REGULATION AND SAFETY MECHANISMS OF THE 4SPIN® TECHNOLOGY

Pokorny M.*, Novák J., Rebecký J., Chvosta M., Velebný V.
Contipro Biotech s.r.o., R&D Department, 561 02 Dolní Dobrouč, Czech Republic
web: www.4spin.info, phone: +420 467 070 339, e-mail: marek.pokorny@contipro.com

INTRODUCTION

There are many parameters affecting the formation of nanofibrous layers in the electrospinning process such as solution properties, process parameters, geometry of electrodes and ambient conditions. The ability to reproducibly produce nanomaterials with identical properties (for example fibre diameters, layer thickness, etc.) is dependent on all production conditions being preserved in a controlled way with as little deviations as parameters and ambient conditions need to be regulated with a suitable electronic system. Automatic functions, regulated parameters and safety systems in the electrospinning device 4SPIN® LAB I are presented here.

General factors affecting nanofibre quality are:
A. Polymer solution parameters (molecular weight, viscosity, surface tension, conductivity, etc.).
B. Processing conditions (high voltage, feed rate, deposition time, electrode distance, etc.).
C. Arrangement (jet needle gauge, needleless emitter shape, collector design, etc.).
D. Ambient parameters (temperature, humidity, air flow, etc.).

METHODS

The 4SPIN® device is controlled by a PLC (programmable logic controller). Processing and other parameters are regulated either by the open or close loop (including feedback) automation principle. Only some quantities are measured. All values are recorded and can be viewed in real time on a PC screen. The device settings can be saved and recalled at any time.

RESULTS

Fourteen nanofibrous samples made of a 6% HA/PED (80:20) solution dissolved in distilled water were prepared under the same conditions to demonstrate the ability to repeatedly produce nanomaterials with identical properties.

CONCLUSIONS

Automatic regulation of all process parameters makes it possible to achieve the consistent material properties in the fabrication of nanofibres. It means that fibre diameter does not change throughout the sample volume. Reproducible morphology, i.e. products with identical properties, can be prepared due to the precise regulation of process parameters (individual procedures can be saved and used again at any time). Various forms and spherical forms with macroscopic arrangement can be easily produced. Precisely controlled conditions make it also possible to create nanofibres with different morphologies by altering the parameters. The central system simplifies control and also improves productivity and operator safety. Therefore, the 4SPIN® device can significantly accelerate experimental research in the field of micro- and nanomaterials.