POTENTIAL TOLL OF A DESALINATION PLANT: A) SEAWATER QUALITY

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Abstract
The potential impact the discharges of brine and backwash (containing the coagulant ferric hydroxide) on seawater quality was monitored at the area of the outfall of a reverse osmosis (RO) desalination plant. Preliminary results showed that water was warmer and more saline at the discharge area, and that the backwash tinted the water red, increased water turbidity and the concentration of suspended particulate matter, the influence reaching up to 1,500m. Nutrient concentrations were also higher at the discharge area and decreased with increased distance. While the effect of the backwash on a few parameters of water quality was obvious, the various discharges in the area make it impossible at this time to attribute a cause-effect to explain the findings of this research.
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Desalination has increasingly been seen as an important element in dealing with water shortage particularly by countries which border the sea. In Israel, increase in water usage and dry years prompted the government to set a goal of 600,000 million m^3 desalinated water per year by 2013. To date, there are two operational seawater desalination plants at the Mediterranean coast of Israel, producing ca. 140,000 million m^3 water yearly by reverse osmosis, a third plant almost operational (ca. 100,000 million m^3 yearly) and two large plants at the planning stage. However, the impact of pumping large volumes of seawater into the plants and of concentrate discharges from the plants has yet to be fully assessed. Pumping large volumes of seawater into desalination plants can cause impingement and entrainment of organisms, in particular plankton, fish eggs and larvae, and depletion of those organisms. Moreover, ca. 50% of the feedwater is converted to concentrate that is discharged back to the sea. If the desalination plant operates in an area where water quality is already poor, the concentrate will contain also excess of the pollutants present in the seawater intake. In addition, the process of desalination utilizes chemicals in the pre-treatment of seawater entering the plant and during the desalination process such as ferric hydroxyde (coagulant) and polyphosphonates (antiscalants) that are discharged to sea with the desalination concentrate (1). In this work we monitored the effect of the discharge of ferric hydroxide on the water quality at the outfall of a RO desalination plant operating in Ashkelon, at the southern Mediterranean coast of Israel , the largest RO plant in the world. The brine and the backwash of preliminary filtration stage, the latter containing ferric hydroxide, are discharged at the shore, next to the discharge of cooling waters of a power plant adjacent to the RO plant. The brine is discharged continuously while the backwash is discharged in pulses, their frequency depending on the seawater quality of the intake. To complete the picture, brine from well's amelioration, containing nitrates, are also discharged in the same area. Three surveys (April and August 2008 and April 2009) were conducted in the area and seawater samples were collected before, during and after the pulsed discharge of the backwash, along a gradient from the more affected area to apparently clear (non affected) water area. Preliminary results showed that seawater temperature at the outfall area was higher by 4-6 ^oC due to the effect of the power plant cooling water discharges. Salinity was ca. 1% higher than the natural salinity in the area (39.5) due to the brine continuous discharge, it's influence traced up to 500 m from the outfall. Similar results were seen in SE Spain (2). The backwash increased water turbidity and tinted the seawater red as a result of the introduction of suspended particulate matter containing Fe, that increased in concentration from 6 to 14 mg/l. It's influence could be traced as far as 1,500 m from the outfall. The bacterial community was also influenced as described by Yacobi and Kress (Submitted abstract, CIESM 2010). Nutrient concentrations at the discharge area was higher than in the vicinity, in particulate nitrate, probably as a result of well's amelioration brine, with concentration decreasing with increased distance from the discharge area. While the effect of the backwash on water quality (turbidity, particulate matter) was obvious, the various discharges in the area make it impossible at this time to attribute a cause- effect to explain the findings of this research.

References

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