The Effect of Hemp Concentration in Natural Fiber Composites

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Research

Title: **The Effect of Hemp Concentration in Natural Fiber Composites**

This research addressed the use of natural fibers in the creation of composite materials. Composite materials are formed when two or more materials are combined to create a new material. The goal is to create a new material that maximizes the strengths of the individual materials while minimizing their weaknesses. Using natural fibers allows for the creation of a new material that contains easily accessible, natural materials and is cost efficient to create. Our research focused on combining hemp fibers with epoxy and a hardener in 1-, 5-, and 10-percent concentrations. Once combined, tension testing was done to determine and compare their average modulus of elasticity and ultimate stress. This allowed us to determine which concentration of hemp composite was the most rigid and which could sustain the most force before breaking. It was determined via graphs of stress vs. strain that the modulus of the 1% samples was on average 616.8 MPa and had an ultimate stress of 36.33 MPa, which was the largest value for the concentrations we tested. The 5% samples showed a lower modulus of 573.33 MPa and an ultimate stress of 20.18 MPa. The 10% samples had the largest modulus of elasticity of 928.47 MPa and an ultimate stress of 21.35 MPa, which was much less than the 1% sample, but only slighter higher than the 5% sample. The stiffer a substance, the larger its modulus of elasticity. The 10% hemp concentration samples were the most rigid because of the strength of the hemp fiber. We expected the 10% hemp concentration samples to also have sustained the most force before breaking, and thus the highest ultimate stress; however, the 1% showed a higher ultimate stress. This could be based on the fact that as the hemp percentages increased so did the amount of air bubbles, which caused inconsistency in the uniformity of the samples and therefore increased the weakness of the 5% and 10% samples.

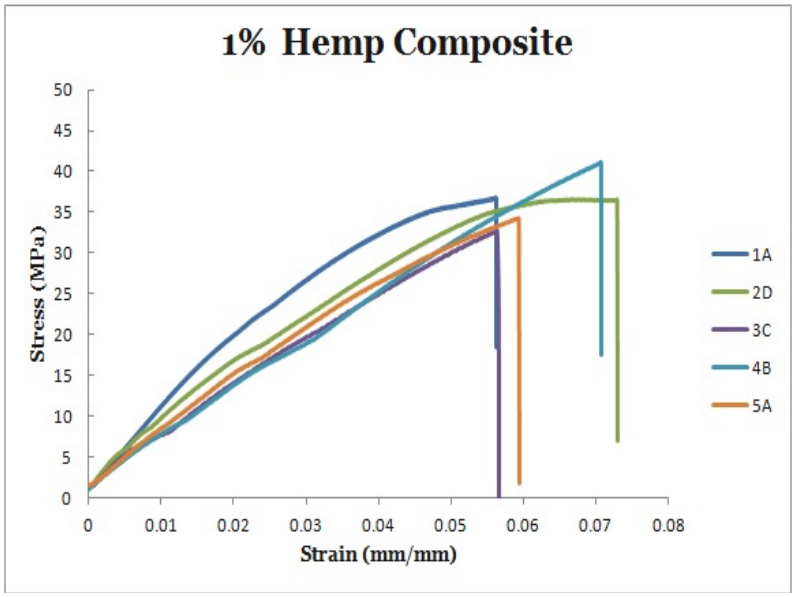

Figure: Tensile strength of 1% hemp composite samples

Lesson Plan

Title: Rebuilding New Orleans Composite Materials Lab

Students will play the role of composite material engineers when they work to create the best composite material to be used in an area that suffers from severe subsidence, such as New Orleans. Students create and analyze composite materials with the intent of optimizing strength while minimizing density. The composite materials are made of puffed rice cereal, marshmallows, and chocolate chips. Students will vary the concentrations of the 3 components to create 3 unique composites. Then they will determine the density of their materials and their compressive strengths by placing weights on top of them and measuring the amount the materials compress. Finally, students will graph stress vs. strain in order to determine the Young's modulus of each sample so they can analyze the strength of their materials.

Figure: Composite samples made using puffed rice cereal, marshmallows, and chocolate chips