CONTENTS

Abstract
List of figures  v-viii
List of tables  ix
Abbreviations  x

Chapter-1 : Introduction  1-44
1.1 Porous Materials in Catalysis  1
1.2 Microporous Solids  2
1.2.1 Zeolite  2
1.2.2 Aluminophosphate  4
1.3 Mesoporous M41S Materials  5
1.3.1 Ordered Mesoporous Materials  5
1.3.2 Random Mesoporous Structures  7
1.4 Synthesis of M41S Molecular Sieves Materials  7
1.4.1 Synthesis of MCM-41 Molecular Sieves  8
1.4.2 Synthesis of MCM-48 Molecular Sieves  8
1.5 Synthesis of Mesoporous Molecular Sieves Containing Elements Other Than Silica  9
1.6 Probable Mechanism of formation of mesoporous materials  11
1.7 Stability of Mesoporous Materials  14
1.8 Pore Size structures  15
1.9 Comparison of MCM-48 and MCM-41  16
1.10 Factors effecting the formation of mesopores compounds  16
1.10.1 Effect of concentration of CTAB  16
1.10.2 Effect of pH  17
1.10.3 Effect of temperature  17
1.10.4 Effect of time  18
1.11 Advantages of MCM-48  18
1.12 Characterization of Mesoporous Molecular Sieves  19
1.12.1 X-Ray Diffraction Study 19
1.12.2 I.R.Study 20
1.12.3 Diffuse Reflectance UV-Visible Spectroscopy 22
1.12.4 Adsorption Studies 23
1.12.5 Nitrogen Adsorption Isotherm 23
1.12.6 Scanning Electron Microscopy (SEM) Study 25
1.12.7 Transmission Electron Microscopy (TEM) Study 26
1.12.8 Solid State Nuclear Magnetic Resonance (NMR) Study 26
1.12.9 X-ray absorption spectroscopy (EXAFS/XANES) 27
1.12.10 Thermal Analysis 29
1.12.11 EPR Study 30
1.13 Catalytic Property 30
  1.13.1 Acid Catalysis 31
  1.13.2 Base Catalysis 33
  1.13.3 Redox Catalysis 34
1.14 Ordered mesoporous as support 37
  1.14.1 Supporting acids and bases 37
  1.14.2 Supporting metals and oxides 38
  1.14.3 Supporting active species for selective oxidation 39
1.15 Location of Transition metal ions 41
1.16 Objective of the present work 43
  1.16.1 Synthesis 43
  1.16.2 Characterization by 43
  1.16.3 Catalytic Applications 44

Chapter 2 : Experimental Methods 45-49
2.1 Synthesis apparatus 45
  2.1.1 Autoclave 45
  2.1.2 Hot air Oven 45
  2.1.3 Muffle furnace 45
2.2 Synthesis Materials / Chemicals 45
Chapter 3 : Synthesis, Characterization of MCM-48 50-68

Molecular Sieve and its application in drug delivery process

3.1 Hydrothermal synthesis of MCM-48 50
3.2 Modification of outside Surface of MCM-48 molecular sieves 51
3.3 CHARACTERIZATION 51
   3.3.1 X-ray diffraction (XRD) Studies 51
   3.3.2 IR Study 53
   3.3.3 Diffuse Reflectance Spectroscopy (DRS) Studies 53
   3.3.4 Scanning Electron Micrograph (SEM) 54
   3.3.5 Transmission Electron Micrograph (TEM) 55
   3.3.6 Nitrogen Adsorption/ Desorption Isotherm 55
   3.3.7 MASS-NMR Study 57
   3.3.8 TGA Study 58
   3.3.9 Energy Dispersive X-ray (EDX) study 59
   3.3.10 Determination of approximate emoirical formula 60
3.4 Drug Delivery 61
Chapter 4 : Synthesis, Characterization and Catalytic Application of Ti-MCM-48

4.1 Hydrothermal synthesis of Ti-MCM-48

4.2 Characterization

4.2.1 X-ray diffraction (XRD) Studies

4.2.2 IR Study

4.2.3 Diffuse Reflectance Spectroscopy (DRS) Study

4.2.4 Scanning Electron Micrograph (SEM)

4.2.5 Energy Dispersive X-ray (EDX) study

4.2.6 Transmission Electron Microscope (TEM)

4.2.7 Nitrogen Adsorption/ Desorption Isotherm

4.2.8 NMR Study

4.2.9 TGA Study

4.3 Catalytic study

4.3.1 Hydroxylation Reaction

4.3.2 Knoevenagel condensation Reaction

4.3.3 Photo catalytic study of Ti-MCM-48
Chapter 5 : Synthesis, Characterization and Catalytic Studies of Mn-MCM-48

5.1 Synthesis of Mn-MCM-48

5.2 Characterization

5.2.1 IR Study
5.2.2 DRS study
5.2.3 XRD Study
5.2.4 SEM Study
5.2.5 EPR Study
5.2.6 Nitrogen Adsorption/ Desorption Isotherm
5.2.7 Thermogravimetry Analysis

5.3 Catalytic Property of Mn-MCM-48

Chapter 6 : Synthesis, Characterization and Hydrogenation reactions of Ruthenium nano particles supported on MCM-48

6.1 Preparation of Ruthenium nano particle
6.2 Preparation of Ru-MCM-48

6.3 Characterization

6.3.1 UV-VIS Spectroscopy
6.3.2 IR Study
6.3.3 XRD Study
6.3.4 SEM Study:
6.3.5 N$_2$ adsorption/desorption isotherm
6.3.6 Thermal stability

6.4 Catalytic study (Hydrogenation Reaction)

Chapter 7 : Synthesis, Characterization and Catalytic Application of Al-MCM-48

7.1 Hydrothermal synthesis of Al-MCM-48
7.2 Characterization

7.2.1 IR Study
Chapter 8 : Synthesis of Amino functionalized MCM-48 and its catalytic activity

8.1 Synthesis of amino functionalized MCM-48

8.2 CHARACTERIZATION

8.2.1 IR Study

8.2.2 Diffuse Reflectance Spectroscopy (DRS) Study

8.2.3 TGA Study

8.2.4 Nitrogen Adsorption/ Desorption Isotherm

8.3 Catalytic Reactions

Summary

References

List of Publication