A Novel Hemp Reinforced Auxetic Structure To Develop Sustainable Wind Turbine

Seker, Iclal (School: Atakum Anadolu Imam Hatip Lisesi)
Zehiroglu, Safa Merve (School: Atakum Anadolu Imam Hatip Lisesi)

Wind turbines, which are one of the main elements of sustainable energy sources, are not produced in a sustainable way. The production of materials used as reinforcement material in the wind turbine blade structure increases the carbon footprint. As a solution, Cannabis plant fibers, which are superior in terms of technical strength properties and have the ability to clean both soil and air, are produced by wet spinning process and have been given Auxetic behavior in a multidirectional fabric structure as a reinforcement material. Experimental mechanism was conducted in 3 different stages, firstly, the pre-cultivation conditions were followed, the hemp raw material was obtained and the mechanical properties of the fibers that had undergone the wet spinning process were examined. Secondly, microscopic examinations of the fibers rendered and cylindrical rod-like structure selected, which theoretically resembles a honeycomb structure to be modelized. Auxetic behavior was provided, which has extra technical properties such as indentation resistance and plane stress-fracture toughness. Finally, we produced biocomposites by using the vacuum infusion method and tested the specimens by Tensile, Bending, Compression, TGA, Maximum Force Elongation-Strip Method, Permeability and Tearing Strength tests. We categorized data and compared them with the test data of the materials which are commonly used in the existing wind turbine structure. Data and comparisons revealed that our product, which we have produced with an interdisciplinary study, is a material suitable for use in the structure of wind turbine blades and can provide more energy in a more sustainable and environmentally friendly way.

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