IN THE NAME OF GOD

DESIGN, CONSTRUCTION AND MODELING OF PILOT SCALE REACTOR OF FERRIC CHLORIDE PRODUCTION FROM ISFSAHAN IRONMAKING CO. CONVERTER SOLID WASTE

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ABSTRACT

"DESIGN, CONSTRUCTION AND MODELING OF PILOT-SCALE REACTOR OF FERRIC CHLORIDE PRODUCTION FROM ISFAHAN IRONMAKING CO. CONVERTER SOLID WASTE"

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One of main problems that steelmaking industries are involved in is solid waste that often are hazardous and their land disposal in environment poses risks to human health and environment. Thus the use of this waste as an effective substitute for commercial product or ingredient or feedstock in industrial process that allows to pollution prevention is important.

In this study, recycling of Esfahan ironmaking co. converter solid waste is outlined. Anew method for reuse of this solid waste to produce ferric chloride is discussed and effect of operating parameters on rate of reaction such as concentration of acid, temperature, agitation speed... are considered.

In the design of reactor, it is desirable to utilize the energy liberated by the reaction to derive the reactor toward autogenous operation. For optimal reactor design, models which couple leaching kinetics and heat effects are needed. In this study, the principles of modeling exothermic leaching reaction are discussed. There was good agreement between pilot-scale batch testes and model predictions.

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NOMENCLATURE

a_i	Activity of i species, $mol.lit^{-1}$
S	Particle surface area, cm^2
A	Chemical formula of compound
B	Stoichiometric coefficient in shrinking core model
$(C_A)_c$	Concentration on particle core, $mol.lit^{-1}$
$(C_A)_s$	Concentration on liquid film layer, $mol.lit^{-1}$
$(C_A)_b$	Bulk concentration, $mol.lit^{-1}$
C_p	Heat capacity at operating conditions, $JK^{-1}mol^{-1}$
ΔC_p	Overall change in heat capacity, $JK^{-1}mol^{-1}$
D_e	Effective diffusion coefficient, $m^2.s^{-1}$
D_a	Diameter of impeller, m
d	Particle diameter, mm
E	Activation energy, $J.mol^{-1}$
Ga	Galileo Number
ΔH	Enthalpy change of reaction, $J.mol^{-1}$
k	Intrinsic rate constant, $mol .min^{-1}.cm^{-2}$
k_m	External mass transfer coefficient
k_s	Apparent heterogeneous rate constant, min^{-1}
K	Equilibrium constant
m	Total number of reaction
m_i	Molality

M	g-mol weight
N	Number of moles
N_{js}	Just-off-bottom impeller speed, rpm
N_h	Near homogenous impeller speed, rpm
P	Pressure, atm
PH	Negative logarithm of hydrogen ion activity
Po	Dimensionless power number
Q	Heat Transferred, J
r	Component rate, $mol.min^{-1}.cm^{-1}$
$\bar{r}$	Reaction rate, $molmin^{-1}cm^{-2}$
r_c	Particle core radius, mm
r_s	Product layer radius, mm
R	Ideal gas constant, $J.mol^{-1}.K^{-1}$
Re	Reynolds Number
T	Temperature, K
t	Time, min , sec
t^*	Dimensionless time
V_r	Reactor working volume, lit
x	Conversion
$\bar{x}$	Overall conversion of wide size feed
U	Overall heat transfer coefficient,$Jmin^{-1}cm^{-2}$ K^{-1}
Δw	Weigh fraction
Y_1,Y_2	Dimensionless parameters

GREEK SYMBOLES

Θ	Stoichiometric dimensionless parameter
ε	Reaction extent in batch reactor, mol
ν	Stoichiometric coefficient in reaction
ρ	Density, $gr.cm^{-3}$
γ_i	Activity Coefficient of spice i
η	Viscosity of fluid, $kg.m^{-1}.s^{-1}$, cp

SUPERSCRIPTS

n	Apparent order

SUBSCRIPTS

f	fluid
i	Reaction component
j	Reaction
k	Size fraction
o	Initial
P	Particle
in	Inlet condition
out	Outlet condition

CHAPTER I
INTRODUCTION

When considering specific type of industries, one finds that there are often many different production processes, resulting in many different production processes, and many different types of pollutants, and also many possible method of pollution control.

Frequently, however, the processes are similar; this allows a discussion of the "general" treatment method for the "typical" wastes produced.

The iron and steel industry is very complex and there are four major Stages to conventional processing:

1.Mining

2.Iron ore concentration

3.Blast furnace operation

4.Steel production

The first two of these steps are generally done at or near the mining site, where as the last two processes are done at steel plants located elsewhere.

The pollutants generated are very diverse, as are the processes, and encompass the full range: air and water pollution and solid wastes. Because of complexity of the steel industry, the processes and associated environmental problems will be considered for each stage separately.

With this background, we can first consider the general methods of pollution control, and then examine some particular solid waste generated in steel industries by the method are typically used to