

GROUNDWATER QUALITY DEGRADATION BY LANDFILL LEACHATES IN A CARBONATE AQUIFERS (LA MINA LANDFILL, SOUTHERN SPAIN)

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Abstract: The urban solid waste landfill of Marbella (south of Spain) is placed on a marble aquifer of the Blanca-Mijas Hydrogeological Unit. The landfill is unlined, so the leachate infiltrates and degrades the chemical quality of the groundwater. The contamination moves towards the SW in agreement with the natural groundwater flow. During a period of 600 days a systematic control of the groundwater surrounding the landfill was done. An increase in the study parameters during the research period has been detected. This increase have been controlled in the most affected piezometers by means of two parameters, electrical conductivity and chloride content. The highest values in these parameters have been measured in the most distant piezometer and at a lower elevation point and the lesser values in a piezometer closer to the landfill. This distribution must be due to the heterogeneity of the karst system. The pumping effect in several points, to the south of the landfill, produces also a degradation in that waters.

INTRODUCTION

Groundwater studies in leachate-contaminated aquifers have been focused almost exclusively in detritic terrains (Cherry et al., 1983; Christensen et al., 1994) were the matrix homogeneity of the aquifer facilitated the study of the complicated processes taking part in this contamination episodes. In karst zones because of its high vulnerability, low self-degradation characteristic (Kresic et al, 1992) and, in general, high groundwater velocities is necessary the detailed study of the whole processes that takes place in landfill contamination. This work present the investigation during a 600 days period in the surroundings of La Mina landfill (sur de España) in order to show the affection of the landfill leachates in the groundwater.

CHARACTERISTICS OF THE URBAN SOLID WASTE LANDFILL

The study landfill is located 60 km to the West of the city of Malaga, South of Spain, (Figure 1) and 2 km from the center of the city of Marbella. The waste dumping began in the early 1975 and is still active. The landfill store all the wastes generated in the municipality. Marbella, as tourist town, presents a great population variability, with 90.000 habitants in winter and 350.000 during summer, what is traduced in the garbage volume generated in winter, 90.000 Kg/day (8 months) and 350.000 Kg/day in summer (4 months, from June to September), considering a daily-produced-waste rate of 1 Kg per person and day. Therefore an annual production of 64.000 metric tons is estimated. The total volume stored until present time has been calculated from aerial photographs, topographic maps (1:10.000) and direct measure in the field. The lateral extent and average thickness of the landfill is 40.000 m² and 15 m respectively, what displays a volume, since 1975 of 600.000 m³. The base of the landfill is unlined, so garbage is putted directly in contact with underlain aquifer materials and therefore an infiltration of the leachate into the aquifer occurs.

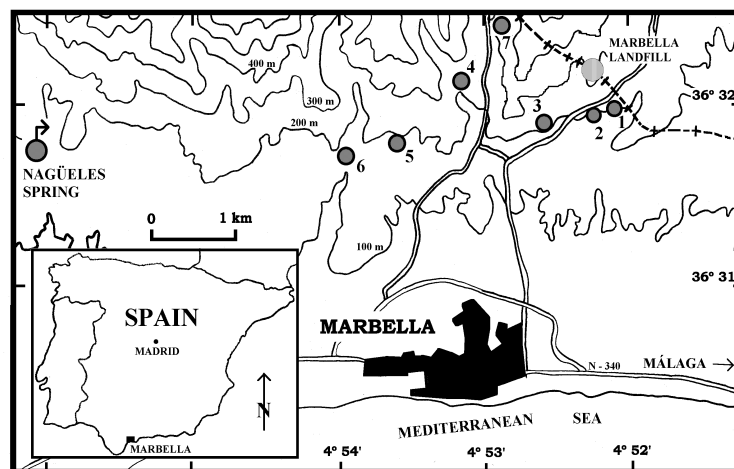


Figure 1.- Map of the study area with location of the sampling points

Leachate presents an average electrical conductivity (EC) of 24.000 $\mu\text{S}/\text{cm}$ and high contents of the majority of ions. Chloride, with average values of 5 g/l, sodium 3 g/l and ammonium, 3 g/l are the dominants ions in the leachate (Vadillo et al., 1999).