ISSN: 2277-3754
ISO 9001:2008 Certified
International Journal of Engineering and Innovative Technology (IJEIT)
Volume 3, Issue 10, April 2014

Technical and financial challenges on Tran's boundary Wastewater Management from Palestinian territories (West Bank) to Israel

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Abstract*— many of countries in the world are suffering from water sources scarcity and Palestine is one of these countries. Some countries have solved the water scarcity problem through the exploitation of treated wastewater. The developed countries still believes that the cost of wastewater treatment is high and expensive and thus; did not take serious actions to utilize and promote the reuse of treated wastewater. This paper addresses the technical, financial, social and health challenges facing the reuse of treated wastewater in West Bank. Due to the poor sanitation system in the West Bank, the collected wastewater from the urban communities is discharged into different Wadis without treatment. The discharged wastewater is flowing by gravity towards Israel. The Israeli side treats the discharged wastewater on the Palestinians expense (by deducting a part from Palestinian tax money) and gets benefit from the treated wastewater. The aim of this paper is to examine the main transboundary wastewater stream; Wadi Al-Zomar; that conveys the discharged wastewater from the West Bank towards the Israeli WWTPs inside the Green Line , in terms of its quantity and quality to compare the cost and benefit of wastewater being treated in Israel versus being treated in West Bank. The total amount of discharged wastewater in the targeted stream is 11 mcm/ year. Discharged wastewater reaches to Israel, is not classified as highly strength wastewater due to the natural treatment. It is for the benefit of the Palestinians to treat the wastewater generated in West Bank instead of discharging it into the wadis to be treated in Israel. Treating and reusing of the wastewater from all transboundary streams will increase the volume of water available for agricultural by 12%.

Keywords: **Wastewater, Treat, Reuse, Transboundary, Green Line, Quantity, Quality and Stream..**

I. INTRODUCTION

The West Bank areas are suffering from limited water resources and poor sanitation system. A general overview on the current situation of sanitation system in the West Bank shows that only 31% of the West Bank population is connected to sewer networks, while the remaining 69% relies on cesspits [1]. Approximately, 70% of households in the urban cities are connected to the sewerage networks, while in the rural and semi-urban communities, which form about 60% of the total population in the West Bank, the collection systems are rarely [2]. The collected wastewater from the urban communities in the West Bank is discharged into different wadis without treatment due to the poor sanitation system and the limited number of sewage treatment plants [3]. The discharged wastewater flows towards Israel, and the Israeli side treats the discharged wastewater on the Palestinians expense (by deducting a part from Palestinian tax money) and gets benefit from the treated wastewater [4]. The Palestinian side claims that the invoices which are sent by the Israelis have no reliable figures regarding wastewater treated both in quantity and quality [5]. Israeli Environmental officer in the West Bank denies this allegation and ensures that the Israeli side is fully committed to solve the sewage cross border problem and that the cost paid by the Palestinians is a fair price and that this is a rational practice because Israel treats the Palestinian waste water [6]. As a result of inspecting some of the Israeli invoices, it is found that the Israeli side deducts the money without referring to the Palestinian side and sends invoices of the deducted money. The purpose of this paper is to examine the main transboundary wastewater stream in terms of its quantity and quality to compare the cost and benefit of wastewater being treated in Israel versus being treated in the West Bank. The specific objectives are:

- Quantify the wastewater discharge in the main trans boundary wastewater stream that flows from Wadi Zomer in West Bank toward Israel.
- Determine the wastewater characteristics of the stream.
- List a preliminary comparison between costs and benefits for the Action and No-Action alternatives in terms of investment costs, running costs and benefits.

It is estimated that there are currently 25 MCM of untreated sewage discharged to the environment each year at over 350 locations in the West Bank [1]. The discharged wastewater composes the wastewater streams that are flowing through the Palestinian communities towards the Israeli side. In the Israeli side, Israel built several WWTPs to treat the discharged wastewater and Israel gets benefit from the treated wastewater by using it in irrigation and groundwater recharge [7]. There are 15 streams that cross the Palestinian/Israeli Green Line within Israel, the West Bank and Gaza Strip. Twelve of these are major streams that flow to the West direction toward the Mediterranean Sea and the other three flows to the East

ISSN: 2277-3754
ISO 9001:2008 Certified
International Journal of Engineering and Innovative Technology (IJEIT)
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toward the Dead Sea and the Jordan River. All of them originate in watersheds located in the Palestinian Authority areas and then flow towards Israel [8]. These main transboundary streams or Wadies are Wadi Al-Moqatta, Wadi Al-Zomar, Wadi Al-Zuhur (Wadi Salman), Wadi Suriq (Wadi Al-Jeeb), Wadi Beit Jala and Wadi Al-Samen. Table 1 lists these streams linked to their Israeli names and district. This paper targeting Wadi Al-Zomar, as one of main transboundary streams that convey the discharged wastewater from the West Bank towards the Israeli WWTPs inside the Green Line.

Table 1 Main Transboundary Streams between West Bank and Israel

No.	Stream (Wadi)	Israeli Name	District
1	Wadi Al-Moqatta	Kishon Stream	North Jenin
2	Wadi Al-Zomar	Alexander Stream	Nablus and Tulkarem
3	Wadi Al-Zuhur	Yarkon Stream	Qalqilia
4	Wadi Suriq	Modein/ Suriq Stream	West Ramallah
5	Wadi Beit Jala	Suriq Stream	Bethlehem
6	Wadi Al-Samen	Hebron or Be′er Sheva Stream	South Hebron

A. Effect of the Transboundary Wastewater Streams on the Palestinians and Israelis

There are many negative impacts for the transboundary wastewater streams on the environment and the Israelis/Palestinian communities. These streams pollute the groundwater which is the most important sources of water for both sides. The problem is even worse when raw wastewater is disposed on the outcrops of the upper aquifer directly. The raw wastewater mixes with the groundwater body with a considerable strength because it travels a short distance through cavities which results in a short travel time. The overall consequence is direct pollution to groundwater resources [9]. The wastewater streams pass through the communities beside the residential areas which cause a great suffering to the nearby people. The wastewater streams produce bad odours, increase breeding of insects, and have a negative impact on the people health in those communities as a result of water borne diseases [10].

B. Transboundary Wastewater Financial issue

Israel built several WWTPs inside the green line to treat the wastewater that is discharged from the Palestinian side. Israel gets benefits from the treated wastewater by reuse it in agricultural projects and groundwater recharge. The Israelis deduct both capital and operational costs of these WWTPs from the Palestinian tax money that are collected by the Israelis. The deducted money by the Israelis is more than 200 million NIS till 2009, this money covers the construction rehabilitation and operational costs of WWTPs inside Israel and operational [11]. There is no clear agreement between the Israeli and Palestinian sides regarding the treatment cost of the discharge wastewater in Israel. The Israeli side sends invoices to the Palestinian Authority with the deducted money. By inspecting some of the Israeli invoices that were collected from PWA, it was found that:

- In general, Israel sends the invoices to the Palestinian Authority informing them about the amount of deducted money for the cost of the treatment of the discharged wastewater from a certain Wadi at certain period without clear breakdown analysis for the deducted money. Some of the invoices include the quantities of the discharged wastewater without details about the cost and how the Israeli calculate the deducted money, while other invoices include the costs without the quantities of the treated wastewater.
- In some cases and based on the Palestinians request, Israel sends breakdown analysis for the calculation of the deducted money. For the calculation of the discharged wastewater quantity, Israel used estimated values in some cases and measured values in other cases. For example, the amount of wastewater from Beit Jala Wadi was calculated based on the measurement that was carried out on Biet Jala pipe line in 2006 by the Israelis, while the amount of wastewater that is discharged form Birnabal, Al Jeeb and Al Ram into Wadi Surik was estimated based on daily wastewater generation of 100 liter/capita, which is unreasonable comparing with actual water daily consumption.
- The Palestinian side does not participate in the measurement or in the estimation of the quantity or quality of the generated wastewater.
- There are different tariffs for the treatment of one cubic meter of wastewater inside Israel. In 2010, the following wastewater tariffs were used to calculate the deducted money (Including addition of 16% for the Added Value Tax):
  - Beit Jala and some of Bethlehem that discharge in Wadi Beit Jala: 1.88 NIS.
  - Birnabala, Al Jeeb and Al Ram that discharge in Wadi Surik: 2.12 NIS.
  - Jenin area that discharge in Wadi Al Muqatta: 0.97 NIS.

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C. Palestinian Wastewater project licenses steps

Any wastewater project to be implemented in the Palestinian Authority area must pass through complicated process, both the implementation of wastewater collection systems and for the construction of WWTPs. Any wastewater project, and in order to get a license for implementation, must comply with several requirements prior to the implementation, these requirements are:

- **Approval from Joint Water Committee (JWC):**

The JWC was established according to Oslo II Interim Agreement- Article 40, and it is responsible for the management of water and wastewater inside West Bank and Gaza Strip. Any wastewater project inside the Palestinian areas whether in area A, B or C must be submitted to the JWC in order to get an approval for project implementation [12]. The Israeli member in the JWC sets many conditions for the approval and requests many studies, and this delay the approval.

- **Approval from Israeli Civil Administration :**

In order to mitigate the environmental and health impacts it is commonly recommended to locate WWTPs far away from the built-up areas. This mostly results in selecting area C for the construction of WWTPs as most of the remote areas are within area C. If the project is within area C, the project must also be approved by the Israeli Civil Administration. Getting an approval from the Israeli Civil Administration is a very complicated process and takes long time; therefore, the Palestinian prefer to avoid implementing WWTPs within area C to avoid this process. Currently, the conducted feasibility studies for wastewater projects inside West Bank consider this constrain as an important factor in choosing the WWTPs locations, and it is included within the selection criteria for the WWTPs locations.

- **Complying with Effluent Quality Standards:**

Based on the Memorandum of Understanding that was signed between the Israeli and Palestinian sides in December, 2003 [13] that includes 'guidelines and technical criteria for sewerage projects', effluent quality should not exceed the values of BOD= 20 mg/L and TSS= 30 mg/L in the first phase. If the end use of effluent is for irrigation in areas of high hydrological sensitivity or for discharging into wadis or streams, the effluent quality limit should be changed in the second phase of treatment to be BOD= 10 mg/L and TSS= 10 mg/L. Commitment to these high standards increase the capital and operational costs of the WWTPs; this reflect on the ability of citizens to pay the operational cost of the treatment and threatening the projects sustainability.

- **Connection of the Israeli Colonies:**

Based on the Palestinian Authority vision towards the illegality of Israeli colonies inside the West Bank, the Palestinian Water Authority (PWA) policy refuses to connect any wastewater coming from the Israeli colonies with the Palestinian WWTPs. PWA consider serving the Israeli colonies by treating their wastewater in the Palestinian territories means that the Palestinian recognize the right of the Israeli colonies to exist on the Palestinian lands.

However; when there is a nearby Israeli colony to the proposed Palestinian WWTP location, Israel through the JWC tries to force the Palestinian to serve the wastewater of the colony, which delays getting the approval from them and increase the complexity of the approval process e.g. Salfit Treatment plant[14].

II. WADI AL ZOMAR TRANSBOUNDARY STREAM FIELD STUDY

- ***Study Area***

Wastewater in Wadi Al zomar is collected from West Nablus, Ein Beit Alma Camp and some adjacent communities which are partially served by sewage network (Beit Iba, Deir Sharaf, Zawata, Anabta). Wastewater from Tulkarem city, Tulkarem camp and Nur Shams Camp is collected and partially treated in Tulkarem ponds then flows towards the Green Line. Wastewater from Nablus and Tulkarm areas is treated inside the Green Line in Yad Hanna WWTP.

A. Methodology

Researcher conducted 6 monthly field visits to the Wadi. The field visits were in June, July, October, November, January and February to cover different seasons. The work included two main activities:

1. Flow measurements: this includes site measurements, time of measurements, equipment, methods for calculating the dimensions of the channel and Methods of calculating the amount of flow.
2. Sampling: this process includes sampling site, period, equipment used in flow measurement and the size of the sample.

B. Measuring Points

Three measuring points were identified in Wadi Al-Zomar District; the first point was at the beginning of Wadi Al-Zomar near Beit Eba, the second point was at the end of Wadi Al-Zomar in the Palestinian areas at Tulkarem area and the third one was at the outlet of Tulkarem ponds. Table 2 summarizes the location of the measuring points and the source of wastewater at those points.

Measuring Points	**Source of Wastewater Discharge**	**Coordinates of Measuring Points**	
		X	**Y**
Beginning of Wadi	West Nablus	167,835	184,222
End of Wadi	West Nablus, Ein Beit Alma Camp and some adjacent communities	153,015	192,298
Outlet of Tulkarem Ponds	Tulkarem city, Tulkarem camp and Nur Shams Camp	151,832	191,326

Table 2 Measuring Points and Wastewater Flow Sources

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C. Flow Measurements

The cross section and the dimensions of each measuring point were selected according to the circumstances of the Wadi path. Table 3 shows the geometric cross sections for each measuring point at the Wadi.

Table 3 Geometric Cross sections for each measuring point

Name	Cross Section
Wadi AL-Zomar- Nablus	Parabolic
Wadi AL-Zomar-Tulkarm	Parabolic
Tulkarem WWTP	Circular

Site visits were conducted on the first day of the month. The period of follow measurement started at 8 am till 5 pm. The Calculation mechanism of the flow quantity was based on two items which are:

1. The position of wadi path and its dimensions.
2. The Flow Meter equipment that used to measure the velocity of the wastewater flow during a specified period with specific dimensions.

D. Sampling

Sampling was conducted two days per month during the period of the study. The average number of field visits was six. Two liters of wastewater was collected and kept in a plastic bottle which printed on the bottle time of the site visit, Wadi name and the sample symbol. The samples were collected with tool made for the purpose of this study. It consists of a stick ends with a bowl. The samples were delivered to laboratory for testing.

III. FINAL RESULTS OF QUANTITY AND QUALITY

A. Final Results of Flow Measurements

The calculated total amount of discharged wastewater in the targeted streams are 11 mcm/ year. Table 4 shows the final results of flow measurements. The average daily flow is calculated based on one instantaneous measurement in the day.

The variation in wastewater discharge in the Wadi is linked to the following factors:

- **Weather Temperature:** during the hot weather, the water consumption increase which reflects on the wastewater generation and discharge, but this factor impact is restricted by the availability of supplied water.
- **Rain Time:** Wet weather flow is higher than dry weather flow. The increase in wastewater discharge during the rainy time at the measuring points is impacted by several factors which are:

1. Intensity of rainfall and formation of storm water runoff.
2. Location of the measuring point whether at the end of a closed system (sewage network) or at an open system (within the Wadi discharge). The effect of rains on the open system is higher due to the receiving of storm water from some sub-streams.

Time of flow measurement: the water consumption varies through the day hours which reflects on the wastewater generation. Since the daily average flow is calculated based on one instantaneous one measure during the day and the discharge measuring were not at the same hour during the measuring months; the average daily flow is affected by this factor.

B. Result of Quality Analysis

Existing data for wastewater quality in the West Bank shows BOD values ranging between 400 mg/l to 1400 mg/l with an average of about 600 mg/l [15]. This high BOD level refers to the low per capital water consumption in Palestine compared to the developed countries [16]. This is compatible with the BOD value of Wadi Al-Zomar which is less than 400 mg/l and classified as medium wastewater; this is because the wastewater receives natural treatments (during its flow through the Wadies before the measuring points) by natural

Date	Q1(m^3/day) June/2010	Q1(m^3/day) July2010	Q1(m^3/day) Oct.2010	Q1(m^3/day) Nov2010	Q1(m^3/day) Jan2011	Q1(m^3/day) Feb2011	Qavg. (m^3/day) Value
Beginning of Wadi / Nablus	10981	11543	11733	11880	15264	17453	**13142**
End of Wadi / Tulkarem	9322	8778	10005	8562	10368	11808	**9807**
Tulkarem WWTP	4320	4276	3888	3542	3637	3628	**3881**

Table 4 final results of flow measurements

ISSN: 2277-3754
ISO 9001:2008 Certified
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Aeration which cause degradation of organic matter. Therefore; there is an important conclusion that the discharged wastewater is not classified as highly strength wastewater when it reaches to Israel due to the natural treatment according to FAO, 1992 [17]. Table 5 shows the classification of wastewater in the measuring points in terms of organic concentration.

Table 5 Classification of wastewater in terms of organic concentration

Location	Avg. BOD (mg/l)	Avg. COD (mg/l)	Classification*
Wadi Al-Zomar-Tulkarem	282.4	502.7	Medium

* Typical categories of raw wastewater in terms of contamination degree

BOD: COD Ratio: This ratio reflects the biodegradability of organic matter in wastewater; this ratio is zero if organic matter is not biodegradable and one if all easily biodegradable. Typical BOD: COD ratio for municipal wastewater is 0.5 [18]. Table 6 shows BOD: COD ratios for wastewater at the measuring points. The average values of BOD: COD ratios are around the typical ratio of municipal wastewater. The final wadi wastewater characteristics results shown in table 7

Location	BOD: COD Ratio		
	Average	Minimum	Maximum
Wadi Al-Zomar Tulkarem	0.53	0.44	0.78

Table 6 BOD: COD Ratio

IV. COST BENEFIT ANALYSIS

Cost-benefit analysis (CBA) compares the costs and benefits of the project (Action) with no project (No-Action) alternatives. The aim of this part of the study is to conduct a preliminary CBA for the "No-Action" and "Action" alternatives as follow:

- No-Action Alternative: the current situation of the transboundary wastewater streams will remain the same, the wastewater continue to discharge in the stream through the Palestinian communities towards Israel, and the wastewater is treated inside Israel on the Palestinian expenses.
- Action Alternative: implementing of WWTPs inside the Palestinian areas to treat the discharged waste water and get benefits from the treated waste water.

A. Comparison between Costs and Benefits

This section shows a preliminary comparison between costs and benefits for the Action and No-Action alternatives in terms of investment costs, running costs and benefits.

-Investment Cost

The investment cost for each wastewater project includes: transmission line to convey the discharged wastewater to the WWTP location, civil works for the WWTP construction including primary and secondary treatment and disinfection system, seasonal reservoirs, conveyance lines to transport the treated wastewater to the irrigation sites and surface irrigation system. Since the construction of the WWTPs inside Israel is on the Palestinian expense in the current situation, there will be no difference between the two alternatives in terms of investment costs, because in both alternatives the Palestinians pay for the WWTPs construction.

- ***Running Costs***

The running costs of the wastewater projects cover the operation and maintenance costs for the centralized wastewater treatment systems. Referring to the invoices that were sent by Israel to the Palestinian Authority; there are different tariffs for the treatment of one cubic meter of wastewater inside Israel. Table 8 presents the wastewater tariffs that are used to calculate the deducted money from the Palestinian Authority in 2010 (This value includes the addition of 16% for the value added tax).

Location	NIS/m3
Wadi Beit Jala	1.88
Wadi Surik	2.12
Wadi Al Muqatta	0.97

Table 8 Wastewater Treatment cost inside Israel

In Palestine; recently many of wastewater treatment plants feasibility studies have been done. For example, the western Nablus WWTP and Jericho WWTP; the cost per cubic meter of the treated wastewater was estimated as follow 1.8 NIS/m^3, 1.5 NIS/m^3, respectively. Moreover, for the existing Al-Bireh WWTP the cost of treatment is about 1.8 NIS/m^3 (Based on the communication with the municipality engineers). Based on these wastewater projects inside Palestine, it is expected that the treatment cost for constructing new WWTPs inside the Palestinian areas (Action Alternative) is within 1.5-1.8 NIS/m^3. In the No-Action alternative the treatment cost is within 0.97-2.12 NIS/m^3

B. Positive Impacts

The establishment of such pioneer wastewater treatment projects throughout the West Bank will have significant impact on the life of Palestinian people as well as the environment. The main benefits gained from such projects are:

- ***Groundwater Protection***

ISSN: 2277-3754
ISO 9001:2008 Certified
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Keeping the current situation of discharging raw wastewater streams in the open unprotected wadis will significantly affect the quality of groundwater basins. Therefore; groundwater quality has the potential to become significantly degraded. The establishment of wastewater conveyance lines with treatment facilities will positively impact groundwater by enhancing its protection and improving groundwater quality in the aquifer.

- ***Impact on Agricultural Sector***

Treated effluent is a non-conventional source of water that could be used for agriculture. This will provide farmers with sufficient and affordable source of irrigation water. It also contains many plant nutrition elements which will promote plant growth and increase yield. This can be beneficial for agriculture as it reduces the use (and so the associated cost) of chemical fertilizers. The targeted wastewater streams generate about 11 mcm/year of raw wastewater. If the wastewater is treated, the treated effluent is almost the same amount. Reusing of the treated effluent will increase the available volume of agricultural water by 12%, where the current supply of water in West Bank through irrigation is about 89 mcm/year [19].

- ***Water Management***

Using treated wastewater as a new source for irrigation water will enhance the quantity of available conventional water resources by reducing the demand on fresh water resources. It offers an alternative water source in economical and efficient way. This will increase the share of water available for the domestic sector.

- ***Health***

By implementing wastewater treatment projects for the transboundary streams, the overall public health and hygiene conditions will be improved. Illnesses related to water contamination will be dramatically controlled.

- ***Socio-Economic Settings***

Many residents and farmers are unemployed due to restrictions and difficulties imposed by the current political situation, increasing water shortages, and difficulty in reclamation of land for agribusinesses. Providing treated wastewater for agricultural purposes will be highly beneficial because it will encourage investing in agricultural businesses, provide job opportunities, and improve the overall quality of life of the population. New job opportunities will be created to operate and maintain the WWTP site. Additional administrative and support roles will be required which will also reduce the unemployment rate.

V. CONCLUSIONS AND RECOMMENDATIONS

Table 9 provides a summary for the comparison between the current situation by discharging the wastewater from the West Bank towards Israel (No-Action alternative) and implementing of WWTPs inside the Palestinian areas (Action alternative). Table 9 shows that the investment and operational costs for the wastewater systems are almost the same in the both alternatives. In the current situation (No-Action Alternative), there are no benefits for the Palestinian and there are many negative impacts, while in the Action alternative the Palestinian will get benefits from the treated wastewater and avoiding the negative impacts of the No-Action Alternative.

Table 9: Comparison between the Action and No-Action Alternatives

Item	No-Action Alternative	Action Alternative
Investment Cost	Palestinians pay the investment cost	Palestinians pay the investment cost
Running Cost	0.97-2.12 NIS/m^3	1.5-1.8 NIS/m^3
Impact on Groundwater	Groundwater quality will be degraded	Enhancing the groundwater protection and improving its quality
Impact on Agricultural Sector	The agricultural sector will remain the same	Providing of new source of water for agriculture, this will enhance the agricultural sector in Palestine
Water Management	The water system will remain the same	The share of water available for the domestic sector will be increased by reallocation of water shares between different sectors; domestic, agricultural and industrial; since the treated wastewater will contribute in the agricultural water share.
Health	Negative impacts on the public health	The overall public health and hygiene conditions will be improved
Socio-Economic Settings	Socio-Economic conditions will remain the same	Encourage investing in agricultural businesses, provide job opportunities, and improve the overall quality of life of the population.

ISSN: 2277-3754
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The following is the main conclusions for this study:

- Palestinians will benefit from treating the wastewater in the West Bank instead of discharging it into the wadis to be treated in Israel as they will also have the advantage of wastewater reuse in the agricultural sector.
- The available volume of water for agriculture will be increased by 12 % by the treatment and reuse of the wastewater in West Bank from the targeted streams. There is a need for detailed CBA and feasibility study for each Wadi in order to study more alternatives and inspect the best specific solution for each Wadi in terms of WWTP location, treatment technology, reuse area and irrigated crops.

ACKNOWLEDGMENT

The author highly appreciates the assistance of PWA. Heartfelt thanks also to the anonymous referees.

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George Sorial, PhD has 24 years of experience in bench scale and pilot scale research and chemical analysis with various analytical instruments. His research interests include: air biofiltration, electrochemical processes for destruction of organic contaminants, activated carbon adsorption (micro pollutant removal from drinking water, adsorption of micro pollutants by activated carbon and alternative adsorbents, At the University of Cincinnati, Professor Sorial teaches graduate courses in the field of Advanced Topics in Environmental Chemistry, Chemical Principles of Environmental Systems.

ISSN: 2277-3754
ISO 9001:2008 Certified
International Journal of Engineering and Innovative Technology (IJEIT)
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Makram Suidan's teaching interests include:

- Fundamentals of Adsorption of natural and synthetic organic chemicals on GAC.

- Biological treatment of gas-phase organic chemicals in natural and engineered systems.

- Fundamental understanding of the application of ultra filtration membranes in waste treatment.

- Fundamentals of the use of electrolytic reactors for the de chlorination of low levels of contaminants.

- Development of the expanded-bed GAC anaerobic bioreactor for the treatment of hazardous wastes.

- Development and modeling of biofilm reactors with emphasis on microbial competition, biomass shear loss and chemical speciation.

APPENDIX

Location		pH	BOD (mg/l)	COD (mg/l)	TSS (mg/l)	NH4 (mg/l)	PO_4 (mg/l)	Cl (mg/l)	B (mg/l)	TDS (mg/l)	DO (%)	Temp. C°
Wadi Al-Zomar/ Tulkarem	Average	7.6	282.4	502.7	3566.7	81.9	1.5	774.7	6.4	1736.5	1.4	19.8
	Min.	7	109	240	1268	64.8	0.16	300	1.77	876	0.78	19
	Max.	7.9	470	720	9510	94	5.5	1200	68.36	2510	2.4	20.7

Table 7 Final Wadi Al -Zomer Wastewater Characteristics