

NANOFIBROUS WEBS POROSITY AND THEIR STRUCTURE ESTIMATION

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ABSTRACT

The investigations in electrospinning process development have become very intensive in the last decades and a lot of papers have been published about the development of technology of electrospinning, influence of some parameters on electrospinning, possibilities to electrospun nanofibrous web from various polymers as well from the blends and with additional functional nano or micro particles. There is no single opinion about the reasons for such phenomena as the distribution of the nanofibre diameter is also very sophisticated. The main problem is that the measurements of the diameter are distributed in an unclear distribution, and to characterise webs mathematically and evaluate the shape of the distribution obtained is not easy.

Key Words: *electrospinning, nanofibers, porosity.*

1. INTRODUCTION

In order to objectively study the influence of various factors on the structure and porosity of the electrospun nanofibers webs and to compare the results obtained by different authors, an objective method of porosity evaluation is needed. Analysis of literature has shown that the lack of a common method for evaluating the structure of electrospun webs generate an uneven results. The method of electrospun web porosity evaluation by maximum pore size in the web is presented in this paper.

The main investigations were done with polyamide 6 electrospun nanofibrous web. It was stated that distribution of maximum pore size in various places of web are close to Gaussian normal distribution with some small negative skewness. This skewness is the reason why for electrospun web porosity evaluation can not be used classical statistical methods.

Parameter which characterises the structure of nanofibrous web is porosity. A very important parameter for describing porosity is the maximum value of the pore diameter in the surface of electrospun web. Such evaluation is especially important for nanofibrous webs of barrier application, which are used, for example, for antimicrobial protection. Preliminary analysis of webs shows a very big inequality of pore diameters in different places of nanowebs. Therefore, to measure only one or two SEM images is absolutely not enough. There are a few methods for measuring the porosity such as conventional methods using apparent density and bulk density, image analysis and mercury porometer. On the other hand, the analysis of webs show a very big inequality of pore diameters in different places of nanowebs, but this inequality has not been fully investigated yet. However, until date, an accurate estimation of porosity in these grades of materials (Nanofiber mat) is a difficult task.

Porosity is also very important if the electrically spiked nano-formed cells are used for cell growth or barrier properties [1-4]. In these cases, not only the maximum size of the pore, but also all the distribution of pores size are important. Many authors describe in their work the porosity of the structure of the nanoweb, but the papers do not provide porosity estimation methods. The investigations in describing nanofibrous web porosity have not yet been

published. So, the evaluation of the structure, and especially the complexible evaluation of porosity is still an open question which needs to be solved in the future [5].

2. RESULTS AND DISCUSSION

One of the reasons of such a situation could be a very low capacity of electrospinning equipment and consequently, the high cost of the product. Another reason could be the reliability of properties, especially barrier properties, of such materials. Despite the numerous studies in electrospinning, the investigations in the electrospun nanofibrous web estimation are not sufficient. So far, no unique standard method has been developed for fibre diameter measurements and estimation. One more sophisticated situation exists in nanofibrous web porosity estimation. There is no completed work or any proposed method in this area. This research field is open for new researchers, new investigations, new suggestions and new discussions.

Nanofibers coating structures formed by electrospinning are influenced by many factors. Analyzing the various literature sources about the electrospinning process, the authors opinion, due to the influence of various parameters on porosity of nanofibers, often differs. Analyzing the SEM images of the coatings formed during the research, it was observed that the coating is formed by pores of different sizes.

3. REFERENCES

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