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Usage of humic materials for formulation of stable microbial inoculants

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Some microbes have been domesticated for environment service, for example in a variety of novel applications, including efforts to reduce environmental problems. For instance, antagonistic organisms can be used as biological control agents to reduce the use of chemical pesticides, or efficient degraders can be applied as bioprophylactics to minimise the spread of chemical pollutants. Microorganisms can also be used for the biological clean-up of polluted soil or as plant growth-promoting bacteria that stimulate nutrient uptake.
Many microbial applications require large-scale cultivation of the organisms. The biomass production must then be followed by formulation steps to ensure long-term stability and convenient use. However, there remains a need to further develop knowledge on how to optimise fermentation of "non-conventional microorganisms" for environmental applications involving the intact living cells.
The goal of presented study is to develop fermentation and formulation techniques for termolabile rhizobacteria isolates – Pseudomonas spp. with major biotechnical potential. Development of efficient and cost-effective media and process parameters giving high cell yields are important priorities. This also involves establishing fermentation parameters yielding cells well adapted to subsequent formulation procedures. Collectively, these strategies will deliver a high proportion of viable cells with good long-term survival.
Our main efforts were focused on development of more efficient drying techniques for microorganisms, particularly spray drying and fluidised bed-drying. The advantages of dry formulations are that storage and delivery costs are much lower than for liquid formulations and that long-term survival can be very high if initial packaging is carefully optimised.
In order to improve and optimise formulations various kinds of humics-based excipients have been added that have beneficial effects on the viability of the organisms and the storage stability of the product. It is known that humic substances can increase of live organism resistance to stress loads, in particular to chemical stress, low and high temperature.
Spray- and fluidized-bed drying and addition of humate-based drying protectants were evaluated for the development of dry formulations of biocontrol and plant growth promoting rhizobacteria. The drying protectants - humic acids and sodium humate gave the highest initial survival rates and the most stable formulations, without significant losses of viability after storage for 1 month at 30oC. As a result, the specific plant growth promoting effect is retained.

Thus, humic materials have an unfulfilled potential for biotechnology industries based on such applications.

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