CHAPTER 9

SUMMARY AND CONCLUSIONS

9.1 SUMMARY

The main aim of this research was to develop compression moulded hybrid composite board using CFF, jute fibre and its blend. Further, it focuses on analyzing the effect of processing conditions like, temperature, pressure and time on the mechanical properties of this composites and also investigating the acoustic characteristics. Another objective is to optimize the process variables by using response surface optimization technique.

This work comprises five main topics

i) Characterization of CFF for its physical, chemical, thermal, morphological and amino acid content.

ii) Investigating the effect of processing conditions on tensile strength properties of CFF and its hybrid fibre composite.

iii) Investigating the effect of processing conditions on impact strength properties of CFF and its hybrid fibre composite.

iv) Investigating the effect of processing conditions on flexural strength properties of CFF and its hybrid fibre composite.

v) Investigating the effect of processing conditions, density and thickness of composite samples on acoustic properties of CFF and its hybrid fibre composite.
9.2 CONCLUSIONS

The experiments lead us to the following conclusions obtained from this study:

The characterization of CFF reveals that it can be used in textile as other natural protein fibres. The presence of micro voids in the CFF leads to good sound absorption. From XRD studies, it can be noticed that the crystals were more oriented. TGA study revealed that the partial decomposition of fibre starts in the range of 186°C and completely decomposed at 577°C. From the properties it can be understood that to spin the CFF alone is difficult because of its stiffness, but maybe it is possible to produce yarn if the CFF is blended with other fibres after studying blending compatibility requirements.

The CFF and its hybrid fibre reinforced polypropylene matrix based composite boards were prepared by using compression moulding machine. The mechanical and acoustic property of the composites produced with varying the process conditions has been analyzed.

When comparing the overall results on the tensile strength of the composites, 100% Jute fibre composite showed the highest tensile strength by keeping maximum temperature, pressure and medium time. The influence of temperature and pressure is significant on the tensile strength of composite samples and the effect of time is insignificant. Time has negative impact on the tensile strength of 50:50 and 25:75 CFF/Jute composite samples.

The maximum impact strengths were observed at minimum temperature, pressure and time for all the composite samples produced. The influence of temperature is significant than the pressure and time. Between the composite samples, 50:50 CFF/Jute composite shows highest impact strength (1.9J).
When comparing the overall results on the flexural strength of the composites, 25:75 CFF/Jute composite showed highest flexural strength by keeping minimum temperature, maximum pressure and medium time. The influence of pressure on flexural strength is significant compared to temperature and time. As time increases the flexural strength decreases.

When comparing the overall results on the acoustic property of the composites, 100% CFF composite showed highest NRC of 0.6 by keeping the process variables at lower conditions (165°C temperature, 5 Bar pressure and 3 Minutes time). The influence of temperature and pressure is significant on the NRC value than time on the acoustic properties of the composite board.

If the fibre loading of CFF rise, the NRC value also increased. The maximum sound absorption observed at 1.8 KHz because of the natural frequency of the CFF material. The processing conditions, reinforcement fibre wt%, thickness and density have a significant impact on the NRC values. There was no direct relationship between mechanical and acoustic properties of the manufactured composites.

From the research work, it was observed that, the mechanical properties of 100% Jute and 25:75 CFF/Jute composite showed better performances amongst the composite investigated. Since the research was mainly focused on utilization of CFF, 25:75 CFF/Jute composite, which is at par with the performance of 100% Jute composite can be considered as the best composite. The competition in the market of materials for automotive applications is substantial. In the more recent years, the environmental concern has opened the need for lighter vehicle for lower fuel consumption. These studied CFF hybrid composites will find suitable place in producing light, strong and thin panels and structures in automobile industry to produce lighter and more environmentally friendly future vehicles.
9.3 RECOMMENDATIONS FOR FUTURE WORK

The results of this study suggested a number of new avenues for research in future. They are:

The work can be extended to study other properties of composites such as creep, compression and aging.

This work can be further extended to study other aspects of such composites like use of other potential fillers for development of hybrid composites and evaluation of their mechanical and erosion behavior and the resulting experimental findings can be similarly analyzed.

Instead of CFF the whole chicken feather itself can be used to prepare the composite board. Surface modified matrix or natural fibre matrix can be used to produce the composite board and the interface and mechanical properties can be analyzed.

Producing multi-layered composite structure by using different materials and manufacturing methods can be experimented on.

The acoustic properties of the composites can also be studied by reverberation room method, various levels of thickness and densities of the composites.