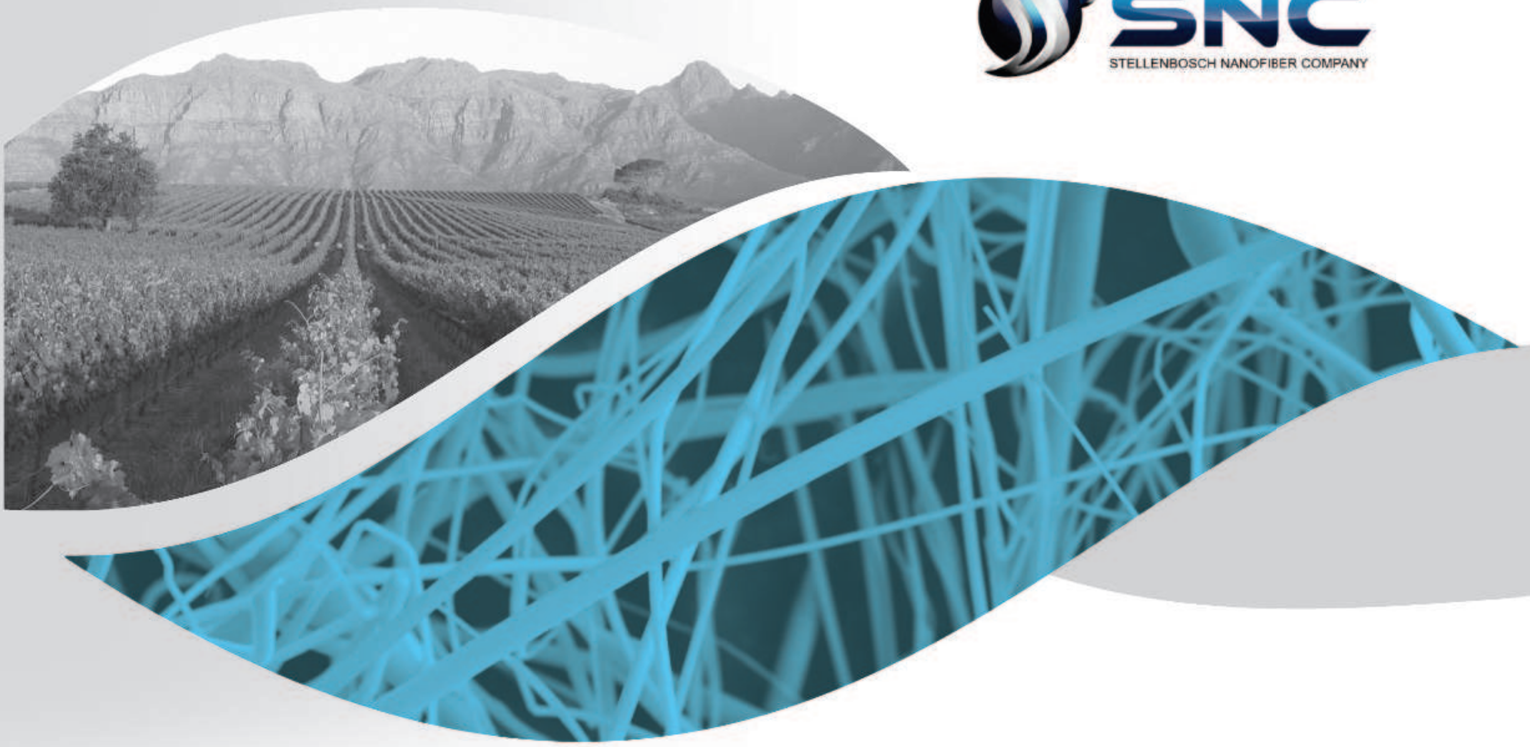

ELECTROSPIN2018
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6. IMMOBILIZATION OF TITANIUM DIOXIDE NANOPARTICLES ON ELECTROSPUN CA AND PAN POLYMER NANOFIBERS FOR ANTIMICROBIAL ACTIVITY STUDY.

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Abstract

Electrospinning is a method that has gained more attention due to its capability in spinning a wide variety of polymeric fibers and nanoparticles embedded polymer fibers [1]. Polymer blending has been considered the most appropriate way for creating new materials with fused properties which improve poor chemical, mechanical, thermal and dynamic mechanical properties of each polymer [2]. Hence, in this study electrospinning technique has been utilized for the preparation of single polymer composite of polyacrylonitrile (PAN) and cellulose acetate (CA) as well as the immobilization of TiO_2 nanoparticles on the polymer blended fibers. The electrospinning parameters such as polymer solution concentration (10-20wt%), spinning distance (10cm-15cm) and applied voltage (16-24kV) were investigated. The effect of the electrospinning parameters on the diameter and morphology of the electrospun polyacrylonitrile (PAN) and cellulose acetate (CA) was investigated in order to obtain optimum polymer fibers diameter for the immobilization of the TiO_2. It was observed that the solution concentration has more effect on the diameter of the polymer fibers as compared to the other electrospinning parameters. The sol-gel method was used to synthesize the TiO_2 nanoparticles. The immobilization of TiO_2 nanoparticles on the suitable polymer fibers by electrospinning technique improved antibacterial properties of TiO_2. The synthesized nanometerials and polymer nanocomposite were characterized using SEM and TEM to display their morphological features. XRD analysis were performed for revealing the chemical structure. FTIR, UV-Vis and thermal analysis confirmed the formation and composition of the nanoparticles, polymer fibers and nanofibers. The CA-TiO_2 nanofibers and PAN-TiO_2 will be tested against strains of *E. coli* and *P. aeruginosa* and *C. albicans* to observe their antibacterial activity.

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7. CELL RESPONSE ON FIBRES' SURFACE PROPERTIES INDUCED BY PROCESS PARAMETERS AND POST-TREATMENT OF ELECTROSPUN NONWOVENS

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Cellular response on materials characteristics depends on various factors eg. chemical composition, topography, wettability, mechanical properties etc.[1, 2, 3]. Materials' surface properties may be optimized by both selection of proper forming method and process parameters as well as post-processing treatment. In electrospinnig, the polymer solution jet is elongated by electrostatic forces occurring between a needle connected to high voltage supply and a grounded collector. In this case various parameters may influence final material surface properties, eg. solvent, voltage, flow rate, humidity, temperature etc. Most of them were widely studied [4, 5]. However, in case of processing polyelectrolytes by this method, like chitosan, also charge polarity applied to the spinning nozzle may play a significant role for surface properties [6, 7]. Repulsive forces between polycations/polyanions and charge accumulated on the spinning nozzle may cause multi-jet electrospinning or phase separation within the fibres' bulk [6, 7].

In this research polycaprolactone/ chitosan (PCL/CHT) blends were processed by electrospinning. In order to vary surface properties of obtained nonwovens two techniques were used: process parameters were changed (positive and negative charge polarity was applied to the spinning nozzle) and post-processing treatment was conducted (embedding of chondroitin sulphate (CS) to fibres' surface was conducted by layer-by-layer technique (LbL)). Finally, cell response on this changes was analyzed.

The data revealed that fibres' morphology varied depending on charge applied to the spinning nozzle, ultimately influencing mechanical properties of obtained nonwovens. Moreover, depending on the applied charge polarity different wettabilities of the same PCL/CHT blend was obtained. XPS data showed that negative charge polarity caused higher efficiency of further post-processing treatment. Also AFM images proved changes in fibres' surface topography. In order to study the effect of process parameters and post-processing treatment by CS, cell studies with fibroblasts and chondrocytes were conducted. Our results revealed that mitochondrial activity of analyzed cells was sensitive to both features, however, their effect may be observed in different time points of cell culture. All described changes in cell proliferation of the fibres occurred in the range of high biocompatibility of the materials.

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8. SUPERHYDROPHOBIC SURFACES VIA GREEN ELECTROSPINNING FROM AQUEOUS DISPERSIONS

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Superhydrophobic surfaces are well-studied and widely applied like self-cleaning textiles, biomedical, and antifouling coatings. [1,2] By combination of rough surface morphologies, which could be produced by green electrospinning, and low surface energy materials, this multifunctional surfaces could be generated from aqueous formulations. [3, 4]

In our work [5, 6], as-spun fiber mats were obtained by green electrospinning of aqueous fluoroacrylate dispersions and coated with siloxane via sol-gel treatment. The nanofibers had very rough porous surface morphology. As a result, contact angle to water increased from less than 50° for untreated fiber mats up to 165° for siloxane coated nonwovens. In addition, the roll-off angle was less than 5°. Therefore the nonwovens showed excellent self-cleaning properties and are ready for other applications in combination with a green approach.

Fig. Water droplets on superhydrophobic nonwovens prepared by green electrospinning.

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