

Article

# Influence of Stem Diameter on Fiber Diameter and the Mechanical Properties of Technical Flax Fibers from Linseed Flax

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**Abstract:** The continued search for sustainable and eco-friendly materials has led to the integration of bio-fibers, such as flax fiber, as reinforcement in composite materials; however, a wide variation in their diameters and mechanical properties poses a considerable challenge for their incorporation in load bearing and structural bio-composite materials. In this paper, a rigorous experimental investigation was performed using two varieties of linseed flax from two growing locations to determine if the variations observed in ultimate tensile strength, Young's modulus, failure strain and diameter could be attributed to the diameters of the stems that produced the fibers. Tests were performed in two different facilities and the results were compared and analyzed using Welch's *t*-tests. Results showed that samples which differed by stem diameter had statistically significant positive correlation with fiber diameter and negative correlation with tensile strength. No correlations for tensile strength, Young's modulus or fiber diameter were found in samples with the same stem diameter range that were grown in different locations or were of different varieties, that is the effect of location and variety is not statistically significant. Failure strain did not show any statistical significance with respect to differences in stem diameter and only showed one statistically significant result between both facilities for one of the two growing location comparisons.

**Keywords:** flax fiber; technical fiber; diameter variation; statistical analysis; Welch's *t*-test; tensile strength; Young's modulus; strain