

AAP Research Notes on Chemical Engineering,

CHEMICAL AND BIOCHEMICAL ENGINEERING

New Materials and Developed Components

Editor

Ali Pourhashemi, PhD

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Edited by

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CHEMICAL AND BIOCHEMICAL ENGINEERING

New Materials and Developed Components

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LIST OF ABBREVIATIONS

AC	Active Sites
BD	Brownian Dynamics
BA	Butyl Acrylate
BMA	Butyl Methacrylate
CFT	Cefatoksime
CM	Continuum Modeling
CBC	Cyano-Bacterial Communities
DFT	Density Function Method
DAC	Dialdehyde Cellulose
DPD	Dissipative Particle Dynamics
DWNTS	Double Walled Carbon Nanotubes
DM	Dry Matter
ER	Estrogen
FEM	Finite Element Method
GC	Gas Chromatograph
GI	Gastrointestinal
GSDBT	Generalized Shear Deformation Beam Theory
GM	Gentamicin
HT	Heterotrophic Bacteria
HTS	High Temperature Shearing
HDB	Hybridoma Data Bank
HCO	Hydrocarbon Oxidizing Cells
HC	Hydrocarbons
IRIS	Immunogenetic Related Information Source
IFN	Interferons
LB	Lattice Boltzmann
LDPE	Low Density Polyethylene
MCC	Microcrystalline Cellulose
MWD	Molecular Weight Distribution
MC	Monte Carlo
MWNTS	Multi-Walled Nanotubes
MMA	Multifunctional Modifying Additive

NCM	Nano-Scale Continuum Modeling
NPS	Nanoparticles
CTZ	Polysaccharide Chitosan
PS	Polystyrene
PR	Progesterone
QM	Quantum Mechanics
QC	Quasi-Continuum
SWNTS	Single Walled Nanotubes
SEM	Spectroscopy
SAN	Styrene Copolymer with Acrylonitrile
TBMD	Tight Bonding Molecular Dynamics
TLR	Toll-Like Receptor
US	Ultrasound
UC	University of Cincinnati
VIM	Variational Iteration Method

LIST OF SYMBOLS

A_m^n and Y_m^n	the cross-sectional area and Young's modulus, respectively, of rod m of truss member type n
E_M	the modulus of the matrix
$E_\rho, E_\theta, E_\varphi, E_\omega$	the energies associated with bond stretching, angle variation, torsion, and inversion, respectively
K_B	the Boltzmann constant.
$\{T\}$	the surface traction vector
v_f	the volume fraction of reinforcement
$[B]$	the matrix containing the derivation of the shape function
$\{d\}$	a vector containing the displacements
b_i	the effective rate constant of a fungus colony growth in the presence of the biocide
b_o	the effective rate constant of a fungus colony growth in the absence of the biocide
C	the biocide concentration
C	the stiffness tensor
D_{260}	absorbance of the solution at 260 nm
D_{280}	absorbance of the solution at 280 nm
E	the modulus of composite
$H(i)$ and $H(j)$	the <i>Hamiltonian</i> associated with the original and new configuration, respectively
k	a constant connected with parameters of interaction polymer-diffuse substance
K_c	a constant quantitatively equal to the biocide concentration
M	molecular weight
m_∞	relative amount of water in equilibrium swelling film sample
$m_{\text{absorbed water}}$	weight of the saturated condensed vapors of volatile liquid, g
m_{sample}	weight of dry sample, g
n	an indicator characterizing the mechanism of transfer of substance

pK_a	universal index of acidity
q_{\max}^{H+}	a maximum positive charge on atom of the hydrogen
ΔU	the change in the sum of the mixing energy and the chemical potential of the mixture
u, v and w	the displacement in x, y, z directions, respectively

GREEK SYMBOLS

$\bar{\sigma}_{fi}$	fibers average stress
$\bar{\sigma}_i$	composite average stress
$\bar{\sigma}_{mi}$	matrix average stress
β	the probability of chain termination
$\overline{F}_i(t)$	the force acting on the i -th atom or particle at time t
$\{\mathcal{J}\}$	the force vector which contain both applied and body forces
$\psi(\beta)$	the distribution of active site over kinetic heterogeneity
Γ	the integration of the traction occurs only over the surface of the body
ν_0	the Poisson's ratio of the matrix

PREFACE

This book facilitates the study of problematic chemicals in such applications as chemical fate modeling, chemical process design, and experimental design. This volume provides comprehensive coverage of modern biochemical engineering, detailing the basic concepts underlying the behavior of bioprocesses as well as advances in bioprocess and biochemical engineering science. It combines contemporary engineering science with relevant biological concepts in a comprehensive introduction to biochemical engineering.

Cyanobacteria are known for their ability to make a significant contribution to soil fertility and enhance the growth processes of plants. In Chapter 1, laboratory experiments studied growth-stimulate activity of cyano-bacterial communities by using the test on the seeds of cress. In Chapter 2, a one-stage technique for the synthesis and modification of nanosized corrosion-inhibiting pigments based on zinc phosphate for the undercoatings with a good affinity to the organic phase has been developed. It was shown that the acrylic monomers can be used as the effective modifiers of the zinc phosphate nanoplates surface. The optimal concentration of modifying agent in the reactive medium is established. With the use of the electrochemical impedance spectroscopy, the anticorrosion activity of the obtained pigment in undercoating composition was investigated. It was determined that at the addition of 1% mass of the nanosized zinc phosphate, the efficiency of the undercoating is higher in comparison with the sample containing of 5% mass of the Novinox® PZ02 pigment.

Chapter 3 deals with development of a new aerobic-anaerobic bioremediation technology for impassable bogs polluted with oil in the north part of the Western Siberia; traditional remediation technologies are impossible technically and economically not favorable there. A research note on immunological databases and its role in immunological research is presented in Chapter 4. A simple scaffold with tremendous therapeutic potential is introduced in Chapter 5.

In Chapter 6 for the first time modification peculiarities of microcrystalline cellulose (MCC) and its oxidized form (dialdehyde cellulose DAC) of guanidine-containing monomers and polymers of vinyl and