بسم الله الرحمن الرحيم

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" صدق الله العظيم"

# Factors affecting the Electrospinning
# العوامل المؤثرة في تقنية الغزل الكهربائي


**By**

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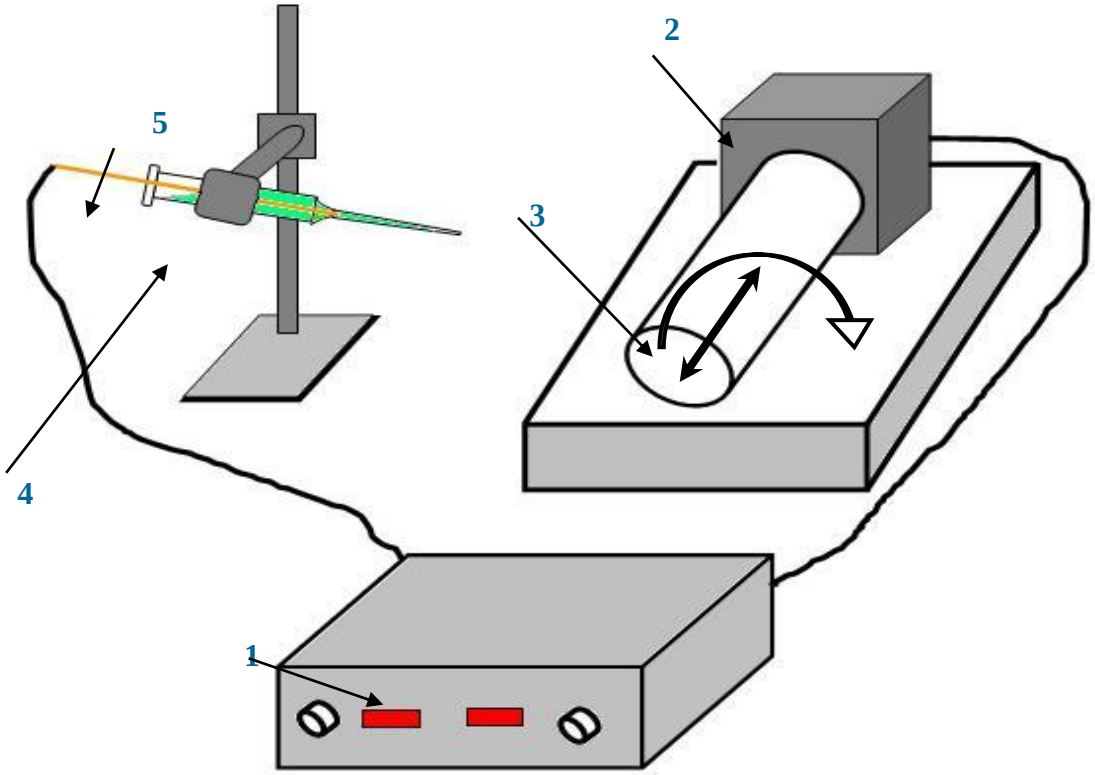
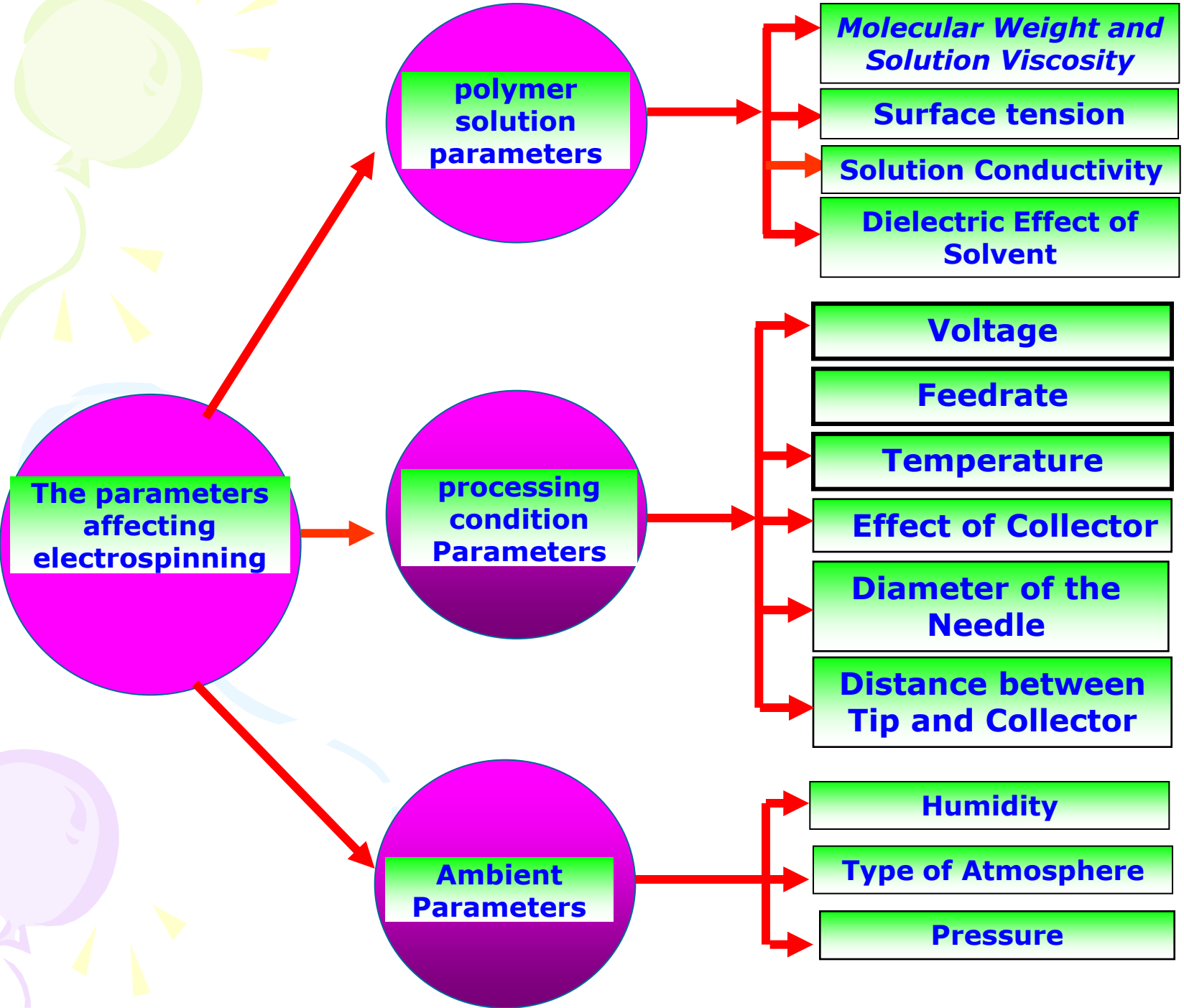
# Introduction

**Although electrospinning is a very simple process, requiring just simple laboratory equipment to yield fibers down to the nanoscale, the science behind it is not simple at all. Electrospinning process involves the understanding of electrostatics, fluid rheology and polymer solution properties such as rate of solvent evaporation, surface tension and solution conductivity. These fundamental properties are constantly interacting and influencing each other during the electrospinning process.**




*.١DC power supply .٢Electric Motor*

*.٣Rotating collector ٤. Syringe ٥. Copper tip*


The parameters affecting electrospinning
polymer solution parameters
Molecular Weight and Solution Viscosity
Surface tension
Solution Conductivity
Dielectric Effect of Solvent
processing condition Parameters
Voltage
Feedrate
Temperature
Effect of Collector
Diameter of the Needle
Distance between Tip and Collector
Ambient Parameters
Humidity
Type of Atmosphere
Pressure

# Polymer Solution Parameters

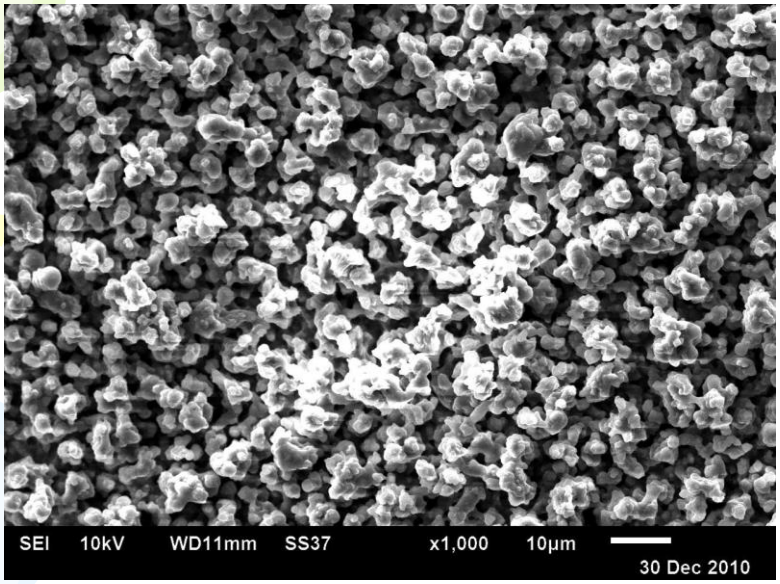
## Molecular Weight and Solution Viscosity

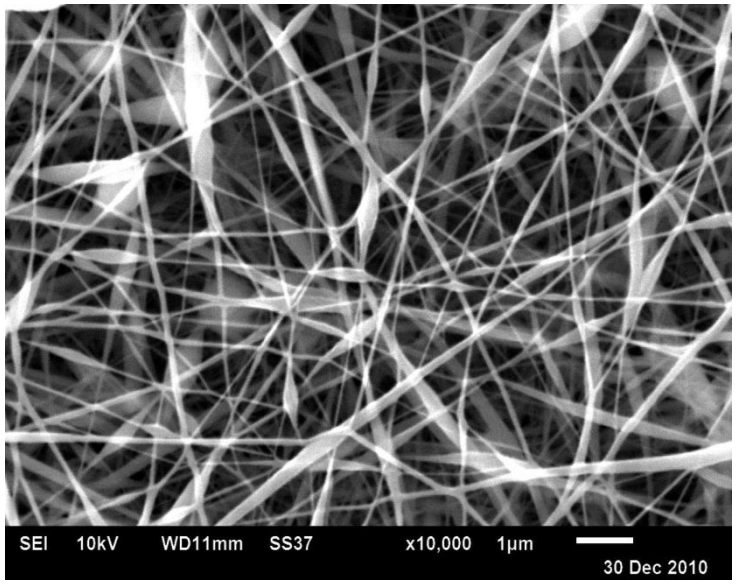
- One of the conditions necessary for electrospinning to occur where fibers are formed is that the solution must consists of polymer of sufficient molecular weight and the solution must be of sufficient viscosity.
- Monomeric polymer solution does not form fibers when electrospun.
- The molecular weight of the polymer represents the length of the polymer chain, which in turn have an effect on the viscosity of the solution.
- Similar to increasing the molecular weight, an increased in the concentration will result in greater polymer chain entanglements within the solution.

- **Many experiments have shown that a minimum viscosity for each polymer solution is required to yield fibers without beads.**

- **At a low viscosity, it is common to find beads along the fibers deposited on the collection plate.**

- **When the viscosity increases, there is a gradual change in the shape of the beads from spherical to spindle-like until a smooth fiber is obtained as shown in Fig.**


SEI 10kV WD11mm SS37 x1,000 10µm
30 Dec 2010


SEI 10kV WD11mm SS37 x10,000 1µm
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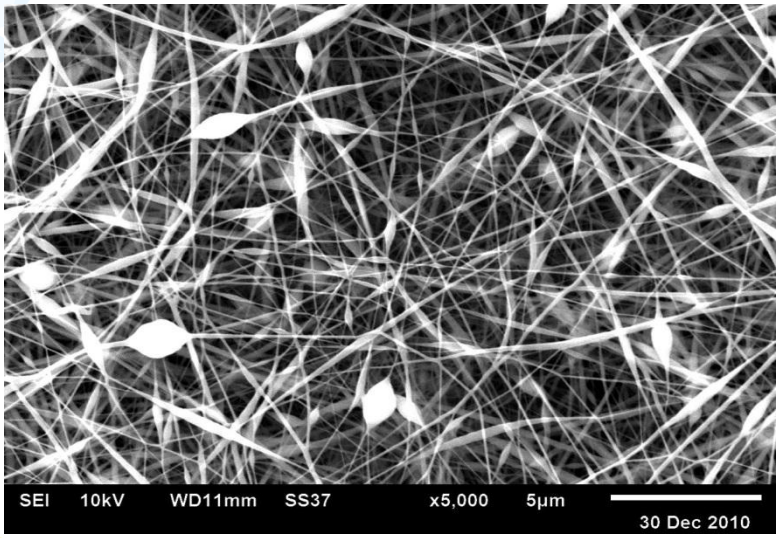
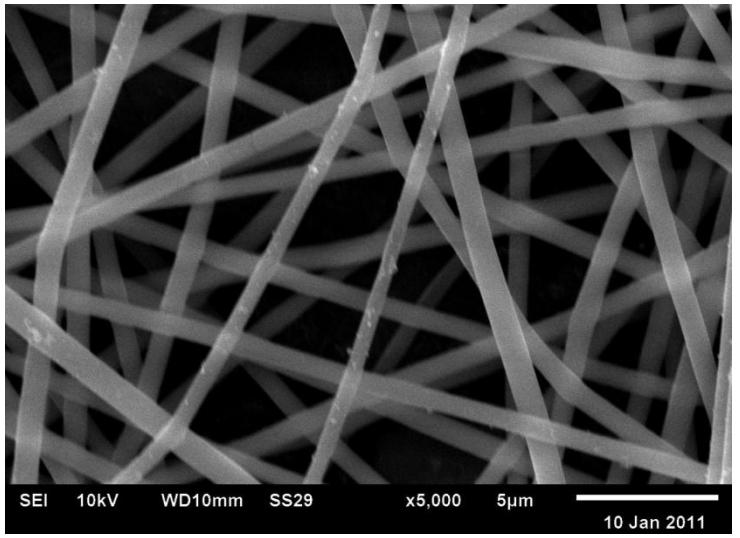

SEI 10kV WD11mm SS37 x5,000 5µm
30 Dec 2010


SEI 10kV WD10mm SS29 x5,000 5µm
10 Jan 2011

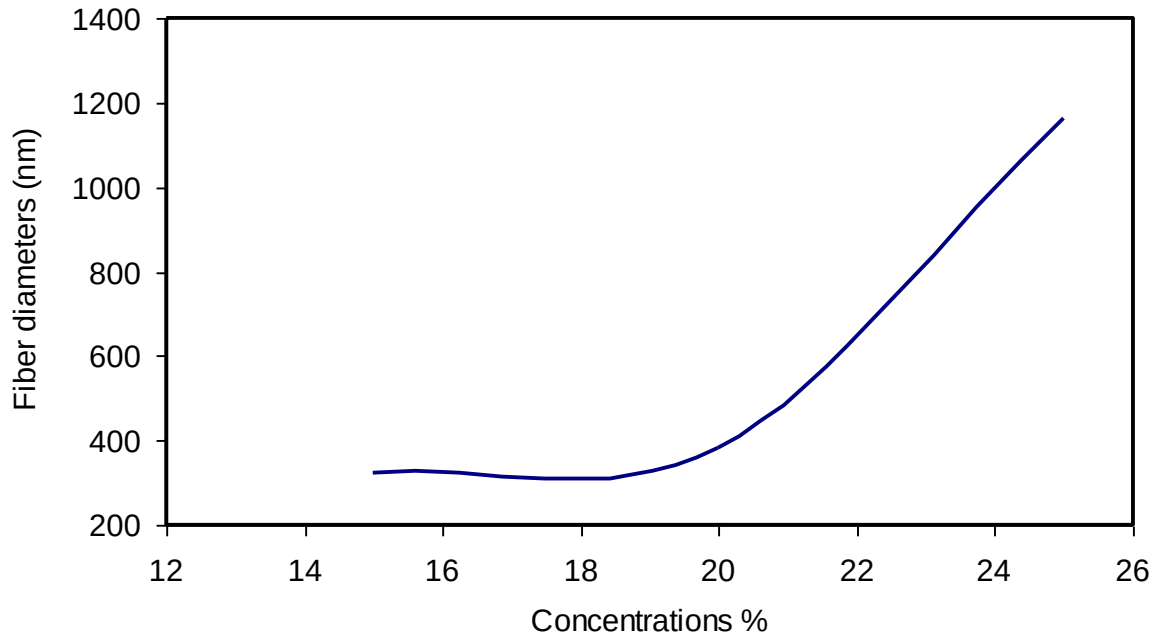



**Figure: Effect of concentration on fiber diameter at constant electric potential, screen distance & flow rate**

| Concentrations % | 15 | 20 | 25 |
|---|---|---|---|
| Fiber Diameters (nm) | 321 | 383 | 1164 |

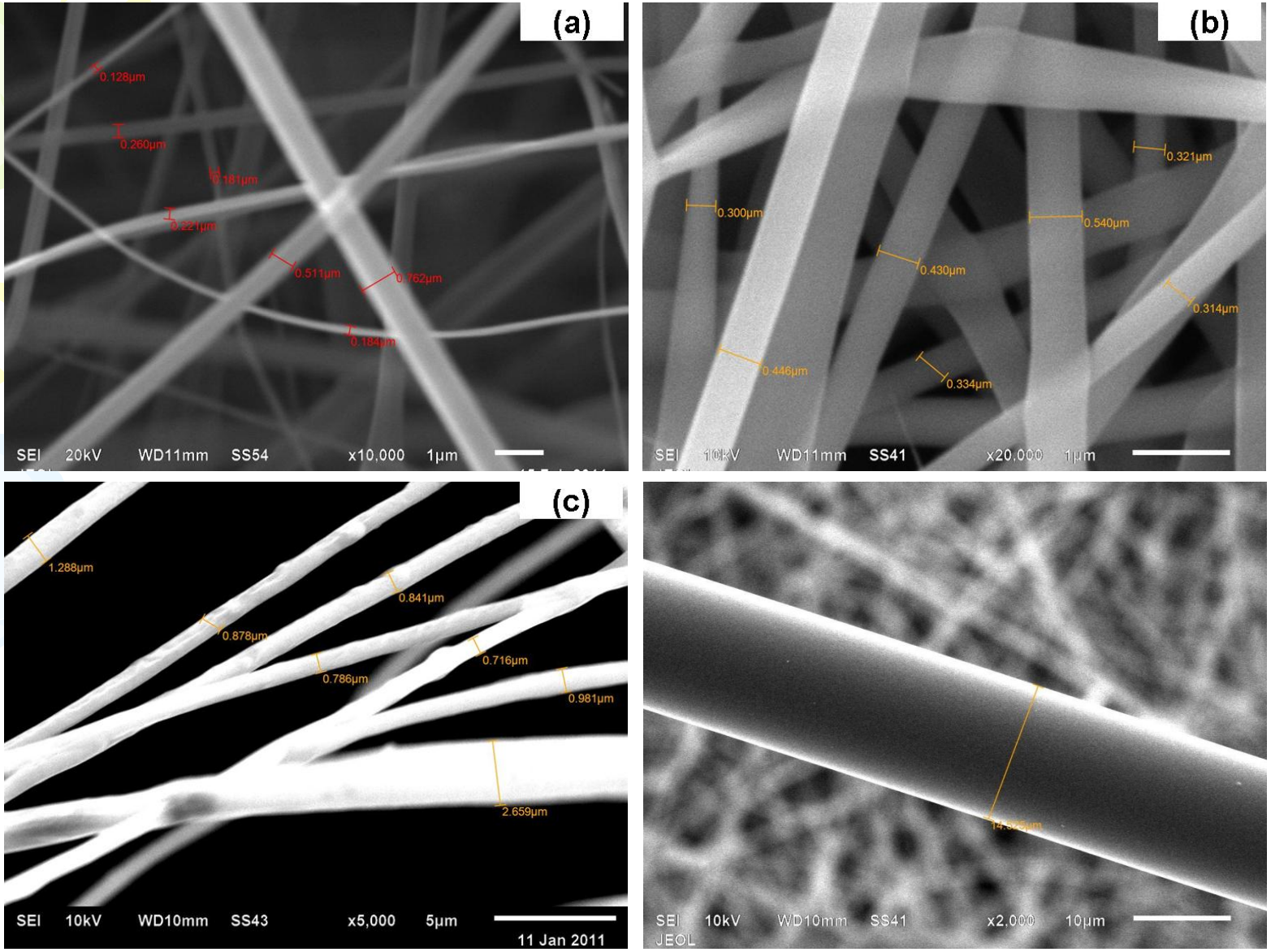



**Figure: Microstructures showing the effect of concentration on fiber diameter at constant flow rate, screen distance & electric potential. (a) 15 %, (b) 20 %, (c) 25 % and (d) 30%**