USE OF SECONDARY TREATED EFFLUENTS BY BIOLOGICAL PROCESSSES (STABILIZATION POND SYSTEMS AND UASB REACTOR/ ACTIVATED SLUDGE PROCESS) IN AGRICULTURAL SOILS

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Within human activities, common agricultural irrigation represents, doubtlessly, one of the most consumptive practices of natural water resources. One alternative to solve and to minimize this high water consumption is the use of residual water (effluents) generated by biological sewage treatment systems.

The increasing agribusiness in Brazil and especially in São Paulo State, combined with the fact that sewage treatment systems generate high amounts of effluents, reveals the great potential of using treated sewage effluents for irrigation, minimizing the use of fresh water.

Thus, the present thematic project aims at investigating the sustainable utilization of secondary treated sewage effluents, disinfected through chlorination and ultraviolet radiation, in agriculture. For this purpose, effluents of different physico-chemical characteristics, produced by stabilization pond systems and up flow anaerobic sludge blanket (UASB) are utilized. After application to the soil, effects on the soil-plant-water system will be monitored. To understand the dynamics of the soil-plant-water system, detailed studies will be carried out: (i) to characterize soils hydrodynamics functioning, soil solution dynamics and to evaluate the soil capacity for element retention; (ii) to monitor nutrients and other elements in the treated sewage effluents and to evaluate the efficiency for nutrient supply, especially for nitrogen; (iii) to observe changes of major physical and chemical soil properties due to irrigation; (iv) to characterize organic matter originating from secondary treated effluents, evaluating its impact on the soil element dynamics and simulating the dynamics using mathematical modeling; (v) to evaluate the effect of secondary treated effluents on soil microbial biomass and its metabolic activity; (vi) to evaluate the nutritional status of plants and the benefit on dried plant material production. Moreover, the sustainability of the system depends on sanitary, technical and economical aspects. Thus, it is fundamental to evaluate: (vii) the disinfection processes of secondary treated effluents from the different treatment systems and to compare their technical and economical aspects; (viii) the formation of toxic sub-products (Trihalomethanes, THMs, and Halo-Acetic-Acids) during the chlorination process under different conditions, especially associated to ammonia concentration; (ix) the drip operability and the sprinkler irrigation system; (x) the economical viability and the environmental impact of utilizing secondary treated effluents.

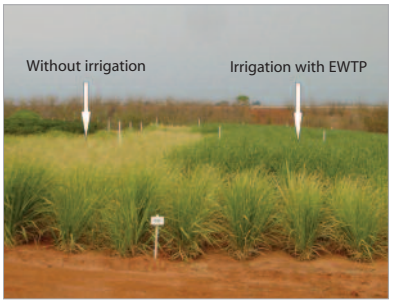
Crops irrigated with effluents from wastewater treatment plants (EWTP)

SUMMARY OF RESULTS TO DATE AND PERSPECTIVES

By means of the study on various crops (coffee, maize, sunflower, Tifton 85 bermudagrass and sugar cane) it was possible to evaluate the impacts of treated wastewater irrigation on the plant-soil-water system.

The results showed the feasibility of using effluents from a wastewater treatment plant (EWTP) as a nutrient and water source in agriculture. The nutrients present in EWTP, especially nitrogen, has reduced the use of N-fertilizers leading to a significant savings of fresh water, representing an important economical and environmental alternative.

Despite the presence of nutrients, only the EWTP was not sufficiently to supply the plants nutritional demands. Thus, it is necessary to implement corresponding management strategies adapted to the EWTP characteristics in order to keep the nutritional balance.



Sugar cane with and without irrigation with effluents from wastewater treatment plants (EWTP)

Considering soil quality, the main limitations found was the presence of high levels of Na in the EWPT, resulting in increased contents of dispersed clay, leading to a reduction of soil hydraulic conductivity in the experiments carried out with corn and sunflower. However, it has to be emphasized that the same effect was also observed in areas irrigated with potable water naturally rich in sodium, as it is used in Lins (SP, BR).

Although the input of N to the system by EWTP irrigation represents an attractive alternative, it can result in environmental problems due to nitrate leaching followed by contamination of groundwater. High levels of nitrate, below the root zone, were observed in soil solution in the experiments with maize, sunflower and sugar cane, however, it was not found for bermudagrass. These findings strengthen the importance of adequate crop selection and management for a successful and sustainable irrigation with EWTP in agriculture.

It can be concluded that from the agronomical and environmental point of view, EWTP may efficiently substitute conventional irrigation water, resulting in economical benefits, as well as in increased crops productivity and quality. Moreover, the use of EWTP has positive effects on soil acidity and other chemical properties, important for tropical soils.

Concerning health aspects, it was found that a dose of 10 mg L^{-1} chlorine, over a treatment time of 20 minutes, was sufficient for inactivation of total coli forms, *E. coli* and *Salmonella sp* in the EWTP. The trihalomethane concentrations were below the drinking water standards, probably due to the priority reaction of chlorine with ammoniac nitrogen.

MAIN PUBLICATIONS

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