

ABSTRACT

The main objective of this study is to compare wastewater treatment plants that serve small rural populations in Portugal, less than 2000 inhabitants, with sustainability indicators.

In a significant number of countries of the world, the needs for providing appropriate treatment for the effluents of small rural communities are still relevant. In countries like Portugal and Spain, rural areas are often characterised by scattered agglomerations, with small populations (< 2000 inhabitants), which do not benefit from the economies of scale that large systems have.

Among usual wastewater treatment techniques applied to small agglomerations are included conventional systems- low rate activated sludge and trickling filters- and non-conventional systems -constructed wetlands (subsurface flow) and pond systems-.

To reach this objective several sustainability indicators were developed, in this study, in three main fields: environmental, economical and social. These three fields reflect the three important aspects of sustainability. The concept of sustainability of sewerage treatment solutions involves a lot of aspects including, for example, the following ones:

- limited use of energy resources and chemical products;
- limited use of concrete and mechanical equipments;
- limited use of human resources for operation and maintenance;
- added value to the surroundings areas, in terms of positive image or beneficial visual impact.

The results obtained applying the indicators to 15 WWTP operating in Portugal - 9 non-conventional and 6 conventional - indicate that non-conventional systems as constructed wetlands or pond systems for the treatment of wastewater from rural areas is appropriate and sustainable in general because they have low consumption in energy (10,1 instead of 46,5 kWh/inh-year in conventional ones) and concrete (0,26 instead of 0,28 m³/inh in conventional ones). Usually the greatest requirement of this non-conventional systems is the area occupation to construct them (8,9 instead of 3,5 m²/inh in conventional ones), but this fact isn't a limitation in rural areas where there are only small communities. Also high costs in civil construction (324 instead of 194 €/inh in conventional ones) and investment (382 instead of 162 €/inh in conventional ones) characterize this non-conventional systems.

Also the percentage of energy consumption of a WWTP in terms of a Concelho is always less than 3,5% for both systems, being almost negligible and thus sustainable in this aspect.

Many of the results of the indicators of sustainability, like produced sludge per inhabitant and year and the costs of operation and maintenance per inhabitant and year are not reliable because the lack of information about the operation of the WWTP.

The results also indicate that low rate trickling static filters without recirculations are conventional systems with low cost of investment, maintenance and operation, low consumption of energy and small occupied area, thus sustainable in most of the aspects.

This study was developed under the project ICREW – Improving Coastal and Recreational Waters for all, financed by the INTERREG IIIB programme for the Atlantic Area. The countries involved in ICREW are Portugal, Spain, United Kingdom, France and Ireland. *Instituto Superior Técnico*, one of the participating institutions from Portugal, is involved in Pilot Action 6, entitled “Sustainable Sewage Solutions”.