Chapter 5

Conclusions and Recommendations

This section describes some general conclusions regarding the success of this research; more specific conclusions are given within each chapter.

5.1. Conclusions

A technique for intercalating stearate anions into $Mg_4Al_2(OH)_{12}CO_3 \cdot 3H_2O$ (LDH-CO_3) was developed. The intercalation reaction mechanism consisted of an acid-base exchange between stearic acid (or any other fatty acid) and the carbonate anion of the LDH-CO_3. The use of surfactants was beneficial, preventing agglomeration during the reaction and in cases where LDO (calcined LDH) was used, the surfactant improved the yield of the stearate intercalated LDH (LDH-SA) and prevented the formation of Mg/Al salts of the fatty acids. The newly developed method gave better intercalation results in comparison to some well-known literature methods.

The anionic polymer poly(vinyl sulfonate) intercalated into LDH-CO_3 in the presence of stearic acid. The stearic acid intercalated as stearate anions, which was exchanged by the polymeric anion. This is an easy and facile way to produce nanocomposites. The anionic polymer and LDH interacts on the molecular level and the thicknesses of the resulting plate-like structures are in the nanometre range.

The stearate intercalated LDH (LDH-SA) successfully reduced the water vapour permeability of dextrin-alginate based films. In addition the Young's modulus increased, showing that the LDH-SA plate-like structures (which had thicknesses in the range of 100 nm), had reinforcing interactions with the polymer chains.

5.2. Recommendations for future research

During this research project aqueous film-forming solutions were used and tested as paper coatings. The solutions tended to penetrate deep into the fibrous matrix of the paper, requiring a high loading of solution before forming a continuous barrier film on the paper. This problem could be overcome by forming a thermoplastic starch-alginate blend filled with the LDH-SA. The thermoplastic blend could be prepared in the method developed by Souza *et al*. [1]. The intercalation reaction would then take place *in situ* between the molten SA and the LDH as in the method developed by Carlino *et al* [2,3]. The thermoplastic blend could then be used for melt paper coating.

The intercalation reaction of stearic acid into the LDH-CO_3 could also be done *in situ* during the emulsion polymerization of polymers such as polystyrene, methyl methacrylate, polyvinyl chloride and many more, which could lead to the formation of exfoliated nanocomposites. Furthermore, the system of the PVS ion exchanging with stearate to intercalate, could be used as a model of intercalating other poly-anionic species, such as DNA into the LDH layers, where it could be protected and used as carriers for gene therapy.

References

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