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Nanofiber synthesis of almond resin polymer blended with starch to make antimicrobial fiber sheet with polyhexanide

Madhan Raja[1*], Sem Abit C[2], Gulshan J Dharmaraj[3]

[1]Biolim Centre for Science and Technology, Chennai

[2]St Joseph's College of Engineering, Chennai

[3]St Joseph's College of Engineering, Chennai

Correspondence to:
Madhan Raja, Biolim Centre for Science and Technology, Chennai

info@biolim.org

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Author Biography:
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Abstract

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Keywords: almond resin; polyhexanide; antimicrobial fiber; Nanofiber

INTRODUCTION

Nanoscience and nanotechnology are at the forefront of modern research. The fastest growing economy in this area requires experts who have an outstanding knowledge of nanoscience in combination with the skills to apply this knowledge in new products. A multidisciplinary scientific education is crucial to provide industry and research institutes with top quality experts who have a generic background in the different sub disciplines such as electronics, physics. The word Nanoscience refers to the study, manipulation and engineering of matter, particles and structures on the nanometer scale (one millionth of a millimeter, the scale of atoms and molecules). Important properties of materials, such as the electrical, optical, thermal and mechanical properties, are determined by the way molecules and atoms assemble on the nanoscale into larger structures.

Nanotechnology is science and engineering at the scale of atoms and molecules. It is the manipulation and use of materials and devices so tiny that nothing can be built any smaller. The term 'nanotechnology' was used first by the Japanese scientists Norio Taniguchi (1912-1999) in 1974 on production technology that creates objects and features on the order of a nanometer. The American engineer K.Eric Drexler (1995) is credited with the development of molecular nanotechnology, leading to nanosystems machinery manufacturing. The inven.

tion of scanning tunneling microscope in the1980s by IBM Zurich scientists and then the atomic force microscope allowed scientists to see materials at an unprecedented atomic level. The concepts of nanotechnology though considered being modern science, has history is the 9th century. Nanoparticles of gold and silver were used by the artisans of Mesopotamia to generate glittering effects of pots. The therapeutics use of gold can be traced back to Chinese medical history in 2500BC since ancient time colloidal gold and silver under the name Swarna Bhasma and Roupya Bhasma is still used in the Indian ayurvedic and Unani medicine for rejuvenation, revitalization and for treating various diseases. Chinese medical history in 2500BC since ancient time colloidal gold and silver under the name Swarna Bhasma and Roupya.

MATERIALS AND METHODS

Production of cellulose:

Almond gum is used to extract cellulose for making cellulose nanofiber. The almond gum was washed with distilled water to remove dirt, dust and water soluble impurities. Almond gum was treated with 4% sodium hydroxide solution at 80□c for 2 hours, under mechanical stirring which removed the residual additives, such partially solubilized pectin, lignin, and hemicelluloses impurities. After each treatment, the obtained reaction mass was filtered and washed with distilled water, until the filtrate became neutral. After this alkali treatment, the residues was decolorized with 3% sodium chlorite to bleach and leach the residues. This process was accomplishment at 80□c, for 2 hours. The resultant residue was washed continuously in distilled water, until the complete remove of sodium chlorite. After this, the residue was hydrolyzed using 10% sulphuric acid at 80□c, for 2 hours, using mechanical stirring.

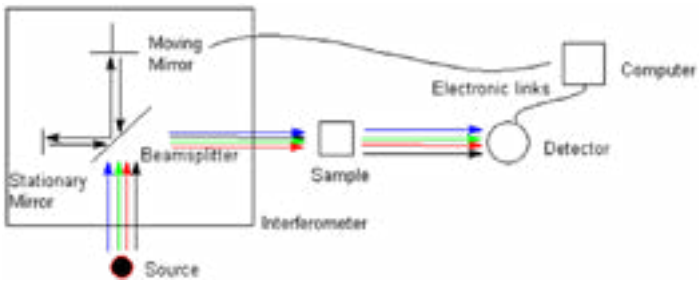

Figure 1: FTIR principle

After the acid hydrolysis, the reaction mass was cooled with ice cubes to quench the hydrolysis, washed with distilled water, and centrifuge for 20 minutes, 8000rpm. The suspension and pellet was collected separately. Extraction of celluloses was carried out by mixing the almond gum with 0.25M sodium hydroxide with ratio of 1:25 (W / V).490 nm versus concentration of glucose in µg/ml on X axis. observed in wave number regions of 3300 - 4000 cm$^{□1}$.

RESULTS AND DISSCUSSIONS

Extraction of cellulose:

Cellulose was extracted from almond gum using chemical method. Almond gum was made into powder and then dissolved in 100 ml distilled water. Then cellulose is precipitated using isopropyl alcohol. Then cellulose is dried overnight in Hot air oven. Then the cellulose is taken and kept in a container. The dried cellulose is taken for UV test to determine its confirmation.

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CONCLUSION

Cellulose Nanofiber has effectively been used in the treatment of topical wounds and is of greater ability. Since it is of plant origin, it prevents the toxic effects to the body like itching, swelling etc. Cellulose is extracted from a common source almond gum which is easily available and has greater amount of cellulose in it. Cellulose is blended with starch, which is also a plant origin compound and has greater effect in wound healing property. Starch has a natural wound healing property which is why it is blended with cellulose. PVA is a synthetic polymer which is used in the nanofiber synthesis along with starch and cellulose. PVA maintains the tensile strength and helps to maintain the surface to volume ratio. It also helps in the proper drug distribution throughout the fiber. The method used for the production of nanofiber is electrospinning technique. And it provides the proper texture for the nanofiber and also the proper distribution. The voltage is being kept at 12KV. The flow rate is kept at 0.1ml/min and it is adjusted depending upon the nanofiber which is being produced. High voltage and potential difference is used in the production of nanofiber. The concentration of the components in nanofiber and PVA is optimized for the effective production of nanofiber. The drug used in the nanofiber is polyhexanide which is effective against gram positive and gram negative bacteria. Concentration of the drug is also optimized for its effective activity. Finally the components are optimized and the fiber is produced be electro spinning method. The fiber produced is then checked for its antimicrobial activity in three different bacterial strains in MHA agar and then given for SEM analysis which confirms the surface to volume ratio and the tensile strength.

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