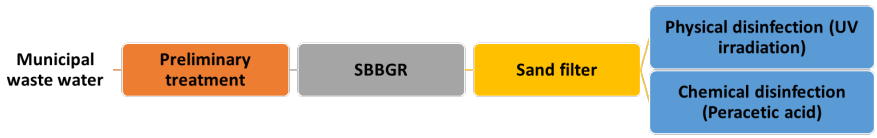
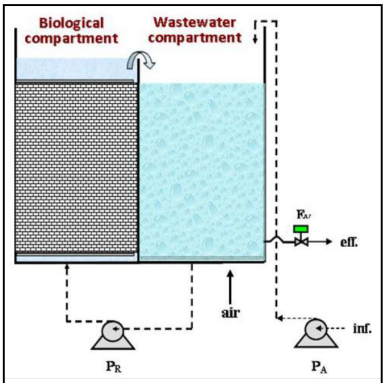
Technology	Sequencing Batch Biofilter Granular Reactor (SBBGR): An innovative system for municipal wastewater treatment
Research organization	The Water Research Institute (IRSA) is part of the Italian National Research Council (CNR). IRSA was established in 1968 as a scientific institution aimed at providing the National Parliament, the Governmental Administrations, as well as water-management agencies and national industries with the know-how necessary for rational utilization and protection of Italian water resources.
Description of the technology being developed	 The SBBGR system operates in discontinuous sequential mode and it is based on a submerged bio-filter. The SBBGR plant consists of a single tank divided into two compartments: biological and wastewater compartment (Figure 1). Biological compartment is the reactive zone as it contains the biomass (mixture of biofilm and granules is completely confined in this compartment). Wastewater compartment is the zone of the liquid phase; its role is to supply the process air by a diffuser device located in the bottom of the compartment. Biological and wastewater compartments are hydraulically connected by means of a pump which continuously recycles the liquid between them during reaction phase. The SBBGR is provided with a pressure meter measuring on-line bio-filter head losses due to the biomass growth and captured suspended solids occurring in the influent. When a fixed set value of head loss is reached, a washing step is carried out by compressed air. The operation of the SBBGR is based on a succession of treatment cycles (six hours), each consisting of three consecutives phases: filling, reaction and drawing.  Figure 1: SBBGR diagram SBBGR effluent is passed through a rapid gravity sand filter before tertiary treatment. Tertiary disinfection is performed on the sand filter effluent by UV or PAA.
Benefits	• 95% removal efficiency for suspended solids, COD and ammonia • 80% removal efficiency of total nitrogen • Significant reduction of sludge production (up to 80%) with consequent decrease of costs and environmental impact due to sludge disposal • The entire wastewater treatment train (i.e., primary, secondary and tertiary treatment) can be performed in a single stage • Offers higher operational flexibility and robustness • Treats higher organic load rate • Produces a high quality effluent suitable for irrigation purposes • Reduces area requirement for treatment plant

Financial viability	Techno-economic assessment carried out at full scale has shown that the upgrading of existing biological section of conventional wastewater treatment plants into an SBBGR allows to reduce the overall costs up to 40%.
Potential users	Rural wastewater treatment plants, companies involved in wastewater treatment technologies
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