Abstract

Porous polymer materials from biodegradable materials

The scientific aim of the doctoral thesis was to determine the influence of interactions in multi-component polymer solutions during the electrospinning process on the obtained materials structure, towards increasing their porosity ratio. The research was based on the biodegradable material polybutylene succinate (PBS), with particular emphasis on its potential use in applications related to environmental engineering. Commercially available granules (PBS) and additives in the form of pore-promoting agents were used during the research. The work contains a description of the physical phenomena on which the electrospinning process is based, as well as the parameters affecting the morphology of the manufactured fibrous structures. The theoretical part of the work also includes examples of applications of electrospun structures along with methods of their modification, as well as alternative methods of producing nanomaterials. The experimental part presents the detailed course of research on the electrospinning process. Several solvent systems were used in the studies, such as: chloroform (CHF) or trifluoroethanol (TFE), as well as mixtures of chloroform with dimethyl sulfoxide (DMSO) or dimethylformamide (DMF). The use of two-solvent systems resulted in the occurrence of solution gelation, which has been only reported in the literature so far, without deep analysis related to phenomenon physical background or modification of the production system (widening of the process window) in the perspective of use in non-laboratory production processes (large-scale production). The work also examined the possibility of additional modification of porosity by using activated carbon and polyethylene oxide (PEO). The produced structures were then characterized in terms of their morphology, porosity and changes in the material structure caused by the electrospinning process by measuring the average molecular weight and differential calorimetry (DSC).