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Integrated Approach Towards Safe Wastewater Reuse in Moroccan Agriculture

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Abstract : The Mediterranean region is considered a hotbed for climate change. Morocco is a semi-arid Mediterranean country facing water shortages and poor water quality. Its limited water resources limit the activities of various economic sectors. Most of Morocco's territory is in arid and desert areas. The potential water resources are estimated at 22 billion m3, which is equivalent to about 700 m3/inhabitant/year, and Morocco is in a state of structural water stress. Strictly speaking, the Kingdom of Morocco is one of the “very riskiest” countries, according to the World Resources Institute (WRI), which oversees the calculation of water stress risk in 167 countries. The surprising results of the Institute (WRI) rank Morocco as one of the riskiest countries in terms of water scarcity, ranking 3.89 out of 5, thus occupying the 23rd place out of a total of 167 countries, which indicates that the demand for water exceeds the available resources. Agriculture with a score of 3.89 is most affected by water stress from irrigation and places a heavy burden on the water table. Irrigation is an unavoidable technical need and has undeniable economic and social benefits given the available resources and climatic conditions. Irrigation, and therefore the agricultural sector, currently uses 86% of its water resources, while industry uses 5.5%. Although its development has undeniable economic and social benefits, it also contributes to the overfishing of most groundwater resources and the surprising decline in levels and deterioration of water quality in some aquifers. In this context, REUSE is one of the proposed solutions to reduce the water footprint of the agricultural sector and alleviate the shortage of water resources. Indeed, wastewater reuse, also known as REUSE (reuse of treated wastewater), is a step forward not only for the circular economy but also for the future, especially in the context of climate change. In particular, water reuse provides an alternative to existing water supplies and can be used to improve water security, sustainability, and resilience. However, given the introduction of organic trace pollutants or, organic micro-pollutants, the absorption of emerging contaminants, and decreasing salinity, it is possible to tackle innovative capabilities to overcome these problems and ensure food and health safety. To this end, attention will be paid to the adoption of an integrated and attractive approach, based on the reinforcement and optimization of the treatments proposed for the elimination of the organic load with particular attention to the elimination of emerging pollutants, to achieve this goal. , membrane bioreactors (MBR) as stand-alone technologies are not able to meet the requirements of WHO guidelines. They will be combined with heterogeneous Fenton processes using persulfate or hydrogen peroxide oxidants. Similarly, adsorption and filtration are applied as tertiary treatment In addition, the evaluation of crop performance in terms of yield, productivity, quality, and safety, through the optimization of Trichoderma sp strains that will be used to increase crop resistance to abiotic stresses, as well as the use of modern omics tools such as transcriptomic analysis using RNA sequencing and methylation to identify adaptive traits and associated genetic diversity that is tolerant/resistant/resilient to biotic and abiotic stresses. Hence, ensuring this approach will undoubtedly alleviate water scarcity and, likewise, increase the negative and harmful impact of wastewater irrigation on the condition of crops and the health of their consumers.

Keywords : water scarcity, food security, irrigation, agricultural water footprint, reuse, emerging contaminants
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