WATER REUSE POTENTIAL OF KONYA CLOSED BASIN, TURKEY

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Abstract

Konya Closed Basin (KCB) is one of the hot spots of Turkey in terms of intense agricultural activity and high irrigation demand. Agricultural areas cover approximately 60% of the basin with water thirsty crops (e.g. alfalfa, corn, sugar beet, wheat) accounting for the largest share. Over 90% of the total water demand is used up for irrigation, which is mainly met from groundwater bodies as surface water resources are quite scarce and mostly seasonal due to semi-arid climatic conditions. The continuous increase in total water demand coupled with unsustainable irrigation methods and unlicensed wells have led to groundwater depletion (> 30 m) over the past decades, giving rise to formation of numerous sink-holes in the basin. Currently, total water potential of the basin (4430 hm^3) is far from meeting the total water demand, with agricultural water use reaching up to 4725 hm^3 and non-agricultural use consuming 234 hm^3. Given that the climate change models project around a 20-30% decline in precipitation for the KCB, current agricultural practices need to be revisited and water reuse options should be considered in order to sustain the water resources and ecosystem of the basin.

To this end, a case study is being carried out in KCB as part of the WATERMED4.0 project to investigate the pros and cons of using treated and disinfected wastewater for irrigation purposes. Overall, WATERMED4.0 project promotes smart farming by enhancing efficient use of conventional and non-conventional water resources in Mediterranean agriculture through the use of IoT technologies. The studies will continue through 2022 with the following expected results: i) evaluation of the suitability of using reclaimed water in growth of root/herbaceous plants, ii) enhancement of irrigation efficiency by employing modern irrigation technologies and optimization of water use through smart farming (sensor deployment/user-friendly platform development, etc.) and iv) assessment of relevant socio-economic aspects.

As part of the study, wastewater treatment capacity of the basin were examined along with existing treatment methods. At present, total daily volume of wastewater in KCB is 560.000 m^3, corresponding to a population of 2.8 million people. However, total number of wastewater treatment plants (WWTPs) operating in the basin is 35, with a total treatment capacity of 329,748 m^3/day. There are only 6 wastewater treatment plants (WWTPs) having a treatment capacity over 2000 m^3, of which 2 are advanced biological and 4 are biological WWTPs, having a total daily treatment capacity of 234,789 m^3. In other words, 3913 ha can be irrigated within an irrigation period. Nonetheless, approximately 10,000 ha of arable land can be irrigated with reclaimed water if necessary investments are made to treat the wastewater of the entire basin. At this point, it is important to evaluate the suitability of chemical and microbiological quality of treated wastewater for irrigation, including tolerance of plants to reclaimed water. The use of reclaimed water for irrigation is regulated under the

"Communique on the Technical Procedures for Wastewater Treatment Plants (27527/2010)" in Turkey. Unlike in the "Regulation of the European Parliament and of the Council on minimum requirements for water reuse", there are 2 classes identified in the Communique for reclaimed water: Class A (all food crops consumed raw - all irrigation methods) and Class B (food crops consumed raw where the edible part is produced above ground and is not in direct contact with reclaimed water, and non-food crops including crops used to feed milk- or meat-producing animals). Based on the minimum requirements as stated in the Communique, effluents of existing WWTPs in the basin are not in adequate quality to be used as irrigation water. First and foremost, *F.Coli* limits (Class A: 0 CFU/100 mL; Class B: 200 CFU/100 mL) cannot be met for water reuse, since WWTPs lack disinfection units. Apart from this, care should be taken in the selection of proper irrigation method due to high specific ion concentrations (especially sodium and chloride) of the treated wastewater.

In conclusion, existing water treatment plants in KCB need revisions or additional units in order to meet minimum requirements for water reuse. Studies conducted during the development phase of River Basin Management Plans showcase that existing WWTPs serve only to ~60% of the basin population. Thus, new WWTPs could actually be constructed providing for water reuse options. Yet, it should be noted that high investment costs to upgrade WWTPs and lack of financial incentives to practice water reuse in agriculture can be identified as the ultimate reasons for the low uptake of water reuse in Turkey. Therefore, it is necessary to address these challenges through the promotion of innovative schemes and economic incentives taking into account not only the costs, but also the socio-economic and environmental benefits of water reuse.

Keywords: reclaimed water, reuse requirements, smart farming, water reuse