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Physicochemical-Mechanical, Thermal and Rheological Properties Analysis of Pili Tree (Canarium Ovatum) Resin as Aircraft Integral Fuel Tank Sealant

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Abstract : Leaks arising from aircraft fuel tanks is a protracted problem for the aircraft manufacturers, operators, and maintenance crews. It principally arises from stress, structural defects, or degraded sealants as the aircraft age. It can be ignited by different sources, which can result in catastrophic flight and consequences, exhibiting a major drain both on time and budget. In order to mitigate and eliminate this kind of problem, the researcher produced an experimental sealant having a base material of natural tree resin, the Pili Tree Resin. Aside from producing an experimental sealant, the main objective of this research is to analyze its physical, chemical, mechanical, thermal, and rheological properties, which is beneficial and effective for specific aircraft parts, particularly the integral fuel tank. The experimental method of research was utilized in this study since it is a product invention. This study comprises two parts, specifically the Optimization Process and the Characterization Process. In the Optimization Process, the experimental sealant was subjected to the Flammability Test, an important test and consideration according to 14 Code of Federal Regulation Appendix N, Part 25 - Fuel Tank Flammability Exposure and Reliability Analysis, to get the most suitable formulation. Followed by the Characterization Process, where the formulated experimental sealant has undergone thirty-eight (38) different standard testing including Organoleptic, Instrumental Color Measurement Test, Smoothness of Appearance Test, Miscibility Test, Boiling Point Test, Flash Point Test, Curing Time, Adhesive Test, Toxicity Test, Shore A Hardness Test, Compressive Strength, Shear Strength, Static Bending Strength, Tensile Strength, Peel Strength Test, Knife Test, Adhesion by Tape Test, Leakage Test), Drip Test, Thermogravimetry-Differential Thermal Analysis (TG-DTA), Differential Scanning Calorimetry, Calorific Value, Viscosity Test, Creep Test, and Anti-Sag Resistance Test to determine and analyze the five (5) material properties of the sealant. The numerical values of the mentioned tests are determined using product application, testing, and calculation. These values are then used to calculate the efficiency of the experimental sealant. Accordingly, this efficiency is the means of comparison between the experimental and commercial sealant. Based on the results of the different standard testing conducted, the experimental sealant exceeded all the data results of the commercial sealant. This result shows that the physicochemical-mechanical, thermal, and rheological properties of the experimental sealant are far more effective as an aircraft integral fuel tank sealant alternative in comparison to the commercial sealant. Therefore, Pili Tree possesses a new role and function: a source of ingredients in sealant production.

Keywords : Aircraft Integral Fuel Tank, Physicochemi-mechanical, Pili Tree Resin, Properties, Rheological, Sealant, Thermal
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