Zinc Silicate Doped PDMS-PVA Nanofibers using Electrospinning Process

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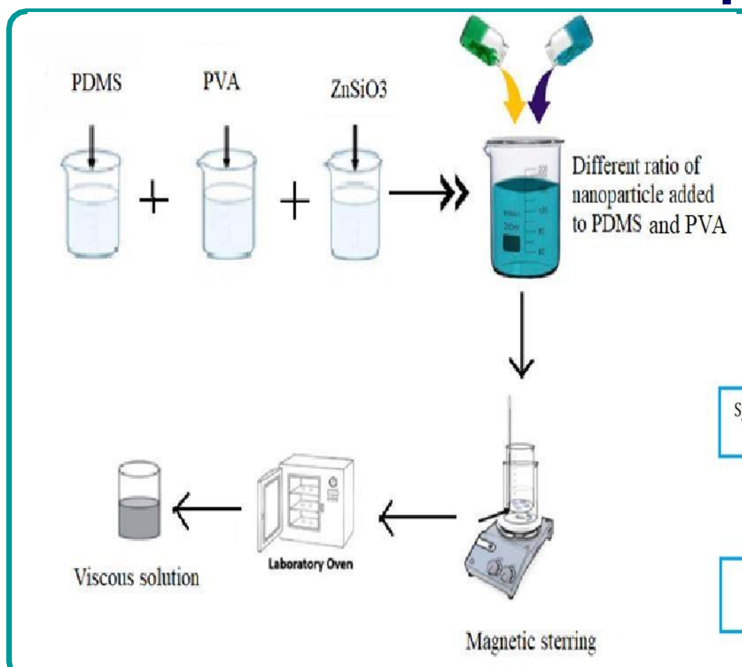
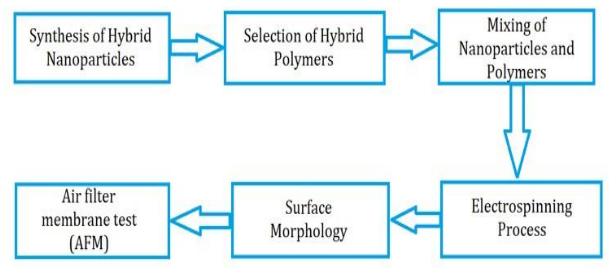
Abstract

***The present work carried out to develop nanofibers by combining hybrid polymers namely Polydimethylsiloxane (PDMS)* and Polyvinyl alcohol (PVA) with hybrid nanoparticles namely Zinc oxide (ZnO) and silicon dioxide (SiO_2) by synthesis of ZnO and SiO_2 to form zinc silicate ($ZnSiO_3$) nanoparticle by solution combustion method and to obtain the selected mixture of PDMS and PVA hybrid polymer by stirring the hybrid polymers and nanoparticles solution to produce viscous solution. The developed viscous solution of corresponding wt.% ratio namely 0.5wt.%, 1wt.% and 2wt.% is electro-spun by electrospinning technology in order to obtain ultrathin nanofibers. The investigation of surface morphology of the nanofibers is carried out by scanning electron microscopy (SEM). From the ImageJ software the developed nanofibers diameter ranges from 142 to 412 nm for 2wt.% loading of nanoparticles. The X-ray diffraction (XRD) analysis was used to study structure and crystallite size of nanofibers where the diffraction peak of 2wt.% is $2\theta=23.6^0$ and for 0.5wt.% it is $2\theta=11.4^0$ and the intensity peak increases as increase in nanoparticles. It implies that the crystallinity is influenced by the surface properties of nanoparticles. The hydrophobicity of the nanofibers contact angle measurement was carried out. I was observed the contact angle of 2wt.% is 92^0 and for without nanoparticle is 43^0 so the 2wt.% sample is hydrophobic in nature. So, the hydrophobic nature increases with the increase in nanoparticles. The nanofiber is tested by air filter membrane test (AFM) which gives permeability, efficiency and porosity. The highest efficiency is obtained for the sample of 2wt.% compared to base 0.5wt.% and other nanoparticle loadings. Hence it was concluded that the 2wt.% nanofibers developed has shown improved performance which can be useful in the filtration media in hospitals, air conditioners and in industries.**

Set up



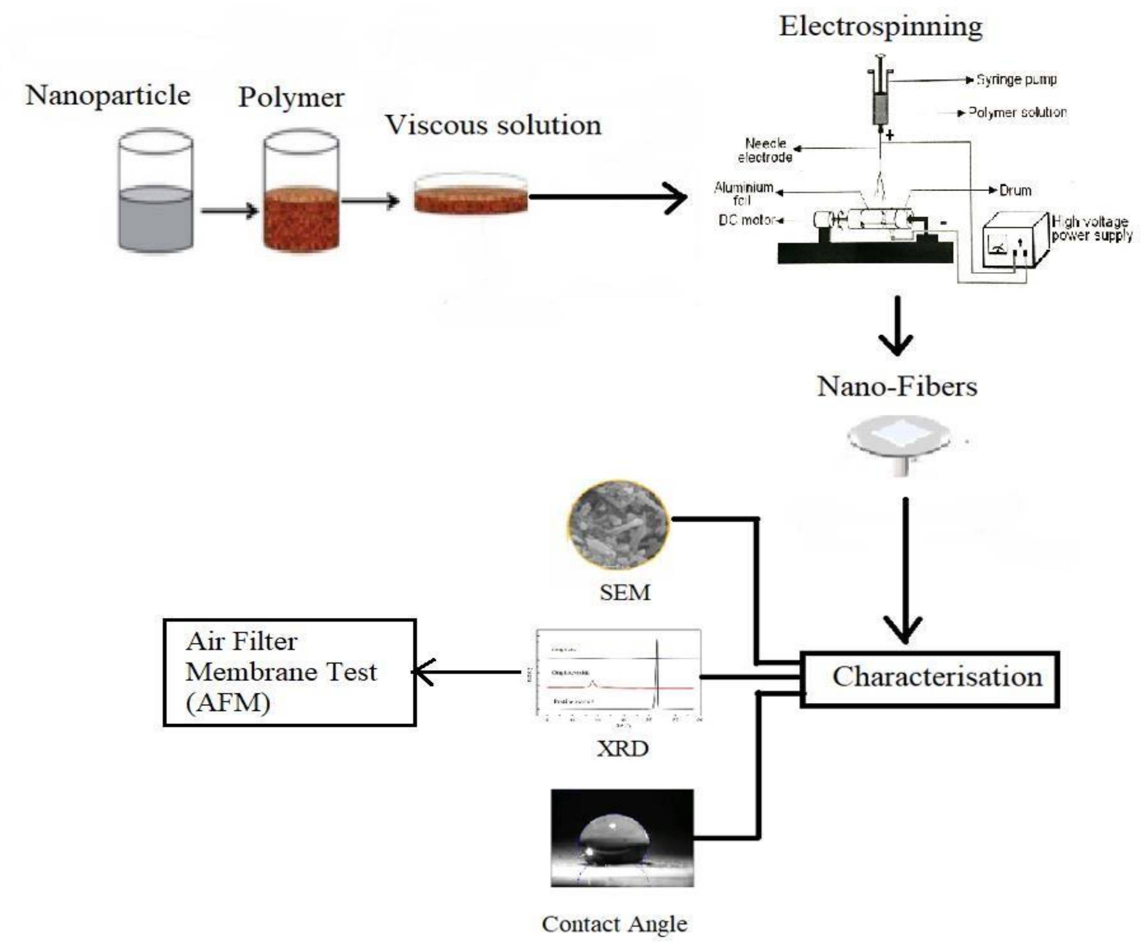
The nanoparticles and polymers are used in this process. The hybrid polymers namely PDMS and PVA with the hybrid nanoparticles namely Zno and SiO2 are used to develop nanofibers.



Introduction

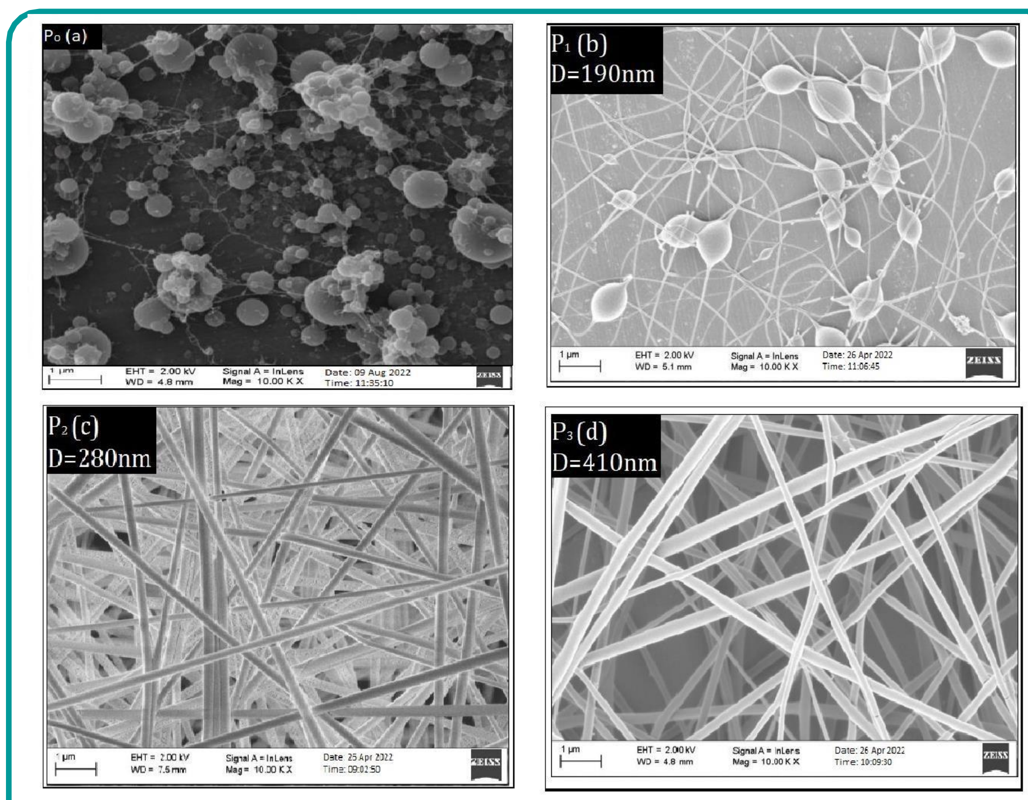
The aim is to develop ultrathin nanofibers by combining hybrid polymers namely Polydimethylsiloxane (PDMS) and Polyvinyl alcohol (PVA) with hybrid nanoparticles namely Zinc oxide (ZnO) and silicon dioxide (SiO_2) with the following steps such as synthesis of ZnO and SiO_2 nanoparticle to form zinc silicate ($ZnSiO_3$) nanoparticle by solution combustion method and to obtain the selected mixture of PDMS and PVA hybrid polymer and stirring the hybrid polymers and nanoparticles solution to produce viscous solution. The developed viscous solution of corresponding wt.% ratio namely 0.5wt.%, 1wt.% and 2wt.% is electro-spun by electrospinning technology in order to obtain ultrathin nanofibers. The study of surface morphology on the developed nanofibers was done by using scanning electron microscopy (SEM), X-ray diffraction (XRD) analysis, contact angle measurement and by air filter membrane test (AFM).

Design/Other information



This instrument produce nanofibers later it is characterized by scanning electron microscope (SEM) where the electron beam is used to scan the surface of a sample to create images with an electron microscope and it can only produce two dimensional views. ImageJ was used to calculate the diameter of the fiber.
Then it is characterized by an analytical method known as X-ray powder diffraction (XRD) is quick and is generally used to determine the phase of crystalline materials.

Results



Sample	Voltage (kV)	Diameter (nm)
P_0	20	-
P_1	20	142
P_2	20	280
P_3	20	410

Conclusions

The nanofibers are developed by combining hybrid polymers namely PDMS and PVA with hybrid nanoparticles ZnO and SiO_2 by synthesis of $ZnSiO_3$ nano particle by solution combustion method.
2) Electrospinning of developed viscous solution to obtain ultrathin nanofibers in the range of 142 to 410 nm.
3) The SEM gives fiber forming bead shape in 0.5wt.% (P_1) sample and diameter is 142nm due to low viscosity. The diameter increases as there is increase in viscosity and bead structure disappear is shown in 2wt.% (P_2) sample and diameter is 410 nm.

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