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METHODOLOGICAL APPROACHES TO BACTERIAL CELLULOSE CULTIVATION IN THE PROTOTYPE DEVELOPMENT OF ROTATING DISK BIOREACTOR *

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Abstract

The cultivation methods of widely studied bacterial cellulose are mainly based on stationary cultivation methods. Modern approaches also aim to improve technical equipment for controlled agitated systems and implement scaling up for production. This article covers methodological principles for bacterial cellulose cultivation in the development of rotating disk bioreactors.

The studies on the cultivation of biomaterials, in particular bacterial cellulose, are promising for the development of a technological process and its optimization to obtain a high yield [1, 2]. Advanced strategies for bacterial cellulose cultivation require not only optimization and modification of potential strains but also improvement of technical equipment and implementation to further expand [3]. This study examines methodological approaches related to biotechnological parameters of bacterial cellulose cultivation and the conceptual development of a novel bioreactor using round disks to increase yield during dynamic cultivation.

To develop a prototype with demonstration functions, traditional methods and parameters of the bacterial cellulose cultivation, including temperature, pO2, pH of the medium and cultivation time, were considered. As a result, a cylindrical bioreactor prototype was developed based on the conceptual model. The prototype consisted of 12 rotating disks with holes for aeration, which were mounted on a shaft. The disks were adapted for fed-batch mode cultivation of bacterial cellulose biofilms. The bioreactor was equipped with pH, temperature and water level sensors, and was initially tested for construction integrity against leakage and speed of rotation with increasing disk weight at byScoby LLC facilities. Notably, the cylindrical design avoided turbulent flows over the housing, minimizing foaming.

The planned further prototype modification is considered to implement the entire 10-day cycle of bacterial cellulose cultivation and confirm the hypothesis of an increase in product yield by at least 10 times, which is the next step in the scaling up production strategy.

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