New Composites Based on Natural Raw Materials and Silylated Polystyrene

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This study explores the development and investigation of new, environmentally friendly composite materials with advantageous properties. These composites are based on pine sawdust, a renewable plant material, and a new binder: trimethoxysilylated polystyrene (TMSPSt). Our research group obtained the binder, which was used in conjunction with different degrees of silylation (15–35%) and various organic and inorganic additives, fire retardants and antioxidants. This binder acts as a reinforcing agent, and wood polymer composite (WPC) materials were produced under different pressures (5–15 MPa) and temperatures (473–493 K).

The surface structures of the novel composites were examined using electron microscopy and energy-dispersive X-ray microanalysis, among other techniques. The mechanical properties of the materials were evaluated through a series of tests, including bending, Charpy impact, and impact viscosity testing. A well-established methodology was employed to investigate the water absorption properties of the composites. Furthermore, differential scanning calorimetry (DSC) was employed to analyse the phase state of the materials, and thermal stability was determined using Vicat analysis and thermogravimetric analysis (TGA).

The optimal conditions for producing new, environmentally safe composites have been identified. Those obtained in this manner exhibit excellent mechanical properties, high thermal resistance, ecological purity, and low water absorption.