities related to the European project.

Scientific approach

A pilot plant was realized at the Water Resource Recovery Laboratory of Palermo University (Mannina et al., 2021). The pilot plant was initially based on a Conventional Activated Sludge (CAS) system conceived for carbon and nitrogen removal according to a pre-denitrification scheme. Several plant configurations were tested to evaluate the best solution for reducing sludge production, less greenhouse gases emissions and better nutrients (COD, NH_4 and PO_4) removal performances. During the experimental campaign, the following main configurations (Subdivided into a certain number of configurations, depending on the study) were evaluated: Oxidic-Setting-Anaerobic Process (OSA), Membrane Bioreactor (MBR), Integrated Fixed-film Activated Sludge (IFAS) and Intermittent Aeration (IA).

Research objectives

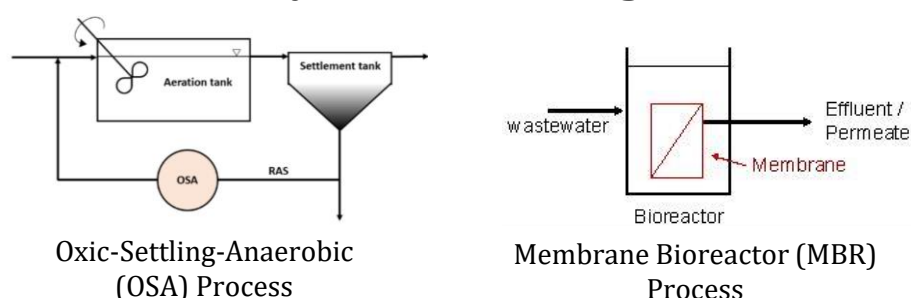
This research project is focused on evaluating different wastewater pilot plant configurations to find a trade-off between sludge production, greenhouse gas emissions, carbon footprint assessment and effluent quality to reduce the environmental impact and promote sustainable development. The achievement of the objectives aims at an overall optimization of the WWTPs through an appropriate choice of the plant layout and the operational and management parameters.



UNIPA's wastewater treatment pilot plant



Different systems and configurations



Qualitative index to evaluate plant performances

