

# Optimum Efficiency of Treatment Plants Discharging Wastewater into the Tigris River in Iraq

By:

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صَبِّكَ <u>قَاللَّهُ الْعَظ</u>يْمَر

سورة المجادلة / الإية: 11

I dedicate this work to my country, IRAQ

I dedicate this thesis to my father and mother,

my lovely husband,

my son and daughter,

and to my brothers and sisters.

I dedicate this work, first and foremost, to all the people who contributed towards the success of this dissertation.

In addition, I would like to thank Hashemite Kingdom of Jordan and their people for their help and for hosting me throughout the duration of my research. I wish to express my deepest respect and sincere appreciation to my family for its kindness and encouragement throughout my undergraduate and graduate study.

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Huda Mohammed

*May* 2017

# **Authorization Form**

I, Huda M. Jawad, authorized Isra University to supply copies of my thesis to libraries or establishments or individuals on request, according to the Isra University regulations.

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#### **Committee Decision**

This thesis titled, "Optimum Efficiency of Treatment Plants Discharging

Wastewater into the Tigris River in Iraq" was successfully defended and

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Table of	<b>Contents</b>
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Item	Title	Page	
	Dedication	i	
	Acknowledgement	ii	
	Authorization Form	iii	
	Committee Decision	iv	
	Abstract	ix	
	Chapter One: Introduction		
1.1	Background	1	
1.2	Introduction to biological oxygen demand (BOD)	2	
1.3	Water quality management	4	
1.4	Study area	7	
1.5	Research Objectives	12	
1.6	Methodology	12	
1.7	Structure of the Thesis	13	
Chapter Two: Literature Review			
2.1	Pollution and regulations	15	
2.2	Definition of BOD	20	
2.3	Optimizing modeling	25	
2.4	Linear programming	30	
2.5	Previous studies	33	
Chapter Three: Data Collection and Modeling			
3.1	Methods	37	
3.2	Water quality data	37	
3.3	Tigris River at Baghdad city	46	
3.4	Modeling	50	
3.5	Solution using MATLAB	57	
Chapter Four: Results and discussion			
4.1	Introduction	60	
4.2	The results of the present condition	63	
4.3	Study of effects	75	
Chapter Five: Conclusions and Recommendations			
5.2	Conclusions	82	
5.2	Recommendations	83	

#### Title Page 3 Figure 1.1: Processes related to BOD modeling (Radwan et al., 2003) Figure 1.2: Water management steps as suggested by UNEP (UNEP, 2016) 5 Figure 1.3: Geographic map (a) and satellite image (b) showing Tigris River in Iraq and 10 Baghdad (Ismail and Abed, 2013) Figure 1.4: The schematic diagram of the study region as presented by Ismail and Abed 11 (2013)Figure 1.5: A flow chart depicting the study methodology 14 Figure 2.1: Wastewater treatment plant units 21 Figure 2.2: General layout for wastewater treatment plant 22 Figure 2.3: Hierarchy of optimization levels, as suggested by Gland et al. (2001) 24 Figure 2.4: Essential activities required to build the management model prior to 28 application Figure 3.1: Schematic diagram of the Tigris River system 38 Figure 3.2: Study area with six wastewater discharge outfalls 38 Figure 3.3: a) BOD5 in and BOD5 out, b) Operating efficiency of AR WWTP 40 Figure 3.4: a) BOD5 in and BOD5 out, b) Operating efficiency of SBEPS WWTP 41 Figure 3.5: a) BOD5 in and BOD5 out, b) Operating efficiency of TI WWTP 42 Figure 3.6: a) BOD5 in and BOD5 out, b) Operating efficiency of AOP WWTP 43 Figure 3.7: a) BOD5 in and BOD5 out, b) Operating efficiency of G1 WWTP 44 Figure 3.8: a) BOD5 in and BOD5 out, b) Operating efficiency of G2 WWTP 45 Figure 3.9: Annual mean discharge (m3/s) for the data collected on water between 1930 and 2004 at the stream flow gaging station IRQ-T18 in 47 Baghdad, Iraq (USGS, 2010) Figure 3.10: Average monthly discharge of the Tigris River in Baghdad city from 48 1930 to 2004 (USGS, 2010) Figure 3.11: Schematic representation of the input/output parameters of the study problem 52

### **List of Figures**

Figure 4.1: Optimized and present efficiency of the five WWTPs in January	
Figure 4.2: Optimized and present efficiency of five WWTPs in February	
Figure 4.3: Optimized and present efficiency of five WWTPs in March	65
Figure 4.4: Optimized and present efficiency of five WWTPs in April	66
Figure 4.5: Optimized and present efficiency of five WWTPs in May	67
Figure 4.6: Optimized and present efficiency of five WWTPs in June	68
Figure 4.7: Optimized and present efficiency of five WWTPs in July	
Figure 4.8: Optimized and present efficiency of five WWTPs in August	
Figure 4.9: Optimized and present efficiency of five WWTPs in September	71
Figure 4.10: Optimized and present efficiency of five WWTPs in October	
Figure 4.11: Optimized and present efficiency of five WWTPs in November	73
Figure 4.12: Optimized and present efficiency of five WWTPs in December	74
Figure 4.13: Effects of variation of river discharge on the optimized efficiency of five	
WWTPs in January	
Figure 4.14: Effects of decomposition value on the optimized efficiency of five WWTPs	78
in January	
Figure 4.15: Effects of initial efficiency value on the optimized efficiency of five	
WWTPs in January	70
Figure 4.16: Variation of costs with the treatment efficiency for all plants	79
Figure 4.17: Differences in the optimized and present costs corresponding to the	
optimized and present efficiencies from JanJun.	
Figure 4.18: Differences in the optimized and present costs corresponding to the	
optimized and present efficiencies from JulDec.	

# List of Tables

Title	Page
Table 3.1: Quantity and means of discharging wastewater from each plant	
Table 3.2: Several statistical values for monthly and annual mean discharge at the	
stream gaging station IRQ-T18 at Tigris River in Baghdad, Iraq from	
1930 to 2004.	
Table 3.3: Wastewater flow rate (m3/day); BOD5 discharge rate (g/day), and	56
maximum allowable BOD5 loading (mg/L or g/m3) for all studied WWTP	
Table 3.4: Variation of wastewater treatment cost (\$/m3) with the operation	57
efficiency for each plant	

The present study proposed a water quality management system for multiwastewater treatment plants discharging wastewater into the Tigris River in Iraq. The proposed system will be useful to determine the optimum removal efficiency of multiwastewater treatment plants that discharge their wastewater into the Tigris River. Hence, the main objective of this study was to determine the most economical efficiency of each plant that ensures reduction in the biological oxygen demand (BOD) concentration of the wastewater to an acceptable level before discharging in the river. Five wastewater treatment plants were randomly selected from the Tigris River region in the Baghdad city, Iraq. The BOD value of  $\leq 30 \text{ mg/L}$  was selected as a water quality parameter according to the Iraqi standards. For this purpose, the BOD actual data were collected from each plant and then fed into the mathematical model. Furthermore, the data collected of BOD, river flow rate, and plants wastewater discharges were found to significantly vary with the month of the analyses. Therefore, the model results were expressed as a monthly variation of efficiencies. The water quality management system of multi-wastewater treatment plants usually occurs in the form of linear equations. Therefore, the optimization techniques of linear programming (LP) were used in combination with the MATLAB program to solve the mathematical model equations in this study. In many cases, the determined efficiencies were found to be lower than the present efficiencies. Although this was good for the environment, it was not costeffective. In addition, this study revealed that the river flow rates were not an important factor in the dilution of BOD concentrations in the river and hence on the effects on the determined values of operating efficiencies. It was found that the variation of BOD decomposition value in the river and the operating efficiency value of the first upstream plant greatly affected the operating efficiency of the downstream plants. Furthermore, no constant rank was recorded for the effects of the natural decomposition on the operating efficiency of each plant. This study presents the modeling method in detail and has a pedagogical value for similar researches.