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SIMULATIONS OF THE DISPERSION IN THE MARINE ENVIRONMENT OF BRINE DISCHARGES FROM DESALINATION PLANTS IN ALGERIA

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Abstract

In the current context where Algeria, like many arid regions, is facing an increasing water shortage, seawater desalination represents a vital solution. However, this technology poses a major environmental challenge in managing brine discharges. This study focuses on analysing the brine discharge systems of two desalination plants in Algeria, Ténès and Magtaa. Our approach relies on modelling using the CORMIX (Cornell Mixing Expert System) code, taking into account meteorological variations and the position of the water intake point. The goal is to evaluate the performance of the discharge systems and analyse the interaction between brine discharges and intake waters.

We observed a significant increase in salinity, sometimes reaching 42 g/L, in the water catchment zone of the Ténès desalination station due to inadequate dilution of brine discharge. In contrast, simulation results demonstrated the effectiveness of the underwater diffuser dilution at the Magtaa station. We also identified that the close proximity of the diffuser outlets limits its dilution efficiency. A proposed reconfiguration, involving reducing the number of orifices while maintaining the length of the diffuser, resulted in reduced salinity meeting the standards after 300 meters of dispersion. In response to these challenges, the study explored the sizing of dilution structures such as a trapezoidal open-channel and a dilution basin. These solutions aim to optimize dispersion.

The integration of the Geographic Information System (GIS) allowed for the overlaying of simulation results on real maps, thus providing a precise and contextual visualization of the environmental impacts of brine discharge and the development of recommendations for improving discharge management. The suggested adjustments have proven effective, reducing the excess brine concentration from 6 g/L to 1.8 g/L at the intake point of the Ténès desalination station.

This work provides an in-depth understanding of the environmental implications of brine discharges from desalination stations in Algeria, along with practical solutions to minimize these impacts while ensuring the operational efficiency of the facilities.

Key words: Algeria, brine, Cormix, desalination diffuser, environnement, GIS, impacts, Megtaa, sea, Tenes

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