Characterization and biological depectinization of hemp fibers originating from different stem sections

The wide variation of mechanical properties of natural fibers limits their applications in matrix composites. The aim of this study is to evaluate the properties of hemp fibers from different stem sections (top, middle and bottom) and to assess fungal retting pretreatment of hemp from different stem sections with the white rot fungi *Phlebia radiata* Cel 26 and *Ceriporiopsis subvermispora*. For the untreated hemp fibers, no apparent difference in tensile behavior for fiber bundles from different stem sections was observed, and more than 90% tested samples demonstrated plastic flow behavior. Fiber strength and stiffness were highest for the fibers from the top and middle stem sections. These properties were related to the compositional make up and morphological properties of hemp fibers, notably the secondary fiber cell contents. In fungal retting, there was a strong dependence of depectinization selectivity on stem section, which decreased from bottom to top presumably due to the significantly higher lignin content in the bottom section than in the top section (middle section was in between). Consequently, the fungal retting caused a lower reduction in strength of fibers from the bottom section than in those from the top stem section, and essentially reversed the influence of stem section on fiber tensile strength through depectinization selectivity. At whole hemp stem level, the fungal retting with *P. radiata* Cel 26 exhibited better mechanical properties with an ultimate tensile strength, strain and stiffness of 736 MPa, 2.3% and 42 GPa, respectively, while fibers treated with *C. subvermispora* exhibited lower mechanical properties of 573 MPa, 1.9% and 40 GPa, respectively. The study thus also showed that less variable and high strength fibers may be reproduced using the dependence of depectinization selectivity on stem section for composite application.