## List of Figures and Graphs

<table>
<thead>
<tr>
<th>Fig. No</th>
<th>Title of the Fig.</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fig 1.1</td>
<td>The secondary building units of zeolite structure</td>
<td>4</td>
</tr>
<tr>
<td>Fig 1.2</td>
<td>Shape selectivity of zeolites (a) Reactant shape selectivity, (b) Product shape selectivity, (c) Transition state selectivity, (d) Molecular traffic control</td>
<td>9</td>
</tr>
<tr>
<td>Fig 1.3</td>
<td>Structure of (a) Hexagonal MCM-41, (b) Cubic MCM-48 and (c) Lamellar MCM-50</td>
<td>18</td>
</tr>
<tr>
<td>Fig 1.4</td>
<td>Illustration of ZSM-5 framework and channel system</td>
<td>29</td>
</tr>
<tr>
<td>Fig 3.1</td>
<td>XRD pattern of ZSM-5 (ZP) samples without carbon black particles with SAR 100.</td>
<td>64</td>
</tr>
<tr>
<td>Fig 3.2</td>
<td>XRD of ZSM-5 (ZC1) with SiO$_2$/carbon ratio of 1:1</td>
<td>65</td>
</tr>
<tr>
<td>Fig 3.3</td>
<td>XRD of ZSM-5 (ZC2) with SiO$_2$/carbon ratio of 1:4</td>
<td>65</td>
</tr>
<tr>
<td>Fig 3.4</td>
<td>XRD of ZSM-5 (ZC3) with SiO$_2$/carbon ratio of 1:8</td>
<td>66</td>
</tr>
<tr>
<td>Fig 3.5</td>
<td>XRD of ZSM-5 (ZC4) in 1:12 SiO$_2$/carbon ratio</td>
<td>66</td>
</tr>
<tr>
<td>Fig 3.6</td>
<td>Variation of FWHM value for different SiO$_2$/C</td>
<td>67</td>
</tr>
<tr>
<td>Fig 3.7</td>
<td>FTIR of ZSM-5 samples synthesized in presence of carbon</td>
<td>69</td>
</tr>
<tr>
<td>Fig 3.8</td>
<td>SEM image of ZSM-5 (parent)</td>
<td>70</td>
</tr>
<tr>
<td>Fig 3.9</td>
<td>SEM image of ZSM-5 (ZC1) with SiO$_2$/carbon = 1:1</td>
<td>70</td>
</tr>
<tr>
<td>Fig 3.10</td>
<td>SEM image of ZSM-5 (ZC2) with SiO$_2$/carbon = 1:4</td>
<td>70</td>
</tr>
<tr>
<td>Fig 3.11</td>
<td>SEM image of ZSM-5 (ZC3) with SiO$_2$/carbon = 1:8</td>
<td>71</td>
</tr>
<tr>
<td>Fig 3.12</td>
<td>TGA of sample ZC1</td>
<td>72</td>
</tr>
<tr>
<td>Fig 3.13</td>
<td>TGA of sample ZC2</td>
<td>73</td>
</tr>
<tr>
<td>Fig 3.14</td>
<td>TGA of sample ZC3</td>
<td>73</td>
</tr>
<tr>
<td>Fig 3.15</td>
<td>$N_2$ Adsorption-desorption Isotherm of Parent ZSM-5 sample</td>
<td>74</td>
</tr>
<tr>
<td>Fig 3.16</td>
<td>$N_2$ Adsorption-desorption Isotherm of ZC1</td>
<td>75</td>
</tr>
<tr>
<td>Fig 3.17</td>
<td>$N_2$ Adsorption-desorption Isotherm of ZC2</td>
<td>75</td>
</tr>
<tr>
<td>Fig 3.18</td>
<td>$N_2$ Adsorption-desorption Isotherm of ZC3</td>
<td>76</td>
</tr>
<tr>
<td>Fig 3.19</td>
<td>Variation of BET surface area with carbon content</td>
<td>77</td>
</tr>
</tbody>
</table>
Fig 3.20  X-ray diffraction pattern of ZSM-5 (ZN) zeolite without Mo in neutral medium.
Fig 3.21  XRD patterns of (A) MoZN1, (B) MoZN2 and (C) MoZN3
Fig 3.22  FT-IR spectra of (A) ZN, (B)MoZN1, (C)MoZN2, (D)MoZN3
Fig 3.23  SEM monograph of ZN
Fig 3.24  SEM of MoZN1
Fig 3.25  SEM of MoZN2
Fig 3.26  SEM of MoZN3
Fig 3.27  UV-DRS spectra of (A) MoZN1, (B) MoZN2 and (C)MoZN3
Fig 3.28  TGA curve of ZN
Fig 3.29  TGA curve of MoZN1
Fig 3.30  TGA curve of MoZN2
Fig 3.31  TGA curve of MoZN3
Fig 3.32  XRD pattern of SiMCM-48
Fig 3.33  XRD pattern of MoMCM-48
Fig 3.34  FT-IR spectra of SiMCM-48
Fig 3.35  FT-IR spectra of MoMCM-48
Fig 3.36  SEM image of SiMCM-48
Fig 3.37  SEM image of MoMCM-48
Fig 3.38  TGA graph of SiMCM-48
Fig 3.39  TGA graph of Mo MCM-48
Fig 3.40  N₂ adsorption-desorption curve of SiMCM-48
Fig 3.41  N₂ adsorption-desorption curve of MoMCM-48
Fig 3.42  UV-DRS spectrum of MoMCM-48
Fig 3.43  XRD pattern of SBA-1
Fig 3.44  XRD pattern of SBA-1 and MoSBA-1
Fig 3.45  FT-IR pattern of SBA-1 and MoSBA-1
Fig 3.46  SEM monograph of SBA-1
Fig 4.1  Effect of reaction time on styrene oxidation reaction over
ZN catalyst.

Fig 4.2 Effect of reaction time on styrene oxidation reaction over MoZN1 catalyst
Fig 4.3 Effect of reaction time on styrene oxidation reaction over MoZN2 catalyst.
Fig 4.4 Effect of reaction time on styrene oxidation reaction over MoZN3 catalyst.
Fig 4.5 Effect of reaction time on styrene oxidation reaction over MoMCM-48 catalyst
Fig 4.6 Comparison of conversion (%) of Styrene oxidation over different catalysts
Fig 4.7 Effect of temperature on styrene oxidation reaction over ZN catalyst
Fig 4.8 Effect of temperature on styrene oxidation reaction over MoZN1 catalyst
Fig 4.9 Effect of temperature on styrene oxidation reaction over MoZN2 catalyst
Fig 4.10 Effect of temperature on styrene oxidation reaction over MoZN3 catalyst
Fig 4.11 Effect of temperature on styrene oxidation reaction over MoMCM-48 catalyst
Fig 4.12 Comparison of conversion (%) , Selectivity of benzaldehyde (%) and Styrene oxide of Styrene oxidation over different catalysts
Fig 4.13 Effect of amount of catalyst on styrene oxidation reaction over ZN catalyst
Fig 4.14 Effect of amount of catalyst on styrene oxidation reaction over MoZN1 catalyst
Fig 4.15 Effect of amount of catalyst on styrene oxidation reaction over MoZN2 catalyst
Fig 4.16 Effect of amount of catalyst on styrene oxidation reaction over MoZN3 catalyst
Fig 4.17 Effect of amount of catalyst on styrene oxidation reaction over MoMCM-48 catalyst
Fig 4.18 Effect of reactants mole ratio on styrene oxidation reaction over ZN catalyst.
Fig 4.19 Effect of reactants mole ratio on styrene oxidation reaction over MoZN1 catalyst
Fig 4.20 Effect of reactants mole ratio on styrene oxidation reaction over MoZN2 catalyst
Fig 4.21 Effect of reactants mole ratio on styrene oxidation reaction over MoZN3 catalyst
Fig 4.22 Effect of reactants mole ratio on styrene oxidation reaction over MoMCM-48 catalyst
Fig 4.23 Comparison of conversion (%) of Styrene oxidation over different catalysts at different reactant molar ratio.
Fig 4.24 Effect of reaction time on the esterification reaction over ZP catalyst
Fig 4.25 Effect of reaction time on the esterification reaction over ZC1 catalyst
Fig 4.26 Effect of reaction time on the esterification reaction over ZC2 catalyst
Fig 4.27 Effect of reaction time on the esterification reaction over ZC3 catalyst
Fig 4.28 Effect of reaction time on the esterification reaction over SBA-1 catalyst
Fig 4.29 Effect of reaction time on the esterification reaction over MCM-48 catalyst
Fig 4.30 Comparison of conversion (%) of esterification of benzyl alcohol with acetic acid over different catalysts at different time.
Fig 4.31 Effect of reaction time on the esterification reaction over ZP catalyst
Fig 4.32 Effect of reaction time on the esterification reaction over...
ZC1 catalyst

**Fig 4.33** Effect of reaction time on the esterification reaction over ZC2 catalyst  150

**Fig 4.34** Effect of reaction time on the esterification reaction over ZC3 catalyst  151

**Fig 4.35** Effect of reaction time on the esterification reaction over SBA-1 catalyst  152

**Fig 4.36** Effect of reaction time on the esterification reaction over SBA-1 catalyst  153

**Fig 4.37** Effect of amount of catalyst on the esterification reaction over catalysts ZP, ZC1, ZC2, ZC3, SBA-1, MCM-48  156

**Fig 4.38** Effect of reactants’ molar ratio on the esterification reaction over catalysts ZP, ZC1, ZC2, ZC3, SBA-1, MCM-48  158