Description for the general public

Saying “morphology of filamentous fungi” we mean the form and shape of their mycelium during their growth in the cultivation medium. It has usually the form of smaller or larger spheres, called agglomerates or pellets, or it is a filament-like suspension. We can influence on this form by means of morphological engineering

Morphological engineering is tailoring morphologies for specific bioprocesses, in which filamentous fungi participate. The aim of this project is to study the mechanism and quantitate the action of the added mineral microparticles on the fungal spores and hyphae in the process of the formation of mycelial agglomerates (pellets) in the submerged shake flask and bioreactor cultures. The cultivation with the addition of mineral microparticles is called microparticle-enhanced cultivation (MPEC).

The majority of the studies on MPEC were conducted for the filamentous fungi of the industrial importance belonging to genus *Aspergillus*. The application of MPEC gave the spectacular increase of the efficiency of biosynthesis of secondary metabolites and enzymes. However, the mechanism of action of microparticles was not studied in detail. But the growth of fungi in the MPEC leads to the decrease of size and change of the structure of the pellets.

The reason of the proposed experimental studies within this project are limited studies on the application of MPEC. It allows for the formulation of the thesis that the decrease of the size of fungal agglomerates and loosing of their structure due to the use of MPEC, which was shown for genus *Aspergillus* need not be identical for the fungi of various genera and the effect of MPEC application can but need not increase biomass growth and the titres of the metabolites produced by other fungi. That is why filamentous fungi of four various genera *Aspergillus*, *Penicillium*, *Chaetomium* and *Mucor* representing various mechanisms of spore germination and spores and hyphae agglomeration were selected for this study.

The following filamentous fungi are going to be used for this study: *Aspergillus terreus* (antihypercholesterolemia drug, lovastatin, producer), *Chaetomium globosum* (degrades cellulose), *Penicillium chrysogenum* (antibiotics, penicillin, producer) and *Mucor racemosus* (*Zygomycetes* representative). As the factor to influence spore and hyphae agglomeration talc and aluminium oxide microparticles of mean diameter equal to 10 μm are to be applied.

In the shake flask culture within the first hours of the evolution of mycelium the process of formation of agglomerates of spores and hyphae will be studied. Also in the shake flask culture the optimum moment of the addition of microparticles to the medium will be found. Each time the control culture without microparticles will be made. Next, the experiments will be performed in the stirred tank batch bioreactor. The MPEC process will be studied when the culture evolve directly from spores and from the preculture precultivated in shake flask. In all these experiments the mechanism of MPEC action and its efficiency will be tracked by the measurement of the size and shape of the formed in time fungal agglomerates by means of digital image analysis and measurement of the conditions of oxygen transfer. Also the formed metabolites and enzymes will be determined.

As the application of MPEC allows for the multiplication of the efficiency of metabolites and enzymes biosynthesis and as the same time is a cheap way to increase the efficiency of these biosyntheses, its worldwide application may decrease the global cost of bioprocesses applied for the production of the metabolites and enzymes. It is especially important for those, which are used in medicine or food technology. It would be undeniable profit for the development of civilization and society.