

Phosphate Bonded Hemp (*Cannabis sativa*) Fibre Composites

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Abstract : The properties of Hemp (*Cannabis sativa*) in phosphate bonded composites were investigated in this research. Hemp hurds were collected from the Hemporium institute for research, South Africa. The hurds were air-dried and shredded using a hammer mill. The shives were screened into different particle sizes and were treated separately with 5% solution of acetic anhydride and sodium hydroxide. The binding matrix was prepared using a reactive magnesia, phosphoric acid, class S fly ash and unslaked lime. The treated and untreated hemp fibers were mixed thoroughly in different ratios with the inorganic matrix. Boric acid and excess water were used to retard and control the rate of the reaction and the setting of the binder. The Hemp composite was formed in a rectangular mold and compressed at room temperature at a pressure of 100KPa. After demolding the composites, they were cured in a conditioning room for 96 h. Physical and mechanical tests were conducted to evaluate the properties of the composites. A central composite design (CCD) was used to determine the best conditions to optimize the performance of the composites. Thereafter, these combinations were applied in the production of the composites, and the properties were evaluated. Scanning electron microscopy (SEM) was used to carry out the advance examination of the behavior of the composites while X-ray diffractometry (XRD) was used to analyze the reaction pathway in the composites. The results revealed that all properties of phosphate bonded Hemp composites exceeded the LD-1 grade classification of particle boards. The proposed product can be used for ceiling, partitioning, wall claddings and underlayment.

Keywords : CCD, fly ash, magnesia, phosphate bonded hemp composites, phosphoric acid, unslaked lime

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