Chapter 5

5.1 Summary of the thesis

Polyethylene/polypropylene based composite films were synthesized using different combinations of alkali treated- agro-wastes (wheat straw, hemp fiber) and observed changes occurred due to blending of agro-wastes in polymer matrix on mechanical, water barrier and thermal properties. Highest mechanical and lowest water barrier properties were optimized using response surface methodology and observed in 28.57 % alkali treated-agro-wastes blended composite films. SEM and XRD analyses confirmed the rough surface with crystalline nature of synthesized biocomposite films. TGA analysis verified the enhancement in thermal stability after incorporation of alkali treated-agro-waste in polymer matrix in place of native-agro-waste. FTIR analysis proved the successfully blending of treated-biomass in polymer matrix. Tensile strength is 45 MPa for PE/PP/Alkali treated-WS, 49.70MPa for PE/PP/Alkali treated-HF, 46.5 MPa for PE/PP, 29.07MPa for real PE packaging and 25.50MPa for real polyester packaging films. This improvement in mechanical strength showed the perfect utilizing of treated-agro-waste in polymer matrix for packaging applications. Dart impact strength is 2000.7 J/m for PE/PP/Alkali treated-WS film and 2034 J/m for PE/PP/Alkali treated-HF film showing benchmark improvement as compared to native-agro-waste reinforced polymeric film. The Water vapor transmission rates for PE/PP/alkali treated-WS and PE/PP/Alkali treated-HF are 51.890 g. m^{-2}.day^{-1} and 51 g. m^{-2}.day^{-1} which are very closer to pure and real PE packaging films. Similar results are observed in the case of hydrophobicity test. Remarkable favourable improvements in

water vapor transmission rate and hydrophobicity properties of composite film prepared from treated-agro-wastes signified the suitability of biomass in packaging applications.

So, treated-agro-waste incorporated polyethylene/polypropylene composite film shows reliable characteristics as compare to synthetic or market existed packaging film. This signifies the perfect use of treated-biomass in the polymer matrix for packaging applications.

5.2 Future scope

Biomass blending in polymer matrix is a promising technique for reduction of non-biodegradable polymer contributions on a global scale. In this study, alkali treated-agro-waste reinforced polyethylene/polypropylene composite films were prepared using solvent casting method for packaging applications. In the future, different agro-wastes can be used for polymer blending. Microbial test can also be done for checking antimicrobial property of composite film. This will help to use same composite film for food packaging applications. To scale up this technique, this study can also be done from lab to commercial level applications.