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Advanced polymer materials and technologies: recent trends and current priorities

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The monograph contains the materials of the 4th International Conference "Advanced Polymer Materials and Technologies", which was held on October 11, 2022 at the Kyiv National University of Technology and Design together with the Lviv Polytechnic National University. The monograph deals with the creation of new polymer composite materials and their processing technologies using extrusion, electroforming, 3D printing, and other methods; development of environmentally-oriented technologies and equipment for the production of polymeric materials for various purposes, including biodegradable ones. Considerable attention is paid to the creation of new polymer composite materials, in particular for environmental protection, using waste from the chemical industry.

The monograph will be useful for teachers, students and graduate students, scientists and manufacturers whose activities are related to the above mentioned topics.

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TECHNOLOGIES FOR THE OBTAINING HIGHLY SOLUBLE POLYMER COMPOSITE MATERIALS WITH ACTIVE PHARMACEUTICAL INGREDIENTS

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Introduction. In the last few decades, the technology of solid dispersed systems (SDS) has become the most successful strategy for increasing the solubility of poorly water-soluble active pharmaceutical ingredients (APIs). Basically, to create polymer solid dispersed compositions, researchers use physicochemical methods, such as solvent evaporation and hot extrusion melt undoubtedly. These technologies have potential both in terms of efficiency and possible scaling to the production level. However, now there are more promising methods of SDS formation. One of such innovative and useful approaches is the production of polymeric fibrous solid dispersions by the centrifugal molding method.

The purpose of the study. The purpose of the work is the study of the main aspects of the process of formation of polymer solid dispersed systems by the method of centrifugal formation of fibers.

Research results and discussion. The method of centrifugal fiber formation was patented in 1924 and was widely used to produce glass fibers for more than half a century. However, in recent years, the potential of this technology has been directed towards the use of this method as a new promising means for the formation of SDS.

The process of formation of fibrous solid dispersions by the centrifugal molding method is a one-step top-down technology, in which a mixture of starting substances (API and polymer carrier) or their melt is placed in a preheated or room temperature

rotating metal container with holes for side nozzles, which rotates at high speed. Centrifugal force created at a high speed of rotation pushes the molten mass through the holes of the spinning head. While the mass is ejected, it undergoes a stretching process followed by rapid solidification and the formation of extruded fibers of various sizes, which settle on the collector [1, 2]. The formed fibrous solid dispersions have an increased surface area, which ensures their rapid dissolution [3]. In addition, this process is characterized by high productivity and low costs.

Literary data confirm the new technology of centrifugal fiber formation as a method of forming SDS. Now, this method has been successfully used only for the formation of SDS of olanzapine and piroxicam [1], oxcarbazepine [2] and ibuprofen [3]. All formed SDS showed significantly higher solubility indicators compared to pure APIs.

Conclusions. It was established that the method of centrifugal fiber formation is an alternative approach for obtaining solid dispersions with improved dissolution parameters and has great potential for further exploration.

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