CHAPTER V
CONCLUSION AND SUGGESTIONS

5.1 Conclusion

Based on the tensile test results of PSP/PVA/BT composite films, several important findings can be highlighted:

1. The mechanical properties of PSP/PVA/BT composite films were strongly influenced by the concentration of Bajakah Tampala (BT) extract incorporated into the PSP/PVA matrix, confirming the role of BT as a natural bio-reinforcement agent in biopolymer systems [23], [24].
2. Tensile strength improved significantly with the addition of BT up to 1 g, where PSP/PVA/BT1 films reached 10.42 MPa, compared to 6.10 MPa in the PSP/PVA control. This indicates that BT contributed to the formation of additional intermolecular interactions, which enhanced the integrity of the polymer network [25], [26].
3. The elastic modulus attained its maximum value at 1270.51 MPa for PSP/PVA/BT1 films, reflecting a substantial increase in stiffness. However, a further increase in BT loading (2 g) reduced the modulus drastically to 90.39 MPa, likely due to filler agglomeration and microstructural inhomogeneities [27], [28].
4. The elongation at break decreased consistently as BT concentration increased, from 102.39% in PSP/PVA films to 21.76% in PSP/PVA/BT2. This demonstrates a trade-off between stiffness and ductility, a well-known phenomenon in reinforced biocomposites where hydrogen bonding and filler–polymer interactions restrict chain mobility [19], [18].
5. Overall, the optimum formulation was achieved with 1 g BT addition (PSP/PVA/BT1), which provided the best balance between tensile strength and stiffness. Although flexibility decreased, the enhanced strength and modulus suggest that this composition holds the most promise for potential applications in biodegradable packaging and functional films [20], [21].

5.2 Suggestions

Future research on PSP/PVA/BT composite films should include additional characterization techniques such as FTIR, SEM, and DSC to better understand the molecular interactions and thermal behavior of the films. It is also important to evaluate barrier properties, including water vapor permeability, oxygen transmission, and UV–Vis transmittance, in order to confirm their suitability for packaging applications. Since the addition of BT reduced elongation significantly, the optimization of plasticizers such as glycerol or sorbitol should be considered to improve flexibility without sacrificing strength. Furthermore, biodegradability tests under soil burial or enzymatic conditions are recommended to validate the environmental benefits of the films. For practical application, scaling up the production process and analyzing the economic feasibility will be necessary to determine the potential of PSP/PVA/BT films in food packaging and other industrial fields.