

## LIST OF TABLES

- Table 2.1 Deposits of Bentonite in Different Countries
- Table 2.2 Different Clay-Organic Interactions
- Table 5.1 Chemical composition of the as-received montmorillonitic clays.
- Table 5.2 Chemical composition and CEC of Na<sup>+</sup> - Mt clays
- Table 5.3 Basal spacing of Na<sup>+</sup>-Mt clays in oriented film after glycolation
- Table 5.4 Lattice parameters of experimental Mt
- Table 5.5 FTIR peaks of Na<sup>+</sup>-Mt clays
- Table 5.6 Structure of the intercalants (*n*-alkylammonium)
- Table 5.7 Measured basal spacing of *n*-alkylammonium cations intercalated clays
- Table 5.8 Layer charge of Na<sup>+</sup>-Mt clays determined from *n*-alkylammonium intercalation
- Table 5.9 Organic content and loading of intercalants in *n*-alkylammonium cations intercalated clays from TG analysis.
- Table 5.10 Methylene symmetric and anti symmetric stretching value of *n*-alkylammonium cations intercalated clays from NK, AP and PGV
- Table 5.11 Structure of the intercalants (dialkylammonium)
- Table 5.12 Measured basal spacing of dialkylammonium cations intercalated clays.
- Table 5.13 Organic content and loading of intercalants in dialkylammonium cations intercalated clays from TG analysis.
- Table 5.14 Methylene symmetric and anti symmetric stretching value of dialkylammonium cations intercalated clays from NK, AP and PGV.
- Table 5.15 Structure of the intercalants (mono, di and trialkyl ammonium)
- Table 5.16 Organic loading and basal spacing of mono, di and trialkyl ammonium cations intercalated NK
- Table 5.17 Organic loading and basal spacing of mono, di and trialkyl ammonium cations intercalated PGV
- Table 5.18 Methylene symmetric and anti symmetric stretching value of mono, di and trialkyl ammonium cations intercalated clays from NK and PGV
- Table 5.19 Organic content and loading of intercalant in intercalated Fe<sup>3+</sup>-exchanged clays from TG analysis.

## LIST OF FIGURES

- Figure. 2.1 Sketch of octahedral sheet
- Figure. 2.2 Sketch of tetrahedral sheet
- Figure. 2.3 Structure of Montmorillonite
- Figure. 2.4 a) Monolayer b) Bilayer c) Pseudotri molecular layer d) & e) Paraffinic arrangements of alkylammonium cations in smectite interlayer
- Figure. 2.5 Alkyl chain aggregation model as shown by Vaia representing a) short alkyl chain b) medium alkyl chain c) long alkyl chain
- Figure. 2.6 Intercalant configurations and corresponding density profiles of organoclays – monolayer, bilayer and trilayer
- Figure. 5.1 X-ray diffractogram of as-received NK
- Figure. 5.2 X-ray diffractogram of as-received AP
- Figure. 5.3a Volume distribution of particle size of as-received NK
- Figure. 5.3b Number distribution of particle size of as-received NK
- Figure. 5.4a Volume distribution of particle size of as-received AP
- Figure. 5.4b Number distribution of particle size of as-received AP
- Figure. 5.5 Number distribution of particle size of NK
- Figure. 5.6 Number distribution of particle size of AP
- Figure. 5.7 Number distribution of particle size of PGV
- Figure. 5.8 DTG Plots of Na<sup>+</sup>-Mt clays
- Figure. 5.9 DTA Plot of NK
- Figure. 5.10 DTA Plot of AP
- Figure. 5.11 DTA Plot of PGV
- Figure. 5.12 XRD pattern of oriented film of Na<sup>+</sup>-Mt clays after glycolation
- Figure. 5.13 XRD pattern of Na<sup>+</sup>- Mt clays in randomly oriented mount
- Figure. 5.14 FTIR spectrum of Na<sup>+</sup>-Mt clays showing hydroxyl stretching bands
- Figure. 5.15 FTIR spectrum of Na<sup>+</sup>-Mt clays showing hydroxyl deformation bands
- Figure. 5.16 FESEM micrographs of experimental Na<sup>+</sup>-Mt clays
- Figure. 5.17 TEM micrographs of experimental Na<sup>+</sup>-Mt clays showing basal planes and low magnification image of the clays with corresponding SAED pattern.
- Figure. 5.18 X-ray diffractogram of *n*- alkylammonium cations intercalated NK

- Figure. 5.19 X-ray diffractogram of *n*- alkylammonium cations intercalated AP
- Figure. 5.20 X-ray diffractogram of *n*- alkylammonium cations intercalated PGV
- Figure. 5.21 Plot of basal spacing (nm) of *n*- alkylammonium cations intercalated clays (from NK, PGV and AP) vs. carbon number in alkyl chain ( $C_n$ )
- Figure. 5.22 TG plots of *n*- alkylammonium cations intercalated clays from NK
- Figure. 5.23 DTG plots of *n*- alkylammonium cations intercalated clays from NK
- Figure. 5.24 TG plots of *n*- alkylammonium cations intercalated clays from AP
- Figure. 5.25 DTG plots of *n*- alkylammonium cations intercalated clays from AP
- Figure. 5.26 TG plots of *n*- alkylammonium cations intercalated clays from PGV
- Figure. 5.27 DTG plots of *n*- alkylammonium cations intercalated clays from PGV
- Figure. 5.28 Plot of organic loading of the *n*-alkylammonium cation intercalated clays vs. carbon number in alkyl chain ( $C_n$ )
- Figure. 5.29 Swelling volume (ml) of the O-Mt clays vs. carbon number in alkyl chain ( $C_n$ )
- Figure. 5.30 FTIR Plots of *n*- alkylammonium cations intercalated clays from NK
- Figure. 5.31 FTIR Plots of *n*- alkylammonium cations intercalated clays from AP
- Figure. 5.32 FTIR Plots of *n*- alkylammonium cations intercalated clays from PGV
- Figure. 5.33 FTIR Plots of O-Mt clays from NK showing  $CH_2$  stretching bands
- Figure. 5.34 FTIR Plots of O-Mt clays from AP showing  $CH_2$  stretching bands
- Figure. 5.35 FTIR Plots of O-Mt clays from PGV showing  $CH_2$  stretching bands

- Figure. 5.36 TEM micrographs of C<sub>10</sub> intercalated clays from NK and PGV showing basal planes and low magnification image of the clays with corresponding SAED pattern
- Figure. 5.37 TEM micrographs of C<sub>12</sub> intercalated clays from NK and PGV
- Figure. 5.38 TEM micrographs of C<sub>18</sub> intercalated clays from NK, AP and PGV
- Figure. 5.39 Proposed arrangement of surfactant cations in the interlayer space of O-Mt clays based on XRD, TG and FTIR study
- Figure. 5.40 X-ray diffractogram of dialkylammonium cations intercalated NK
- Figure. 5.41 X-ray diffractogram of dialkylammonium cations intercalated AP
- Figure. 5.42 X-ray diffractogram of dialkylammonium cations intercalated PGV
- Figure. 5.43 Plot of basal spacing vs. alkyl chain length in dialkylammonium cations intercalated clays
- Figure. 5.44 TG plots of dialkylammonium cations intercalated NK
- Figure. 5.45 DTG plots of dialkylammonium cations intercalated NK
- Figure. 5.46 TG plots of dialkylammonium cations intercalated AP
- Figure. 5.47 DTG plots of dialkylammonium cations intercalated AP
- Figure. 5.48 TG plots of dialkylammonium cations intercalated PGV
- Figure. 5.49 DTG plots of dialkylammonium cations intercalated PGV
- Figure. 5.50 Plot of organic loading vs. alkyl chain length in dialkylammonium cations intercalated clays
- Figure. 5.51 FTIR Plots of dialkylammonium cations intercalated NK. Methylene stretching bands (Inset)
- Figure. 5.52 FTIR Plots of dialkylammonium cations intercalated AP. Methylene stretching bands (Inset)
- Figure. 5.53 FTIR Plots of dialkylammonium cations intercalated PGV. Methylene stretching bands (Inset)
- Figure. 5.54 TEM micrographs of di-C<sub>18</sub> intercalated clays from NK, AP and PGV showing basal planes and low magnification image of the clays with corresponding SAED pattern
- Figure. 5.55 X-ray diffractogram of mono, di and trialkylammonium cations intercalated NK

Figure. 5.56	X-ray diffractogram of mono, di and trialkylammonium cations intercalated PGV
Figure. 5.57	TG plots of mono, di and trialkylammonium cations intercalated NK
Figure. 5.58	DTG plots of mono, di and trialkylammonium cations intercalated NK
Figure. 5.59	TG Plots of mono, di and trialkylammonium cations intercalated PGV
Figure. 5.60	DTG Plots of mono, di and trialkylammonium cations intercalated PGV
Figure. 5.61	Plot of basal spacing vs. organic loading/CEC of mono, di and trialkylammonium cations intercalated NK and PGV
Figure. 5.62	FTIR Plots of mono, di and trialkylammonium cations intercalated NK
Figure. 5.63	FTIR Plots of mono, di and trialkylammonium cations intercalated PGV
Figure. 5.64a	XRD Plot showing $d(001)$ spacing of $\text{Na}^+$ and $\text{Fe}^{3+}$ exchanged NK and O-Mt clays
Figure. 5.64b	XRD Plot of $\text{Fe}^{3+}$ exchanged NK showing the phases present
Figure. 5.65a	XRD Plot showing $d(001)$ spacing of $\text{Na}^+$ and $\text{Fe}^{3+}$ exchanged PGV and O-Mt clays
Figure. 5.65b	XRD Plot of $\text{Fe}^{3+}$ exchanged PGV showing the phases present
Figure. 5.66a	TG Plot of $\text{Na}^+$ and $\text{Fe}^{3+}$ exchanged NK only
Figure. 5.66b	TG Plot showing $\text{Na}^+$ and $\text{Fe}^{3+}$ exchanged NK and O-Mt clays
Figure. 5.67a	TG Plot of $\text{Na}^+$ and $\text{Fe}^{3+}$ exchanged PGV only
Figure. 5.67b	TG Plot showing $\text{Na}^+$ and $\text{Fe}^{3+}$ exchanged PGV and O-Mt clays
Figure. 5.68a	FTIR of $\text{Na}^+$ and $\text{Fe}^{3+}$ exchanged NK only
Figure. 5.68b	FTIR of $\text{Na}^+$ and $\text{Fe}^{3+}$ exchanged NK and O-Mt clays
Figure. 5.69a	FTIR of $\text{Na}^+$ and $\text{Fe}^{3+}$ exchanged PGV only
Figure. 5.69b	FTIR of $\text{Na}^+$ and $\text{Fe}^{3+}$ exchanged PGV and O-Mt clays
Figure. 5.70a	TEM micrographs of Na-Mt and Fe-Mt clays
Figure. 5.70b	TEM micrographs of Na-O-Mt and Fe-O-Mt clays