IC4WATER RDI FUNDED PROJECTS BOOKLET

Project: Innovative Decentralized and low cost treatment systems for Optimal Urban wastewater Management"

IDOUM

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Project structure (WPs description):

WP1 Selection of chemical and microbial indicators

Task 1 Screening of antibiotics and ARB&G. A standardized analytical method based on an off-line SPE method followed by LC-MS/MS or LC-high resolution-MS will be implemented among partners for quantification and identification of trace concentration of antibiotics in raw wastewater and in reclaimed water. Partners will also develop harmonized methods to assess the abundance of ARB&G in wastewater relying both on culture-dependent and culture-independent methods (quantitative PCR).

Task 2 Assessing possible antibiotic resistance proliferation through wastewater reuse

Developed analytical methodologies will be applied to properly evaluate wastewater treatment technologies and to investigate the mobility/persistence

of antibiotics and ARB&G in reclaimed water in each of the participating countries. A priority list of antibiotics and ARB&G will be defined.

WP2 Development of biological-based treatment systems

Task 1 Phytoremediation with endophytic bacteria inoculation. First step will consist in the identification of endophytic microorganisms of *Phragmites australis*. Second step will include the bio-inoculation of ponds and/or constructed wetlands for bioremediation improvements of antibiotics and ARB&G

Task 2 Phycoremediation with specific algae species. First, specific selected algae will be evaluated for antibiotic and ARB&G removal. These latter will be released in sewage ponds to assess their capacity to multiply by effectively outcompeting resident non-productive species and by sequestrating the nutrients.

Task 3 Mycoremediation with specific *Trichoderma sp.* Different commercially available *Trichoderma sp*. strains will be cultivated under controlled conditions to evaluate their capacity to eliminate antibiotics and ARB&G. The best performing fungal species will be adapted in bioreactors for real domestic wastewater treatment assessment.

WP3 Development of nano-structured catalytic materials for oxidant activation

Task 1 nano-CuO assisted generation of sulfate radical. CuO nanoparticles will be anchored in clay mineral (e.g., bentonite). Clay composites will be granulated and tested for persulfate activation into sulfate radical. Filtration by nanoclay composites will be assessed for antibiotics and ARB&G removal.

Task 2 Modified iron minerals and iron mining residues for heterogeneous Fenton processes with H2O2. The iron materials will be prepared by coprecipitation method in the presence of different concentrations of modifying metals (Cu or Ce). Process efficiency will be evaluated by kinetic studies and by-products identification by LC-MS.

WP4 Technology integration and technology demonstration

Task 1 Technology demonstration. Feasibility and technical capability of the combined (biological + chemical) operation will be planned at several experimental sites. At the wastewater reuse platform for irrigation located in Murviel-lès-Montpellier, a mixed reactor will be specifically designed to treat secondary biological WWTP effluents and will be coupled to an AOP step involving CuO clay composite and persulfate working in a filtration mode. At the Helmholtz Institute in Munich, it is proposed to connect a series of middle-sized (10-50 m3) treatment basins to the original domestic wastewater effluent pipe. Each basin would represent a certain type of treatment option such as vertical surface, vertical subsurface and horizontal subsurface constructed wetlands and some AOPs tanks. At the Mossay Bay sanitation facilities (South Africa), sewage ponds will be inoculated by the specific selected algae and effluents will be passed through CuO filters before they will be used as food source for aquaculture species in final ponds. At the clinic hospital of Universidade Estadual de Campinas (UNICAMP), hospital effluents will be treated by a combination of anaerobic biological treatments with heterogeneous Fenton tanks using modified iron minerals.

Task 2 Technology benchmarking. Proposed technologies will be benchmarked against other treatment methods (for instance, UV-C or BRM) in terms of energy consumption (electric energy per order) and the cost of chemical addition (if required).

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