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## Effects of a high pressure compression-molded process and its parameters on the mechanical properties of compressed $\alpha$ -cellulose

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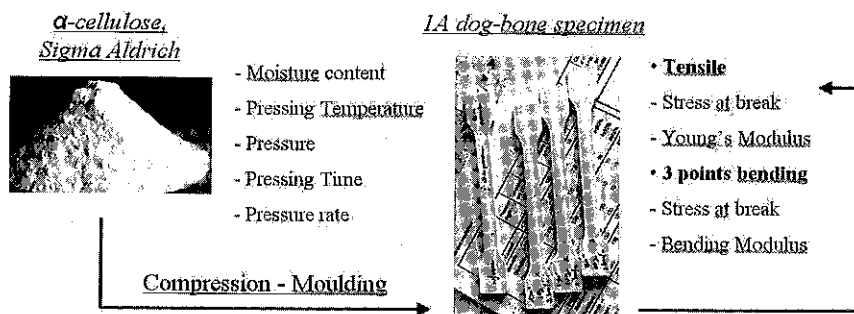
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The agromaterials are a very promising field [1] and ultimately, the moulding of 100 % natural fibers without any additive and binders is of high hopes. Because of having no melting point, cellulose which is the main constituent of plant fibers have to be molded under its solid form. Therefore, compression-moulding is a common and convenient process [2,3,4]. A specific mold was designed in order to produce 1A dog-bone specimens (according to NF EN ISO 3167) from dry  $\alpha$ -cellulose by direct compression. Tensile and 3-points-bending tests were conducted according to NF EN ISO 527 and NF EN ISO 178. Operating parameters were taken as follow : Pressure (1300 to 5400 kgf/cm<sup>2</sup>), Temperature (100 to 200°C), Moisture content (0 to 10.8%), Mass (5 to 12.5 g), Time (30 to 300 seconds) and Pressure establishment rate (1 to 50 bar/s). Their effects on the mechanical properties of the samples were investigated. Pressure, pressure increase rate, temperature and moisture content had a positive effect on the mechanical properties.



The compression moulded  $\alpha$ -cellulose samples exhibited Young's modulus as high as 2.6 GPa, and Flexural modulus as high as 7.2 GPa. The stresses at break were respectively 20 MPa (tensile) and 43 MPa (flexural) at their maximum. The sample mass had a greater impact than expected : it appeared that the surface of the material exhibits a much higher Young's Modulus than its core. Microscopic observations were done on specimen fractures and cristallinity index tended to increase upon pressure. Kinetic of the moulding being very fast some 3D mouldings were successfully tested opening ways for industrial applications.

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