Establishment of Protocols for Natural Fibre Density Measurement

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Executive Summary

This report presents the results of a study to recommend an appropriate test method for measuring the density of natural fibres. Various methods were evaluated on the basis of accuracy, cost, speed, ease of use, and worker safety. Five existing test methods were identified through a literature review. These included Diameter and Linear Density, Archimedes, Helium Pycnometry, Gradient Column, and Liquid Pycnometry. Following an initial screening, three test methods were selected for further investigation. These were Diameter and Linear Density, Archimedes, and Helium Pycnometry. Experimental trials were conducted on a single sample of oilseed flax fibres using the three methods to measure density.

The average measured density was determined from each set of experiments and compared to published values for flax fibre density to assess the accuracy of the tests. Repeatability was assessed through a calculation of each method's standard deviation. The trials were also timed to evaluate the labour requirements for conducting testing, including equipment set-up and calibration.

The recommended test method from this study was the Archimedes test using canola oil as an immersion fluid. This method provided accurate results in comparison to published values and demonstrated good repeatability. It was also simple and safe to conduct, and required the lowest equipment cost for set-up. Methanol, ethanol, acetone, water and glycerol were also trialed as potential immersion fluids for the Archimedes method. However, their overall performance was poorer than the canola oil. The Diameter and Linear Density test method was found to be the most labour intensive and showed the largest variation in results. Although Helium Pycnometry had the highest repeatability, the results of this test did not agree with published fibre densities.