



Scaling study for obtaining microbiological fertilizers and plant protection products in depth and surface cultivation processes, no. 1.1.1.1/19/A/150

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SIA Bioefekts started *Trichoderma spp.* surface and depth cultivation studies. Surface cultivation experiments of *T. harzianum* in Petri dishes were performed by varying the substrates (wheat bran, gray pea bran), their combinations and moisture regime. Deep cultivation experiments of *T. asperellum* were performed on a flask scale and the concentration of microorganisms (biomass, colony forming units) was analyzed. Methods of aerobic cultivation of surface culture bioreactors were studied, analysis of the corresponding *Trichoderma spp.* surface cultivation bioreactor design possibilities. A comparison is made between the shelf type, auger mixer and rotary cylinder surface cultivator design types. Development of the methodology and reactor design of the surface cultivation biotechnological process, which includes a prototype of a periodically stirred aerated rotating cylinder type bioreactor and its operating principles.

The Latvian State Institute of Wood Chemistry (LVKĶI) started *Bacillus spp.* depth cultivation and *Trichoderma spp.* compilation of mathematical models of surface cultivation processes. In *Bacillus spp.* case, work was started on the development of a cultivation process modeling program in the MATLAB® environment. Mathematical models of depth cultivation were developed to model vegetative biomass [Xv], spores [Xsp], substrate [S], environmental volume [V] and substrate feed rate [F] during the cultivation process. Adaptation of the *Trichoderma spp.* mathematical model to the operating principles of the periodically rotating surface culture bioreactor, the chosen mathematical model for the simulation of a stationary, aerated bioreactor, adapting to the surface culture bioreactor envisaged in the project. Mass and energy balance equations for gas and solid phase have been compiled. In the future, the evaluation and analysis of the fixed and variable values of the model for the current substrates - wheat and gray pea bran - must be performed.

B. subtilis cultivation experiments in flasks were started. An in-depth review of the scientific and patent literature identified three different media with potential applications for *B. subtilis* cultivation on a production scale. Three *B. subtilis* culture experiments were performed in flasks using the above media. In these experiments, the dynamics of microorganism biomass growth and substrate uptake rate, as well as the effect of culture temperature and pH on these parameters were studied. The performed experiments allowed to improve practical skills, gave an idea of *B. subtilis* biomass growth dynamics under different cultivation conditions, as well as allowed to identify the starting cultivation conditions and medium for cultivation experiments in the bioreactor.