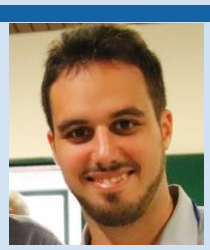
The reduction and recover of sewage sludge from wastewater treatment plants



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Sewage sludge management

Concept

In recent years, there has been a considerable increase in the production of sewage sludge from wastewater treatment plants (WWTPs). This increase has caused important environmental and operating consequences. Indeed, around 50% of the WWTPs operating costs regard sludge management. Very often the sludge is disposed of in solid waste landfills, with the consequent risk of soil and groundwater pollution, or incinerated without energy recovering, with the consequent production of greenhouse gases. The sewage sludge management has become a critical and challenging issue in WWTPs operation. Therefore, in accordance with the most recent European policies on environmental protection, it is necessary to adopt technologies that can reduce the sludge production and find solutions for the sludge reuse. These solutions are part of the current European trend that provides for a transition towards the concept of circular economy, which includes the Horizon2020 EU "Wider-Uptake" project, with the aim to promote the resources recovery from wastewater treatment and promote industrial symbiosis [1].

Scientific approach

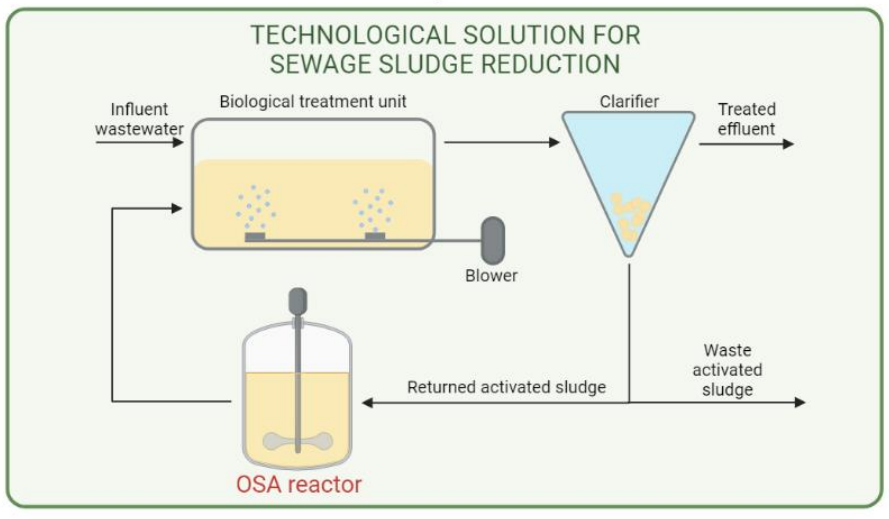
The research activity involves experimentation on pilot plant, located at the laboratory Wider-Uptake of Palermo University and treating real wastewater produced by the Palermo University campus. The pilot plant is characterized by an oxic-settling-anoxic/anaerobic (OSA) treatment scheme, fed by domestic wastewater. The OSA process, a variant of the conventional activated sludge process (CAS) technology, creates aerobic and anaerobic conditions, corresponding to an alternation of rich and poor substrate phases. The OSA treatment minimizes the production of sludge, improves sedimentation and reduces the growth of filamentous bacteria [2]. The experimentation also involves the implementation of the OSA treatment at the Corleone (IT) WWTP, to evaluate the technology potential on a full-scale plant. The activities at the Corleone WWTP are part of a revamping plan aimed at improving the efficiency of processes and reducing direct and indirect emissions. The sewage sludge produced by the WWTP will be treated with a composting process allowing its recovery and reuse in agriculture as a soil improver. Composting will be carried out using innovative techniques for the removal of residual organic and inorganic pollutants to avoid soil and environmental pollution [3].

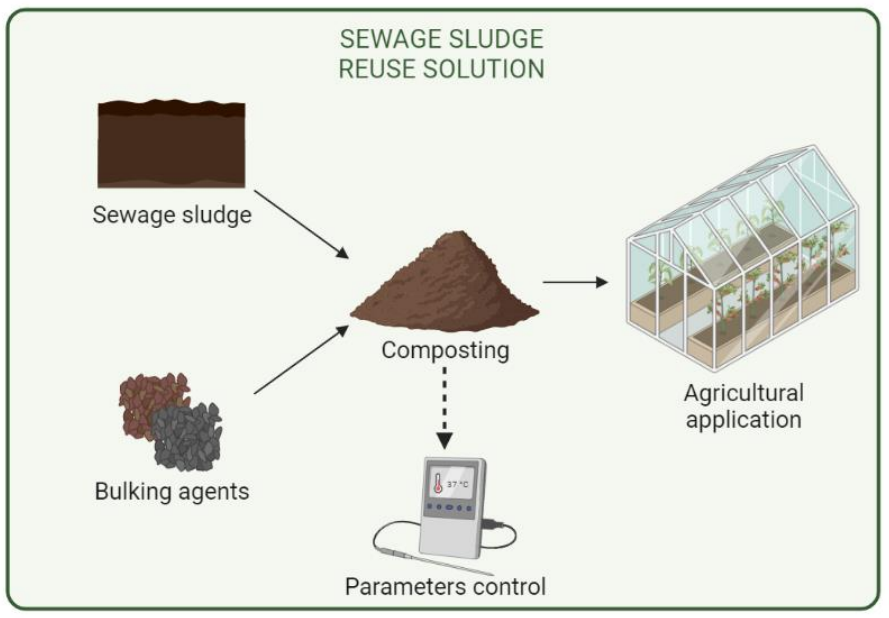
Research objectives

The research aims to reduce and recover the sewage sludge from WWTP. In order to reduce the environmental impact and promote sustainable development, the research also is aimed at reducing the carbon footprint associated with greenhouse gas emissions from direct and indirect emissions. 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.

Pilot-scale plant
UNIPA

Full-scale plant
Corleone





[1] Mannina et al. (2021), Water 13(7), 946
[2] Karlikanovaite-Balikci et al. (2019), Journal of Environmental Management 240, 303-310
[3] Gherghel et al. (2019), Journal of Cleaner Production 228, 244-263