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## EFFECT OF SOLVENT SYSTEM ON THE MECHANICAL PROPERTIES OF NYLON66 NANOFIBER YARN PRODUECD BY ELECTROSPINNING

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### KEYWORDS

*Electrospinning, Nanofiber yarn, Solvent, Mechanical properties*

### ABSTRACT

The aim of this article is to find proper solvent to produce nylon 66 nanofiber yarn with enhanced tenacity. Nylon 66 with high molecular weight (77000 g/mol) is used. Two solvent systems were applied: 1) formic acid 2) mix of formic acid and chloroform solvent with ratio of 75 to 25. Results showed that solvent affects the mechanical properties of Nylon66 nanofiber yarn. To produce high tenacity nanofiber yarn, formic acid is a suitable solvent in high concentration, while in low concentration mix of formic acid and chloroform is good.

### INTRODUCTION

Electrospinning uses an electric field to control the formation of polymer nanofibers. Customary electrospinning equipment consists of four main parts: a metallic capillary, a high voltage source, a pump and a collector. Various structures such as aligned nanofibers, arrayed nanofibers and uniaxially aligned electrospun nanofibres yarn have been achieved using different mechanical collection devices and the manipulation of the electric field [1]. The two oppositely metallic spinnerets is a system for producing uniaxially aligned electrospun nanofibres yarn [2].

It is well known that many parameters, such as viscosity, elasticity, conductivity, surface tension, distance between tip and collection screen, etc. can influence the transformation of polymer solutions into nanofibers through electrospinning. Among them the solution viscosity is one of the important factors in electrospinning. Traditionally, formic acid is used as a solvent for the dissolution of nylon 6 or 6,6. However, its boiling point of 100° C is relatively high and therefore it is not very suitable for electrospinning. Nevertheless, the boiling point of formic acid can be lowered by addition of a cosolvent with a relatively low boiling point (bp), namely chloroform (bp of 61° C) [3]. One may also expect that tensile strength of as-spun nylon fibers can be improved by changing ratios of formic acid and chloroform. Indeed, Gogolewski and

Pennings [4] found the morphology and tensile strength differences of dry spun high molecular weight nylon 6 fibers vary with different mixture ratios of formic acid and chloroform. They also documented that the ratio of formic acid to chloroform of 75/25 (v/v) gave the highest tensile strength fiber when a super high molecular nylon 6 was used for making dry spun fibers. In this article we investigated the effect of solvent system on mechanical properties of Nylon 66 nanofiber yarn.

### EXPERIMENTAL

#### MATERILAS

Nylon 66 polymer chips with 77000 g/mol molecular weight was acquired from Zanjan Tire Cord Company. Formic acid and chloroform were purchased from Merck Company. Polymer solutions of Nylon66 in Formic acid with a concentration of 10 and 18 wt. % were prepared. Also polymer solutions of Nylon66 in mixture of formic acid and chloroform (3:1) with the same concentration were prepared.

#### YARN PRODUCTION

In this article two oppositely metallic spinnerets system was selected to produce twisted yarns (Fig. 1).

#### SOLVENTS PROPERTIES

Electrical conductivity, surface tension and viscosity