

CHAPTER V

CONCLUSION AND SUGGESTION

5.1 Conclusion

Based on the results of the fabrication process, physical testing, density testing, porosity testing, and XRF analysis, the conclusions of this study are as follows:

1. The arm bone model was fabricated using chicken eggshell powder, synthetic CaCO_3 , resin, and catalyst/hardener as the main materials. In this study, two material variations were used, namely the Sample A and Sample B. The Sample A consisted of chicken eggshell 35%, synthetic CaCO_3 35%, resin 30%, The Sample B consisted of chicken eggshell 50%, synthetic CaCO_3 20%, resin 30%. These materials were selected because chicken eggshell powder and synthetic CaCO_3 contain high calcium content, while resin functions as a binder to form a solid and stable phantom structure. The fabrication process included material weighing, mixing, molding using a silicone mold, and curing for approximately one day until the phantom hardened. Therefore, the fabrication process successfully produced an arm bone model with calcium-rich composite material and stable physical form.
2. The fabricated arm bone phantom satisfied the dimensional requirements of the ISO 4037-3:2019 reference, with an average length of approximately 27.5 cm, diameter of 19 mm, and volume of 79.3 cm^3 . Both Sample A and Sample B exhibited identical physical dimensions, indicating that the variation in material composition did not affect the geometric characteristics of the fabricated phantom.
3. The material characterization demonstrated that Sample B exhibited the best overall performance among the investigated samples. Sample B showed a higher average density (1.9011 g/cm^3) than Sample A (1.8019 g/cm^3), while maintaining acceptable porosity (19.10%) and exhibiting the highest estimated effective atomic number Z_{eff} is 20.062 with slightly higher Sr content, which contributes to radiological attenuation. XRF analysis also confirmed that calcium was the dominant element in both sample groups. Therefore, Sample B is considered the most suitable composition and better than A for the proposed arm bone phantom because it provides the best overall balance of physical and radiological characteristics.

5.2 Suggestion

Based on the results of the fabrication process, physical testing, density testing, porosity testing, and XRF analysis, the conclusions of this study are as follows:

1. Future research is recommended to further optimize the material composition in order to achieve a better balance between density and porosity that more closely resembles human bone characteristics..
2. Further studies should include CT scan analysis to obtain Hounsfield Unit (HU) values as a radiological validation of the developed phantom material.
3. The fabrication process should be improved by applying more homogeneous mixing techniques, such as vacuum mixing, to minimize microvoid formation that affects porosity.