

CHAPTER V

CONCLUSION AND SUGGESTIONS

5.1 Conclusion

Based on the results and discussion, the following conclusions were drawn:

1. The characterization of CNDs produced from EPFB and watermelon rind shows significant differences. Watermelon rind-based CNDs have better optical characteristics compared to EPFB-based CNDs. The UV-Vis results show that the pure watermelon rind sample has a high absorbance of 1,4 with an absorption percentage of 96,0%, while EPFB only achieves an absorbance of 0,6 with an absorption percentage of 74,9%. Additionally, fluorescence and photoluminescence observations indicate that watermelon rind produces brighter, more homogeneous, and more stable emission compared to EPFB. This difference is influenced by the composition of watermelon rind biomass, which is rich in simple organic compounds, making it easier to form active emission center (surface state) and a more uniform carbon structure. FTIR and XRD characterization show the successful synthesis of Carbon Nano Dots from both biomasses. The general FTIR spectrum shows the presence of oxygen and nitrogen functional groups that play a role in the material's fluorescence properties, while the XRD pattern indicates a dominance of amorphous to semi-crystalline structures, which are characteristic of CNDs. The watermelon rind sample shows a more dominant amorphous structure and is more in line with the characteristics of CNDs compared to the EPFB sample. Watermelon rind samples show a more dominant amorphous structure and are more in line with the characteristics of CNDs compared to TKKS samples. Watermelon rind-based CNDs with the addition of 1 g of urea and doping with $\text{FeCl}_3 \cdot 10^{-3}$ show the best performance, making them candidates for bioimaging materials, as they possess high fluorescence intensity, optical stability, and surface functional groups that support interaction with biological systems.
2. The addition of varying amounts of urea affects the optical characterization of the resulting CNDs. The addition of urea aids in the formation of nitrogen functional groups and improves the fluorescence properties of the material. A

variation of 2 g urea mass produces the most optimal fluorescence in both EPFB and watermelon rind samples. At a urea mass of 3 g, there is a tendency for a decrease in fluorescence intensity due to the possibility of particle agglomeration and inhomogeneity in the carbon structure, which leads to an increase in non-radiative recombination. Variations in FeCl_3 concentration tend to increase fluorescence intensity thru the formation of active emission centers and modification of surface functional groups. However, at excessively high concentrations, there is a tendency for agglomeration to occur, which can reduce the efficiency of the optical material. Medium concentration provides the best balance between emission intensity and particle homogeneity.

5.2 Suggestions

1. Further research can use a wider range of FeCl_3 concentrations to obtain optimal metal doping conditions for enhancing the optical and fluorescence properties of CNDs.
2. Imaging tests on simple biological systems or biocompatibility tests need to be conducted to prove the potential application of EPFB-based and watermelon rind-based CNDs as biological imaging agents.
3. It is recommended to explore other types of biomass that are rich in natural carbon and nitrogen to compare the effectiveness of CND formation and improve the resulting optical quality.