

DIFFUSION/DILUTION OF DESALINATION DISCHARGES INTO SEAWATER

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INTRODUCTION

Holographic interferometry (HI) is an optical technique, by means of which changes in the refractive index can be visualized as interference fringes. The technique has been used to study the behavior of brine discharges from desalination plants into the sea. When the brine is discharged into the sea, the diffusion/dilution of the salts in the seawater begins thus causing concentration changes associated to changes in the refractive index. This variation of the refractive index can be visualized as an interference fringe pattern by means of HI.

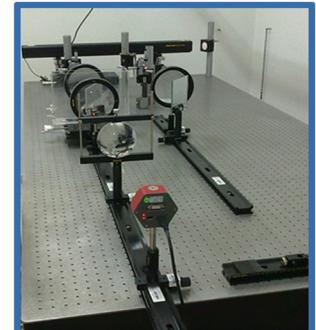


Figure 1: Experimental setup

MATERIALS

The experimental setup (*figure 1*) consists of an optical device and a module (*figure 2*) where mass transfer process will take place. Whole experimental setup is arranged on a optical table provided with a good insulation. Since the technique is sensitive to small movements, the insulation avoid vibrations.



Figure 2: Picture of the module

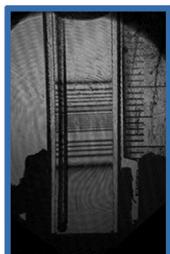


Figure 3: Interferogram

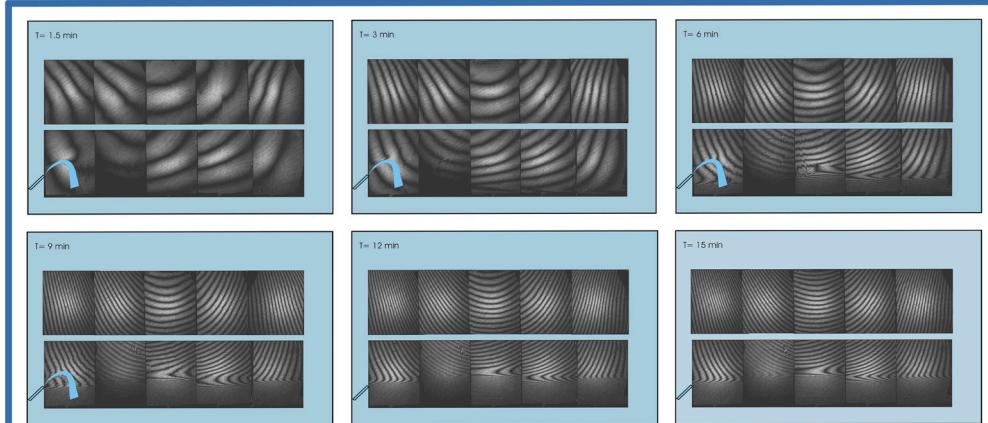


Figure 4: Interferograms of a experiment with 5mL/min of flow rate and sloping entry (40°) to 2.5 cm

METHODS AND RESULTS

The first aim is to determine the diffusion coefficient of brine in seawater. Diffusion experiments, consisting on a slow introduction of brine in a transparent cell (1x1x5 cm) containing seawater, have been carried out. When both solutions get in contact, the diffusion of solute starts and interference fringes (interferogram) begin to appear. The diffusion coefficient of brine in sea water has been calculated using this interferograms (*figure 3*), obtaining a value of $1.27 \cdot 10^{-5} \text{ cm}^2/\text{s}$.

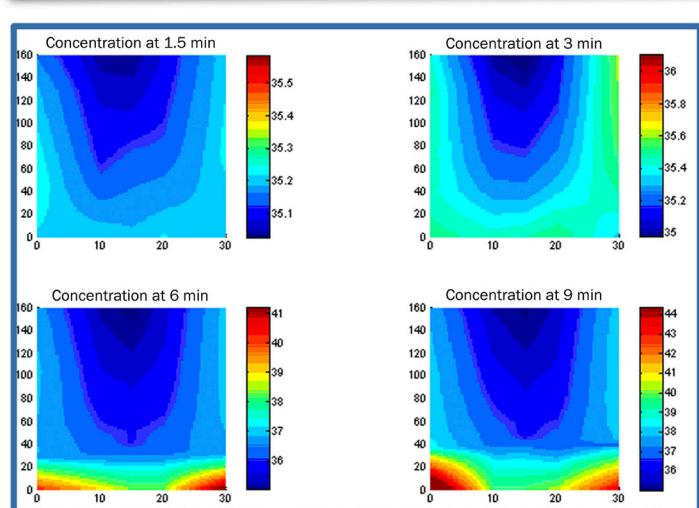


Figure 5: Simulation of experiment with 5mL/min of flow rate and sloping entry (40°) to 2.5 cm

Dynamic experiments have been also carried out, introducing a flow of brine into a module (*figure 2*) with seawater. Several characteristics of the brine discharge as the flow rate, concentration, depth and angle of discharge have been studied. The interferograms (*figure 4*) obtained show the evolution of the fringes with time, and hence the evolution of diffusion process. Using the interferometric fringe patterns obtained, concentration profiles (*figure 5*) in the container have been calculated.

CONCLUSIONS

Results obtained show a better diffusion/dilution of brine when the discharge is not horizontal and a moderate flow rate is used. Furthermore, using diluted brine there is less accumulation of salts in the bottom which is better for the sea bed.

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