Various Characteristics of Some Bifunctional Supported Complex Catalysts Used in Reactions of Applied Interest

A Thesis Submitted

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B.Sc. and M.Sc.

For the Award of

Ph.D. degree in Chemistry

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بسم الله الرحمن الرحيم

قَالُواْ سُبْحَانَكَ لاَ عِلْمَ لَنَا إِلاَّ مَا عَلَّمْتَنَا إِنَّكَ أَنتَ الْعَلِيمُ الْحَكِيمُ

صدق الله العظيم

سورة البقرة

الايه ٣٢

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Thesis Approved

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To my mother, wife and my dearest brother

Abstract

Name: Atef Samir Darwish

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In the present study, the pure raw bentonite clay has been modified by acid treatment and by pillaring with titania and vanadia. Iron (II) phthalocyanine complex was immobilized in different wt% loadings onto the various modified bentonite supports.

Structural characteristics of the various samples were investigated through XRD, FTIR, TGA, and ICP-EDX techniques. Textural and morphological characteristics were estimated from low-temperature adsorption-desorption isotherms of N_2, pore size distribution analysis and SEM. Dispersion parameters of iron (II) phthalocyanine were determined from H_2 chemisorption isotherms. Acid-base properties were followed up via potentiometric titration method and cation exchange capacity in each case was also determined.

Bifunctional catalytic activities of the prepared catalyst samples were examined in oxidative dehydrogenation of ethylbenzene to produce styrene monomer as well as in *in-situ* bulk polymerization of methyl methacrylate. The catalytic results were correlated with various characteristics to determine the most active and selective samples for application.

A new approach was achieved for using the bulk polymerization of MMA in presence of FePc complex immobilized onto modified bentonite

clay samples for synthesis of a PMMA/clay hybrid composite, with dispersed clay in minute sizes. Characterization of the produced hybrid composites was performed by XRD, FTIR, NMR and SEM techniques.
Keywords:

Modified bentonite; ATTB; V-PILB; Ti-PILB; Immobilized FePc; ODH of EB; Bulk polymerization of MMA.

Abbreviations

Raw bentonite Clay	RB
Acid/thermally treated bentonite	ATTB
Vanadia- pillared bentonite	V-PILB
Titania- pillared bentonite	Ti-PILB
Iron phthalocyanine	FePc
X-ray diffraction	XRD
Fourier Transform infrared	FTIR
Scanning electron microscope	SEM
Specific Surface area	S_{BET}
Ion coupled plasma	ICP
Energy dispersive X-ray spectroscopy	EDX
BET-C energetic constant	C_{BET}
Monolayer coverage	V_m
Pore size distribution	PSD
Metallic specific surface area	S_{FePc}
Apparent degree of dispersion	$[D]_{app}$
Degree of surface coverage	α
Cation exchange site density	D_{CE}
Silanol site density	D_{SiO^-}
Aluminol site density	D_{AlOH}
Methyl methacrylate	MMA
Poly methyl methacrylate	PMMA

Average weight molecular weight	$\overline{M}_w$
Average number molecular weight	$\overline{M}_n$
Oxidative dehydrogenation	ODH
Ethyl benzene	EB

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II- Experimental Details

III- Results and discussion