بسم الله الرحمن الرحيم

شبكة المعلومات الجامعية

سامية محمد مصطفى

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

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جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
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بالرسالة صفحات

لم ترد بالأصل

WALL-SOLUTION MASS TRANSFER IN AGITATED VESSELS

A Thesis

Submitted to the Faculty of Engineering,

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In Partial Fulfilment of

The Requirements For The Degree of

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By

Ahmed Hassan Mohamed El-Shazli

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We certif that we have read this thesis, and in our opinion it is fully adequate, in scope and quality as a disseration for the degree of master of science.

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CONTENTS

LIST OF SYMBOLS

Symbol	Name	Units
A	Surface area	cm^2
C	Concentration of ferricvanide ions	$mole/cm^3$
C_{Ai}	Concentration of species A at the interface	$mole/cm^3$
C_{Ao}	Bulk Concentration of species A.	$mole/cm^3$
d	Impeller diameter	cm
d_e	Eqivalent diameter of rectangular vessel	cm
d_t	Tank diameter	cm
D_v	Diffusion coefficient	cm^2/s
D_{AB}	Diffusion coefficient for solute A diffusing in mixture of A and B	cm^2/s
E	Height of impeller above vessel floor	cm
f	Friction factor	dimensionless
F	Faraday's constant	96500 coulomb
g_c	Newton's law proportionality factor	$cm.g/N.S^2$
g	Gravitational acceleration	cm/s^2
h	Heat transfer coefficient	$W/m^2.C^o$
H	Depth of liquid in vessel	cm
J	Width of baffles	cm
K_L . K_T	Constant	
K	Mass transfer coefficient	cm/s
L	Length of impeller blades	cm
N_{Aav}	Molal flux of solute A	$moles/cm^2.s$

P	Power consumption	W
r	Radius of Impeller	cm
S	Fractional surface renewal rate	s^{-1}
t	Time	s
U	Bulk average velocity	cm/s
U_t	Fluctuating velocity at time t	cm/s
V	Linear solution velocity (ω.r)	cm/s
W	Impeller width	cm
ω	Rotational speed	r.p.s
Nu	Nusselt number	dimensionless
Re	Reynolds number	dimensionless
Pr	Prandtle number	dimensionless
St	Stanton number	dimensionless
Sh	Sherwood number	dimensionless
Sc	Schmidt number	dimensionless
T	Temperature	^oC
I_L	Limiting current	amp.
Z	Numbers of electrons involved in the reaction	

Greek Symbols

μ	Absolute viscosity	gm/cm.s
ρ	Density of solution	gm/cm^3
τ_i	Shear stress at the interface	N/cm^2
τ_w	Wall shear stress	N/cm^2

CHAPTER I
INTRODUCTION

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Agitated vessels are used widely in chemical engineering practice to effect processes such as liquid-liquid extraction, dissolution and crystallization of salts, ore leaching, mixing, chemical and biochemical reactions, etc. One of the most important design parameters of agitated vessels is the heat and mass transfer coefficients from the wall of the vessel to the agitated solution. By far, cylindrical agitated vessels have received most of the attention in heat and mass transfer studies, scant attention was given to other geometries of agitated vessels such as the rectangular geometry which is used frequently in practice. The object of the present work is to study the rate of mass transfer between agitated solutions and the walls of rectangular vessels. The study of mass transfer from the vessel wall to the agitated solution is essential for predicting the rate of diffusion controlled processes which might take place at the vessel wall e.g biochemical reactions taking place at a layer of immobilized enzyme fixed to the wall of the agitated vessel, electrochemical reactions taking place at an electrode fixed to the wall of the vessel. Besides, the present work is of importance to designing batch dialyzers involving two rectangular compartments divided by a membrane. The present work is also useful for predicting the rate of diffusion controlled corrosion of rectangular agitated vessels where the rate of corrosion is limited by the diffusion of dissolved oxygen to the vessel wall in the pH range 4-10. In addition, by virtue of the analogy between heat and mass transfer, the present mass transfer study can serve to predict rates of heat transfer from the wall of the vessel to agitated solutions during heating or cooling. The study was carried out using an electrochemical technique which involved measuring the limiting current of the cathodic reduction of potassium ferricyanide. The technique is widely used to study solid-liquid mass transfer in view of its simplicity and accuracy.