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INNOQUA: INNOVATIVE ECOLOGICAL ON-SITE SANITATION SYSTEM FOR WATER AND RESOURCE SAVINGS*

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Abstract

The paper discusses the main concerns of an European project, within "H2020-EU.3.5.4. - Enabling the transition towards a green economy and society through eco-innovation". As described on the EC website "INNOQUA will accelerate the path to market of a modular set of innovative, patent protected, award winning and scalable fully ecological sanitation solutions that address wide market needs in rural communities, for agricultural industries, for sustainable home-builders or collective housing owners and for developing countries worldwide".
The project is built based on a modular system addressing the purification capacity of biological organisms (worms, zooplankton and microalgae) so as to bring the necessary ecological, safe and affordable sanitation capacity, "by fully addressing the thematic and cross cutting priorities of the European Innovation Partnerships (EIP) on Water".
The integrated solution proposed by the project is a new and innovative one. The final reuse of wastewater offers a particularly attractive strategy in European communities characterized by small to medium remote water stress, but also with high water demand for agricultural purposes and/or in the view of natural freshwater ecosystems conservation. This way, the proposed strategy can prove to be a sustainable solution for 'zero' wastewater production with the complete reuse of this resource, at small to medium scale situations. However, to reduce the waste directed to surface freshwaters, an integrated solution for the treatment of wastewater is required. This will lead to the attainment of good quality of water, as stated by the Water Framework Directive. The robust but efficient technologies are also perfect for distribution in markets where resources are restricted and trained staff inaccessible.

Keywords: environmental impact, innovation, sustainable solution, wastewater treatment

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1. Introduction

In Europe there are still significant non addressed water concerns. Directive 91/271/CEE, related to the treatment of urban wastewater, establishes criteria and deadlines for the purification of wastewater in all EU Member States, while the Directive 2000/60/CEE (Council Directive, 1991; WFD, 2000) establishes a community framework of action for water policy aspects, which had to be achieved before the end of 2015. Both Directives state the need for an appropriate spill treatment with the purpose of maintaining a good ecological status of water resources. Although 91.4% of EU settlements have less than 2000 inhabitants, making up 20% of the total population of the EU (Somogyi et al., 2009), a large proportion of these communities still fall short of the standards that were stipulated in these measures in terms of wastewater purification and sanitation.

The percentage of the EU population connected to central water supply systems ranges from 55.6% to 99.3%, depending on the country (EEA, 2012), while the proportion of the population coupled with waste water treatment plants (WWTPs) varies from 40% to 90% (EEA, 2007). Data from individual countries show that EU countries have established target ranges from 75–90% of their populations to become connected to sewerage and treatment systems (Somogyi et al., 2009). Despite the fact that EU Water Framework Directive (EU WFD) obliges all countries to achieve the "good status of all the waters" in their territories, there is a gap of 10–15% of the population, equivalent to about 20 million rural inhabitants, who will endure the lack of proper sanitation systems after 2015.

Worldwide, one of the great challenges of the twenty-first century is to reach a global level of development that eliminates inequalities ensuring a decent quality of life and minimum standards for all peoples across the globe. Without a doubt, one of the most important objectives to achieving this global goal is to find a solution for the lack of access to potable water and basic sanitation, which are key aspects to be considered in national development strategies (Benetto et al., 2009; Chianura, 2014; Miksch et al., 2015). Currently, more than one billion people across the globe do not have access to clean water, while 2.6 billion people do not have access to adequate sanitation. Differences between rich and poor communities and urban and rural populations further aggravate this situation, whilst the lack of basic sanitation negatively affects health and social development, especially in the case of women and children and impacts seriously on the environment and the capacity for a society to develop economically. Climate change is also bringing new challenges. In many European Mediterranean countries a severe drought is in many cases cutting people off the water grid or wells have run dry. Water scarcity is a growing concern (Allouche, 2011; Ozkan, 2014; Pagano et al., 2014; Sorlini et al., 2015).

It is in this context that the main economic and technical limitations occur. In order to be able to offer a solution that is of practical benefit to rural areas both in the developed world and countries, and regions that face serious economic constraints, it is necessary to guarantee the elimination and adequate treatment of wastewater with minimum implementation costs and affordable service costs and in a socially acceptable manner. Decentralized, small-scale systems and non-conventional purification technologies such as those presented in INNOQUA offer a solution to the problem faced by these communities. They resemble natural purification processes, are simple, low energy consuming and easy to manage and are cost effective (https://www.openaire.eu/search/project?projectId=corda__h2020::bac817591510efce0aae9ae0064be1db).

The main objectives of this study are to integrate individual low cost, sustainable and biologically based water sanitation technologies capable of performing a whole water treatment cycle and available in multiple modular configurations adapted to local contexts and markets (5 technologies in total, 5 possible configurations).

To demonstrate across 10 countries in 4 continents the long term viability of innovative, modular and sustainable solutions for wastewater treatment in real-environment, to support the commercialization of the proposed solutions in order to encompass pre-commercialization challenges of innovative water solutions and to start stimulating economic growth, business and job creation in the water sector both inside and outside Europe. To eco-design and optimize the proposed solutions to increase the sustainable performance of the water sector through an optimized environmental performance (reduced water consumption, increased resource efficiency, reduced carbon footprint...), a socially accepted and affordable wastewater treatment system (Allouche, 2011; Garrote et al., 2015; Pagano et al., 2014).

2. Concept and approach

The project concept is to develop and demonstrate an innovative, modular and sustainable wastewater treatment technology based on the purification capacity of certain biological organisms (earthworms, zooplankton and microalgae) and alternatively sun light exposure (Fig. 1). State-of-the art technological processes will be employed; in particular, the combination of biodegradation and photo degradation to increase the chemical and ecological quality of the final water effluents (http://cordis.europa.eu/project/rcn/203388_en.html).

The project will perform commercial scale planning and exploitation of the resulting system to include commercial development, technology integration, eco-design, controlled environment demonstrating, real use demonstration actions and market uptake preparation in several European and non-European countries (France, Ireland, Romania, Italy, Scotland, Turkey, Peru, Ecuador, India and Tanzania), and further preparation for post project uptake. The entailed integrated solution for the treatment of wastewater with final reuse of wastewater is innovative and has not been applied in the past, being also particularly attractive for small to medium remote temporal water stressed European communities (http://cordis.europa.eu/project/rcn/203388_en.html).

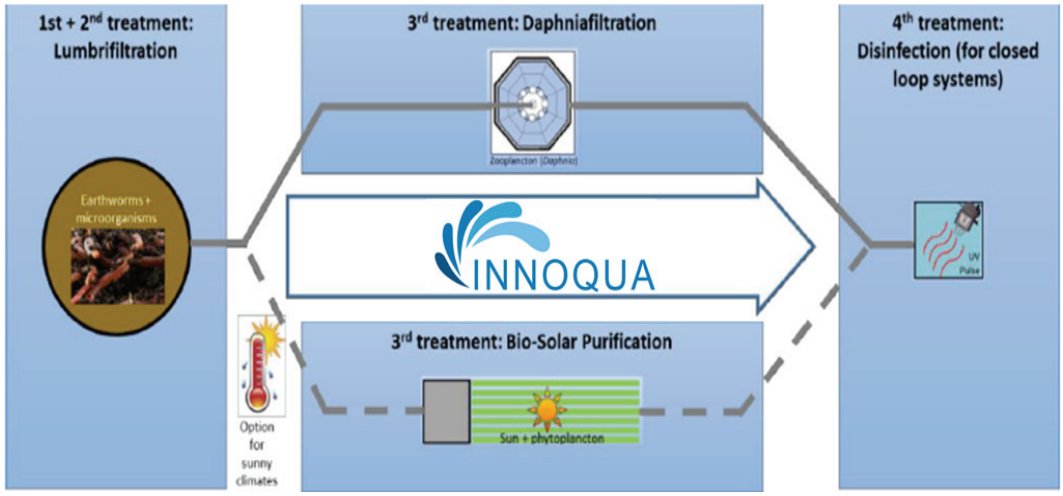

Fig. 1. INNOQUA concept

These communities are generally characterized by high water demand for either agriculture and/or the conservation of natural freshwater ecosystems. Also, this innovative system is ideal to provide an integrated solution for the treatment of organics from wastewater, essential to diminish the amount of pollutants concentrating to surface freshwaters, in the view of the attainment of good quality water resources, as stated by the Water Framework Directive. This requirement is particularly important in South-Eastern (Romania and Bulgaria) and Eastern (Slovenia, Poland etc.) European countries. Figure 1 provides an overview of the INNOQUA modular system.

3. Results and discussion

INNOQUA intends to build on these projects and address key gaps in market including key concerns surrounding the sustainability of implemented solutions in remote and decentralized areas (technical, cost and environmental sustainability), sludge production, presenting commercial offerings that can be modular and site-specific and promoting re-use of treated wastewater where feasible and desirable.

5. Concluding remarks

This project will address demonstration and pilot activities in real environments, the first application and market replication of proven solutions for small-scale wastewater treatment facilities and address two of the thematic priorities identified in the EIP on Water: water reuse and recycling; water and wastewater treatment, including the recovery of resources.

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