A novel approach to immobilization of whole microbial cells in alginate capsules

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Immobilized whole cells offer several potential advantages over suspended cells: enhanced productivity, ability to reuse biocatalyst, and simpler isolation of product. Among the various techniques for immobilizing cells, calcium alginate gel entrapment has been widely used because gellation can be easily performed under mild conditions. The maximum cell loading in the entrapped beads is limited to only 25% by volume because of weak mechanical strength. Another drawback of the conventional entrapment methods is cell leakage during fermentation processes.

Encapsulation is regarded by some researchers as one of the most promising methods for cell retention, which have been shown to overcome these disadvantages arising from the gel etrapping method. In this method, cells are confinned in a thin, semipermeable membrane. The cell concentration in the capsules can be much higher than in the gel-core beads due to better availability of space. The advantage of encapsulation compared to the cell entrapment is having less resistance to the diffusion. Encapsulation can be carried out by using either natural or synthetic polymer. The encapsulation of cells in hollow calcium alginate capsules is the most widespread method. Liquid core alginate capsules can be produced by adding a cell-suspended solution of calcium chloride dropwise into a sodium alginate solution with agitation. In this method the calcium chloride solution contains a thickening agents such as xanthan, dextran, carboxymethylcellulose, starch, and polyethylene glycol to prevent the deformation caused by the shear stress arising from agitation in alginate solution. Usually two-steps procedure is used. In the first step capsules are produced and in the second step capsules are incubated in growth medium to proliferate cells. This technology has successfully been applied in both ezymatic biotransformations and fermentation processes.

Recently, we have developed new procedure which has advantage over conventional because in one step perfectly spherical capsules can be produced with concentration of cells at least 20% s.m. Wall thickness (50μm - 200μm) and mechanical strength can be easily controlled by alteration of the concentration of alginate and calcium chloride.