DESCRIPTION FOR THE GENERAL PUBLIC

Polymeric materials derived from renewable resources are currently an important research subject due to the inevitable depletion of fossil resources, the need to reduce energy use and carbon dioxide emissions, as well as growing public awareness to preserve the environment. The development of biomass-based chemicals and materials has really taken off in the last few years and leading research centers are active in this field worldwide. Among different polymers based on fully or partially derived renewable sources biopolyamides are an important class of materials which offer promising mechanical, thermal and barrier properties having thus high growth potential in future applications in e.g. automotive and packaging sectors. They are synthesized from monomers derived from vegetable oils originating from inedible or toxic plants, such as *Ricinus Communis* plant. The monomers obtained from these oils are vastly used for synthesis of e.g. bio-based polyurethanes or epoxy resins, however, polyamides are engineering thermoplastics combining advantageous mechanical properties with good chemical resistance. Among various reinforcements applied to polymer matrices, including polyamide matrices, cellulose gets an increasing attention due to its bio-origin, low density and interesting properties. Cellulose has the basic repeat unit made of two anhydroglucose rings linked by β-1,4 glycosidic bond and is characterized by a hierarchical structural arrangement. Polymer chains form microfibrils containing highly ordered (crystalline) and amorphous regions; these microfibrils agglomerate further into larger aggregates and these, together with hemicelluloses and lignin, form the plant cell wall. The diversity of cellulose particle types and geometries results from the plant origin and the extraction processes from the cellulosic plant fibres, which include pretreatments and disintegration of the hierarchical structure of the cell wall. Currently, cellulose nanocrystals (CNC) produced by acid or enzyme hydrolysis of the amorphous parts of cellulose have attracted much interest. They have a rigid rod-shape structure, 1–100 nm in diameter and up to tens of micrometers in length. As one of the strongest and stiffest natural materials available, they exhibit remarkable properties, such as high tensile strength, high stiffness, high aspect ratio, large surface area and other intriguing properties, such as electrical and optical properties. CNC is called a ‘material of future’ and research works on its modification/applications in e.g. composite industry will be intensified in the current decade. Hence, the main objective of the project is to get new knowledge on the influence of modified cellulose nanocrystals (CNC) on the structure and thermal / mechanical properties of bio-based engineering polyamide 10.10 (PA10.10) composites, as well as to investigate phenomena associated with modification of CNC and fabrication of PA10.10/CNC nanocomposites by melt processing methods using high volume manufacturing processes - extrusion and injection molding. However, at the processing temperatures required for thermoplastic polymers CNC may undergone thermal degradation and the resultant composites with partially decomposed CNC will be characterized by unfavorable properties, e.g. low mechanical durability; therefore CNC will be prepared by cellulose hydrolysis involving phosphoric acid which yields CNC with improved thermal stability.