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Lignocellulose nanofibrills and titanium dioxide nanoparticles impact on PVA/NF/TiO_2 nanofibers web morphology and mechanical properties

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Electrospinning is method to produce nanosize diameter fibrous mats from a variety of polymeric systems. A number of reports indicate the improvement of properties of electrospun nanofibers, when incorporate with nanoparticles as reinforcing agents. Extremely high specific surface area and small pore sizes of nanofibers together with the feasibility to diversify fiber composition have attracted increased attention in the past decades. As a result of the current research nanostructure assemblies consisting of polyvinyl alcohol, lignocellulose nanofibrills and titanium dioxide (PVA/NF/TiO_2) were developed and influence of component content on fiber diameter and mechanical properties of fiber mats were investigated.

To obtain lignocellulose nanofibrills hemp fibers were exposed to the steam explosion auto-hydrolization with following water and alkali treatment, ball micro-milling and ultrasonification. Nano-sized TiO_2 powder with average particle size of 20 nm was used as filler. PVA based spinning solution with different compositions were prepared and nanofibers produced on needless electrospinning equipment Nanospider^{TM} (Fig.1).

It was demonstrated that CN can be effectively incorporated in electrospun PVA nanofibres. Nanowebs were characterized using FTIR, tensile strength test, SEM micrographs, average fiber diameter measurements, elemental analysis and web microstructure analysis. As a result, it is concluded that TiO_2, hemp fiber and PVA composite nanoweb have high tensile strength values with low average fiber diameter.

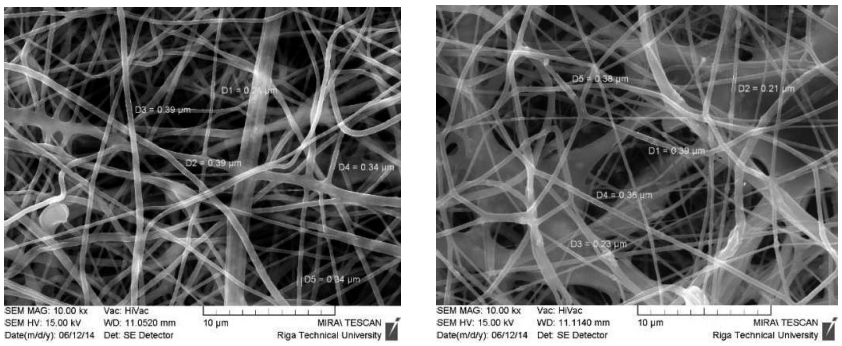

Figure 1. SEM micrographs of PVA/TiO2 (a) and PVA/NF/TiO2 (b) nanofiber composites morphology

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