

carbonate, which was in good agreement with the peaks 1403.92, 1029.80, 871.67 (after 24 hours); 1398.14, 1029.80 and 871.67 (after 48 hours); and also 1398.14, 1029.80, and 871.67 (after 72 hours elapsed time).

This result shows the presence of calcium carbonate on the bio-based materials, thus showing that dry yeast mediated the CaCO₃ precipitation. The FT-IR spectra of the B2 and B3 mixtures are indicative of the presence of calcium carbonate on the precipitation formed of bio-based materials. The similar precipitation assessed by XRD analysis to confirm the polymorph of crystals.

For the B2 mixture, the XRD patterns of the precipitates obtained in the presence of CaCO₃ are presented in Fig. 8. In the precipitation after 24 hours, the three polymorph of CaCO₃ (aragonite, calcite, and vaterite) coexisted. Vaterite and calcite were the dominant polymorphs. There were 4 peaks of vaterite and calcite respectively. However, after 48 hours, intensities on calcite increased. Correspondingly, after 72 hours calcite was the dominant polymorph of CaCO₃ material as shown in 5 peaks of calcite in XRD pattern. Similarly, in the B3 mixtures, there were only calcite and vaterite polymorph in the calcium carbonate precipitation. After 24 hours of elapsed time, there were 5 peaks of vaterite and 3 peaks of calcite. There was no peaks indicating the presence of aragonite in this pattern. After 48 to 72 hours of elapsed time, showed the same pattern. Vaterite is the dominant polymorph of CaCO₃. Accordingly, a high concentration of tris buffer solution promotes the vaterite phase in experimental temperature.

IV. CONCLUSIONS

The result showed that calcium carbonate precipitates depending on the different concentration of tris buffer solution within 72 hours after mixing. In this study, the concentrations of Tris buffer solution were found to be adequate in the range of 0.5 to 0.75 (mol/L) in the case of an initial pH 9.0 and 0.75 to 1.0 (mol/L) in the case of an initial pH of 8.0. In the case of mixtures mixed in initial pH of 9.0, the rate of initial reaction tended to be faster, which could be attributed to the lower concentration of Tris buffer solution adjusted to a relatively higher pH in the mixture.

Based on the precipitation results were apparently assessed by Fourier-Transformed Infra-Red Spectroscopy (FT-IR) analysis, confirmed dry yeast mediated the CaCO₃ precipitation. Also, the FT-IR spectra for precipitation in the test tube are indicative of the presence of calcium carbonate. Furthermore, the XRD analysis confirmed vaterite and calcite are dominant polymorphs in the calcium carbonate precipitation. Also, the results showed that a high concentration of Tris buffer solution promotes the vaterite phase in the calcium carbonate precipitation.

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