Austrian Development Agency	**Title: Small Scale Waste Water Treatment Plants in West Bank: Comparative Study**
	Prepared by: Majdi Shaker Shaheen
	Supervised by: Dr. Mutaz Qutob Prof. Mustafa Khamis
	University: Al-Quds University
	Funded by: Austrian Development Agency (ADA)
	Email: majdi_shaheen78@yahoo.com.

Abstract:

Palestinian territories are suffering from water shortage. High population growth generate a large amount of wastewater with sanitation problems, which causes diseases related to the contamination in drinking water, so the demand for clean water is growing. The wastewater situation in the West Bank is not quite as alarming, but is serious nonetheless. Roughly (91%) of the population relies on septic tanks for temporary storage of wastewater, none of which is treated. The majority of these septic tanks are emptied through private-sector vacuum trucks which discharge their contents into the closest Wadi. Of the 9 percent that is collected by sewers and sent to one of seven treatment plants, only that of al Bireh Municipality is functioning properly. The result is that roughly 25MCM of untreated wastewater per year is discharged into the environment at over 350 locations.

To solve this problem a lot of wastewater treatment plants were established in Palestine. Most of them are based on biological treatment such as aeration bonds, wetland, and activated sludge process. Membrane technology has been widely spread in many countries in the past decade, for both water purification and wastewater treatment for their efficiency in removing pollutant. There are about 688 WWTPs in West Bank which was constructed by the NGOs, all of these plants are onsite treatment plant and a few of them are decentralize WWTPs (15) (small to medium scale) and only(3) centralized WWTPs (large scale)where are in Albiereh, Ramallah, and Jenin.

In this work, a comprehensive contrast between small scale waste water treatment plants that are located in deferent regions in Palestine utilizing different technologies is presented. During this investigation, eleven WWTPs have been visited. Two of these plants were found not functioning, four were found in bad conditions, and five plants were found functioning properly. Wastewater grab samples from the influent and effluent were taken from the selected plants once every month during the experimental period from January 2010 to December 2011.

Two kinds of analysis were carried out on these samples. The first analysis was carried out immediately once the sample has reached the lab. These include pH, Electrical Conductance (EC), Total Plate Count (TPC), Total Coliform (TC), Fecal Coliform (FC) and Biochemical Oxygen Demand (BOD). The second group of analysis was measured in

ix

later stage. These include Total Solids (TS), Total Dissolved Solids (TDS), Total Suspended Solids (TSS), and Chemical Oxygen Demand (COD).

The results for the average influent parameters for Al- Quds WWTP are TDS = 917 mg/l, TSS = 303 mg/l, BOD_5 = 196 mg/l, and COD = 465 mg/l. The result for the average influent parameter for Nahalin WWTP are TDS = 2433 mg/l, TSS = 588 mg/l, BOD_5 = 264 mg/l, and COD = 901 mg/l. The result for the average influent parameter for Nuba WWTP are TDS = 1097 mg/l, TSS = 315 mg/l, BOD_5 = 215 mg/l, and COD = 692 mg/l. The result for the average influent parameter for Al-Aroub WWTP are TDS = 830 mg/l, TSS = 116mg/l, BOD_5 = 143 mg/l, and COD = 483 mg/l. The result for the average influent parameter for The Inter Continental Hotel in Jericho WWTP are TDS = 1123 mg/l, TSS = 219 mg/l,

BOD_5 =153 mg/l, and COD = 11988 mg/l.

At Al-Quds WWTP the average effluent concentrations are TDS =9 mg/l, TSS = 3 mg/l, BOD_5 = 10 mg/l, and COD = 28 mg/l. While in Nahalin WWTP the average effluent concentrations are TDS =1147 mg/l, TSS =110 mg/l, BOD_5 = 111 mg/l, and COD = 389 mg/l. In Nuba WWTP the average effluent concentrations are TDS = 857 mg/l, TSS = 210 mg/l, BOD_5 = 99 mg/l, and COD = 531 mg/l. In Al-Aroub WWTP the average effluent concentrations are TDS = 713 mg/l), TSS = 64 mg/l), BOD_5 = 83 mg/l, and COD = 388 mg/l. The Inter Continental Hotel in Jericho WWTP average effluent concentrations are TDS = 600 mg/l, TSS = 9 mg/l), BOD_5 = 62 mg/l and COD = 720 mg/l.

The main purpose of any WWTP is the removal of pollutants from the waste water, and the reduction of emissions mainly (organic matter, solids), specially when the effluent of these plants were discharged in wadies or it used in irrigation, or other purposes. Also the cost of treated wastewater is important to the continuity of the WWTPs. The efficiency of studied plants were calculating by considering the effectiveness of reducing COD, BOD_5, TS, TDS, and TSS of the final effluent from each plant.

For the implementation and promotion of new technology, strategies must include local participation as well as municipal. The importance of local participation is a positive growing trend in government projects. The participation must fit with the local population to meet particular local needs. Local communities can contribute indigenous, valid ideas for cost savings in the project.

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Upon comparing the efficiency of all the studies plants, it can be concludes that membrane technology coupled with activated sludge process in Al-Quds University was found to give the best removal efficiency for all the studies quality parameters.

Furthermore, upon comparing the actual cost of treatment of one cubic meter for each plant together with the removal efficiency, activated sludge technology is found to give the most economical technology. It is recommended to try to implement an activated sludge technology to treat wastewater in Palestine but this technology need good control to produce a good production, this control can be satisfied by daily or weekly analysis for COD, TSS, TDS, EC, TC, FC, TPC, and once a months for BOD.

However, parallel to the actual cost, the sustainability of reuse and environmental cost should be addressed for future discussion in the adaptation of any treatment technology in Palestine by the decision makers.