

Pollution Sources Determination of the East – West Profile of the spring system / Ramallah West, Palestine

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Abstract

The pollution sources to the spring group system in Natuv catchment were detected. A hydrochemical study was carried out in order to determine the pollution degree. Twenty springs were sampled for two rounds in the years 2010 and 2011. The physical, hydrochemical characteristics of the East west Profile of a spring group system was determined. The major ions, trace elements indicate that the springs inside the rural communities are polluted. The high concentration of nitrates of 250 mg/L in the springs of Ein Qinia and Ein Areek groups indicates the water spring pollution from the cess pits of the nearby villages. The high concentration of sulfate was found in the springs of Ein Areek group as an indicator of an intensive agricultural activities. The high levels of 20 to 100 c/100 ml of bacteriological parameters of FC and TC were found in the springs, which are locating inside the villages of housing around. A spring water treatment techniques were recommended for the springs of high pollution degree rates.

Key words: Pollution, Natuv Catchment, Springs

Introduction

The chemical, physical and biological properties of the springs differ from place to place, depending on their locations and the nature of outcropping. There are different pollution sources affecting the properties of their waters, such as an increase in the concentration of nitrates and salts, as well as the Coliform bacteria. Contaminants are divided into three main sections: One is the pollution that changes the physical properties of natural spring water and makes it unbootable for use such as odor, color and impurities. The second section is the chemical pollution that results from the presence of toxic substances in the spring water, such as lead and pesticides. The third section appears in the presence of pollutants, which contains biological pathogens such as coliform bacteria (Water Authority, 2009).

Study Area

The study area consists of the springs in the villages of Beitillu, Deir Ibzai, Ein Qinia and Ein Areek. Its location is in the western side of the city of Ramallah / Palestine. Beitillu village is one of the more communities with the province number of springs of more than 100 spring water. There are two main springs in Dier Ibzai village, named Ein Bubeen and Majour which lies a 12 km west of Ramallah city. Ein Qinia village lies to the west of the city of Ramallah with a small area and 1000 inhabitants with three major springs in the village. The springs flows reaches a 250 thousand cubic meters annually (PWA, 2012), and

they are located in the center of the village. There was reliable population assembly mainly in the spring water uses in Ein Qinia village in the absence of a public water network. Two main springs in the Ein Areek village, Ein Arik Fawqa and Tahta discharging of over 250 thousand cubic meters per year, located in central part of the locality, close to the cesspits and close to the landfills. In addition to that, three small springs are located in the area (water Authority, 2004).

Methodology

Beitillu samples were taken from the waters of the springs in the study area between the periods of 24/6/2011-28/6/2011. Samples were taken in one 1 liter of all springs in the study area. They reserved in sterile containers and sealed and they were analyzed in the laboratory of the Faculty of Science at the University of Birzeit. The analyses were interpreted by using specialized software AquChem to demonstrate the results of tests. Samples were analyzed chemically and physically and biologically, where their chemically results taken parameters are calcium, sodium, potassium, magnesium, chloride, sulfate, bicarbonate, and nitrate. The results pH and dissolved substances as well as the electrical conductivity were analysed. The biological parameters were analyzed for the bacteria of total and fecal Coliforms, which reveal the presence of fecal bacteria in the water.

Results & Discussion

Beitillu Group Springs

The pH results of the **Beitillu springs**, reveals that the pH ranging between 7.5 in each of the springs of Alwaysi and Zarqa to 8.0 in the spring of Al Balad, and this means that the degree of pH is within the allowable limit globally (6.5 to 8.5). But Al Balad spring was approaching the upper limit because of the presence beside housing of the community, and is at the leakage of the waste water from the nearby septic tanks.

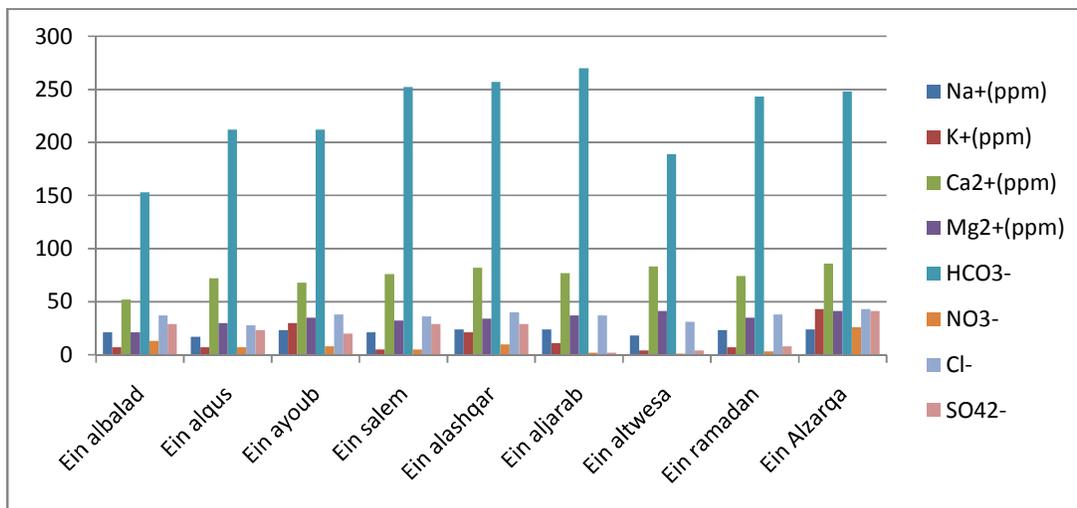


Figure 1: The results of hydrochemical tests of water springs of Beitillu village.

The concentration of calcium and bicarbonates salts were found within the allowable limit globally. It is considered to be high more than other parameters in group springs of Beitillu due to the nature of the rocks, and thus typed calcium – Bicarbonate springs. This harmonizes with nature rocky limestone and dolomite that form the underground reservoir. The high concentration of potassium and sulfate salts were found in the

Zarqa, Ramadan and Salem springs in compared with the other springs from the whole spring groups, which is due to the agricultural activities around these springs. Using the agricultural pesticides around these springs increased the concentration of salts in general in the groundwater and springs (Shalash and Ghanem, 2007).

The nitrates ranged between 1.0 mg / L to 26.0 mg / L in the spring of Ataiwasha, due to the fact that it is far from the population centers of the nearby village from one hand and it hasn't agricultural activities in the other hands. Biological tests showed that the fecal coliforms is of zero count in all springs, but the total bacteria coliform has reached 20 colonies / 100 ml in the Ramadan spring, which is considered to be high compared to the other springs.

Deir Ibzai Group Springs

PH reached 7.6 in Ein Bobbin spring, while it was 7.2 in the spring Almagor, and this means it is within allowable international standards. The total dissolved solids were 264, 260 mg/l in the springs of Ein bobbin and Ein Major respectively.

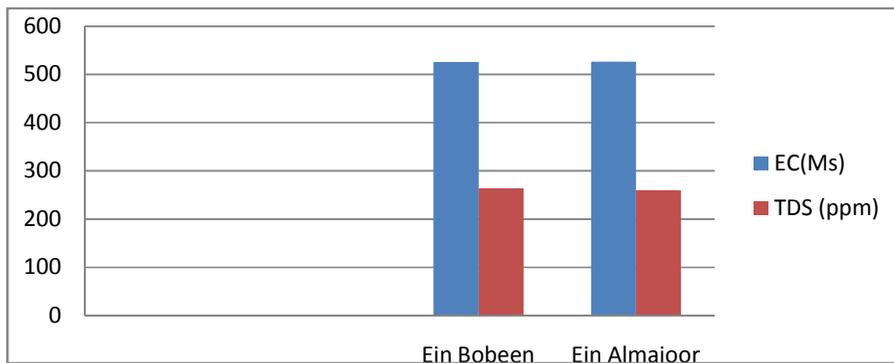


Figure 2: The results of physical tests of water springs of Deir Ibzai village.

The concentration salts of calcium, potassium and magnesium in both springs are within the allowable limit globally. The spring Majoor showed high concentration of calcium of 91 mg / L in (Figure 3). This increase reflects the calcium - Bicarbonate type which reflects the rock formations of the spring - discharge zones, namely limestone and dolomite. The nitrate was of 9 mg / L in the spring Majoor.

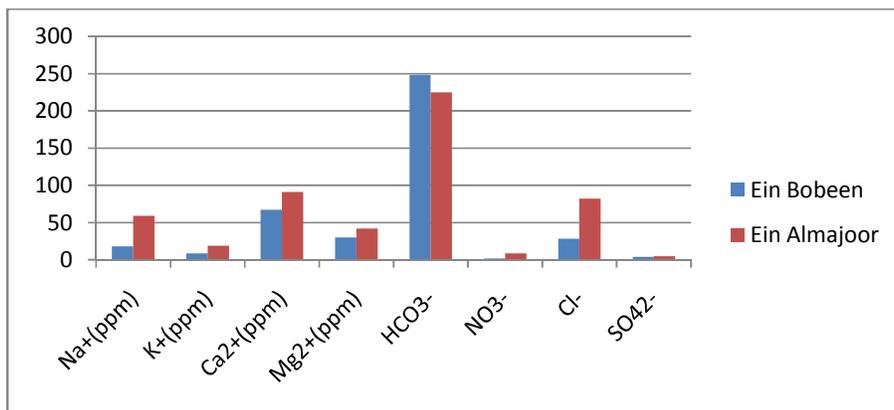


Figure 3: The results of hydrochemical tests of water springs of Deir Ibzai village.

Ein Qinia Group springs

In **Ein qinia** village the analyses revealed that these springs have been contaminated in accordance to the high concentration of nitrates. The nitrate concentration was high comparing with the springs in other groups and higher than the allowable concentration universally, as the upper limit for the concentration of nitrates should not exceed 50 mg / l. The nitrate increase is the indicator of water pollution of these three springs with wastewater from cesspits and waste water flow in the valleys, in addition to the presence of livestock that drink from the spring water directly causing contamination and makes them unsuitable for drinking purposes.

A high concentration of dissolved salts were found, where the percentage of calcium closer to the upper limit allowed globally in the three allocated springs with a high concentration in the Al Balad spring reaching 92 mg / l (Figure 4). This is due to the focus of human activities as well as the agricultural activities and the use of agricultural pesticides, which in turn raises the proportion of dissolved salt in the groundwater as well as increasing the sulfate concentration, especially in the springs of Al Balad and Qaws.

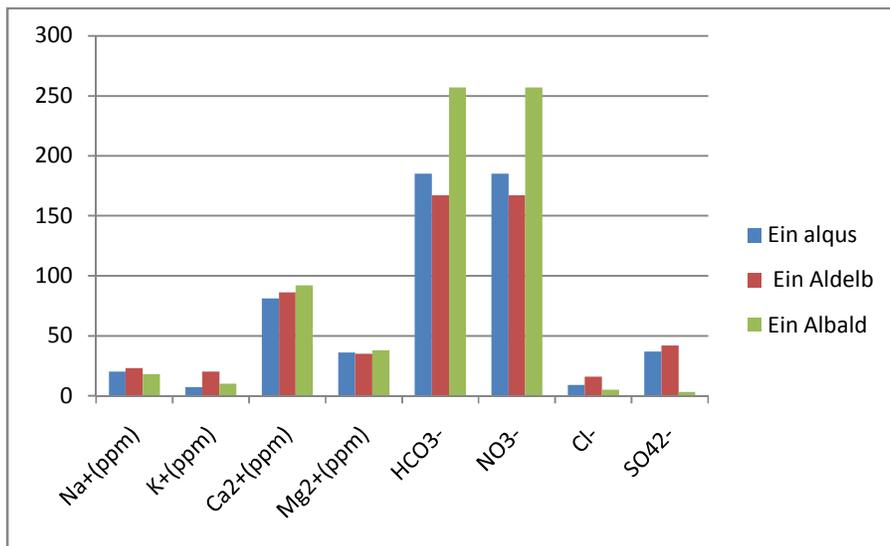


Figure 4: The results of hydrochemical tests of water springs of Ein Qinia village.

The Ein Qinia springs are exposed in the limestone and dolomite formations which reveals to the Calcium – Bicarbonate type. The Ein Al Balad spring is polluted and has a high salt concentration compared with the other springs in the catchment.

Ein Areek Group springs

The Ein Arik springs, which are used for irrigation, drinking and domestic purposes are contaminated, especially the main Ein Arik springs (Fawqa and Tahta) which are located in the center of the village, close to cesspits and the solid waste landfills.

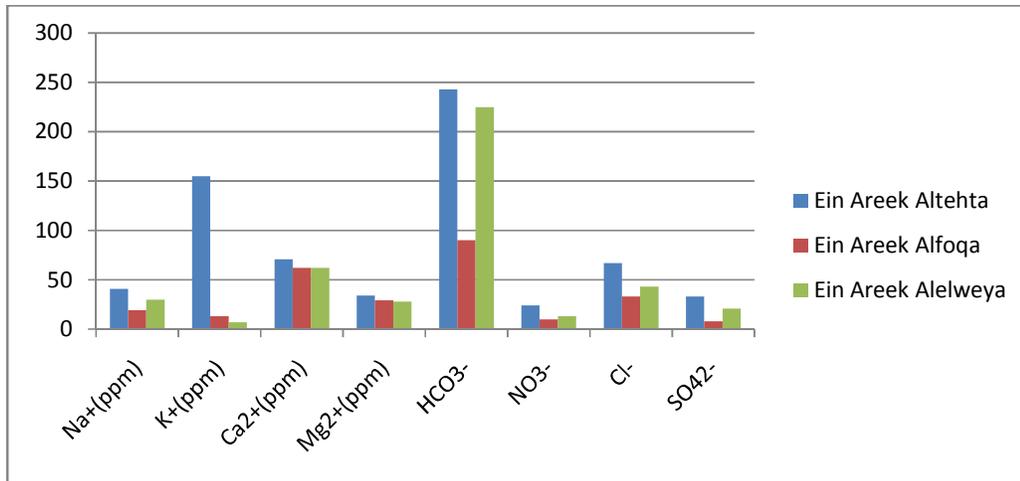


Figure 5: The results of hydrochemical tests of water springs of Ein Areek village.

The high potassium concentration salts in the Ein areek springs, especially in the Ein Arik Tahta is due to the agricultural activities around its exposure, where citrus groves and fruit trees, as well as growing vegetables. This in turn leads to the use of agricultural pesticides significantly that will seep into the groundwater and thus lead to a high salts concentration. The spring group typed calcium - bicarbonate returns to the limestone and dolomite rocky nature of their exposure.

Groups Comparison

The physical, chemical and biological analyses show that some springs approaching the upper concentration limit for some chemical parameters. The pH in the springs of the study area is within the allowable limit globally and differs from one area to another. It is higher in Beitillu springs reaching 8.0, whereas is less in the Ein Arik springs. This does not reflect their suitability for drinking purposes. The total dissolved solids was higher in Beitillu springs comparing with the springs of the other groups with a minimum the Dir Ibzai springs.

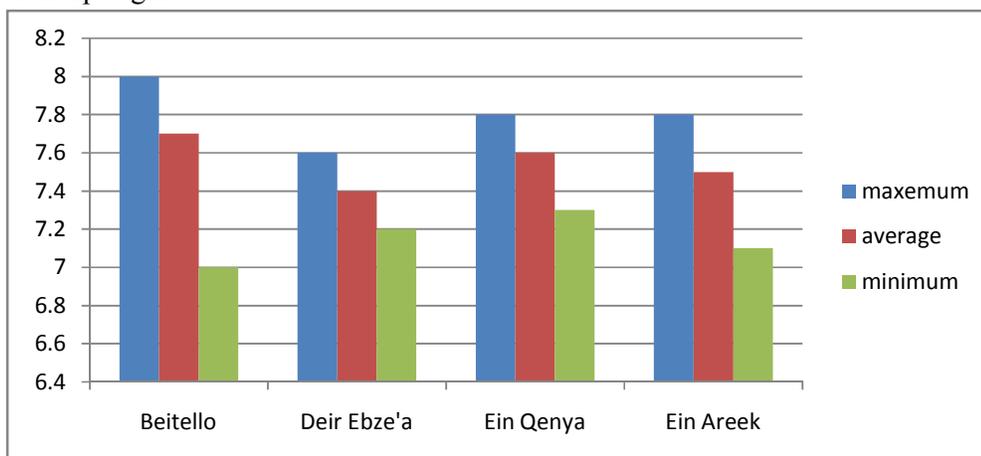


Figure 6: Min and Max of PH in the whole spring groups.

The TDS linked to the electrical conductivity solutes in proportional way, which are usually higher in springs Beitillu group than the others. This high concentration did not exceed the allowable limit globally.

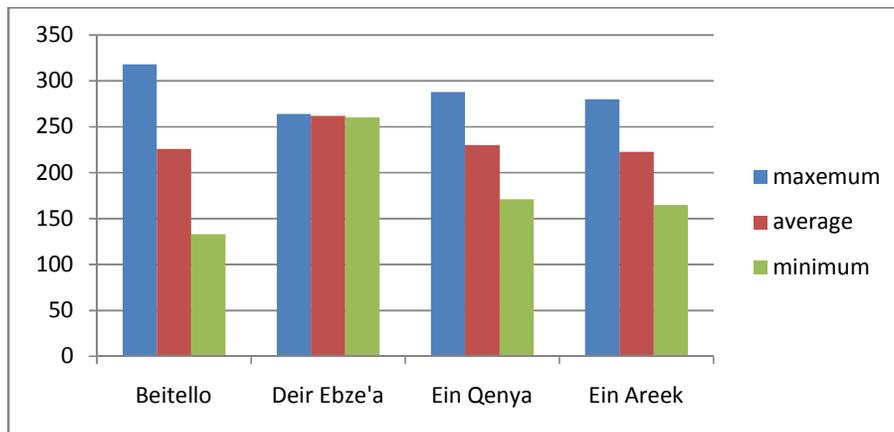


Figure 7: Min and Max of TDS in the whole spring groups.

Figure (8) shows the comparison between the minimum, maximum and average of the nitrite concentration of the targeted spring groups. A sharp rise of nitrite in the Ein Qenia springs in comparing with the others where exceeded 150 mg / l confirms the pollution of these springs with the waste water of the cesspits in the nearby houses.

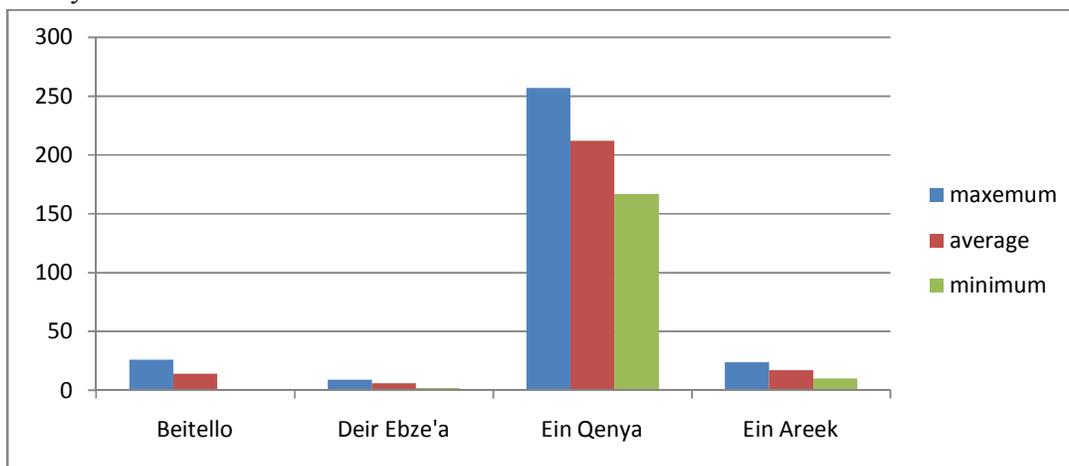


Figure 8: Min and Max of NO₃ in the whole spring groups.

Conclusion

The results reveal that Ein Qenia group springs is of high proportion of nitrates, which leads to the evidence of the contamination to wastewater of cess pits in the nearby houses and the wastewater flowing in the nearby Wadies. The rise in the concentration of calcium and sulfate salts in some springs means the using of the agricultural pesticide in the agricultural activities in areas adjacent to the Ein Arik springs group and leads to contamination. The spring water type of all spring groups is calcium – bicarbonate, which reflects the rocky nature limestone and dolomite in the study area.

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