

PRIMENA LIOFILIZACIJE ZA IMOBILIZACIJU ĆELIJA KVASCA U POLISAHARIDNE NOSAČE

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Sažetak:

Imobilisane ćelije kvasca imaju veliki potencijal primene u feremtaciji alkoholnih pića zbog svojih tehničkih i ekonomskih prednosti u odnosu na sisteme sa slobodnim ćelijama. Polisaharidni nosači su se pokazali kao efikasno rešenje za unapređenje vijabilnosti i zaštitu ćelija tokom fermentacionih procesa. Ovaj rad ima za cilj imobilizaciju ćelija kvasca *Saccharomyces pastorianus* primenom tehnike liofilizacije. Suspenzije su pripremljene mešanjem natrijum-alginata i maltodekstrina (1.5%) sa ćelijama izdvojenim u ranoj ekspanzionalnoj fazi rasta. Nakon liofilizacije, prahovi su analizirani u pogledu prinosa, vijabilnosti ćelija, sadržaja vlage, prečnika čestica i ζ potencijala. Mikrostruktura nosača ispitana je pomoću skenirajuće elektronske mikroskopije (SEM). Sadržaj vlage i rastvorljivost oba tipa nosača bili su slični, a nizak sadržaj vlage ukazuje na mikrobiološku stabilnost polisaharidnih nosača, što ih čini pogodnim za primenu u prehrambenoj industriji. Vijabilnost imobilisanih ćelija u nosačima bila je znatno viša (>74.3%) u poređenju sa slobodnim ćelijama (64.2%). Prosečan prečnik čestica bio je $7.4 \pm 0.2 \mu\text{m}$ za alginat i $7.2 \pm 1.2 \mu\text{m}$ za maltodekstrin. Površinsko naelektrisanje svih uzoraka mereno je u cilju potvrde fizičko-hemijske stabilnosti nosača, pri čemu je u svim uzorcima zabeleženo negativno naelektrisanje. Niske vrednosti kod kontrolnog uzorka ukazuju na sklonost slobodnih ćelija ka agregaciji, ističući značaj nosača u očuvanju stabilnosti sistema. SEM mikrofografije su pokazale uspešnu imobilizaciju ćelija i manju poroznost kod nosača sa maltodekstrinom. Ovi rezultati potvrđuju efikasnost polisaharidnih nosača u imobilizaciji i zaštiti ćelija, kao i njihov potencijal za industrijsku upotrebu.

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APPLICATION OF LYOPHILIZATION FOR IMMOBILIZATION OF YEAST CELLS IN POLYSACCHARIDE CARRIERS

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Summary:

Immobilized yeast cells have significant potential for application in the fermentation of alcoholic beverages due to their technical and economic advantages over free-cell systems. Polysaccharide carriers have proven to be an effective solution for improving cell viability and protection during fermentation processes. This study aims to immobilize *Saccharomyces pastorianus* yeast cells using the lyophilization technique. Suspensions were prepared by mixing sodium alginate and maltodextrin (1.5%) with cells harvested during the early exponential growth phase. After lyophilization, the powders were analyzed for yield, cell viability, moisture content, particle size, and ζ potential. The microstructure of the carriers was examined using scanning electron microscopy (SEM). The moisture content and solubility of both types of carriers were similar, and the low moisture content indicates the microbiological stability of polysaccharide carriers, making them suitable for application in the food industry. The viability of immobilized cells in the carriers was significantly higher (>74.3%) compared to free cells (64.2%). The average particle diameter was $7.4 \pm 0.2 \mu\text{m}$ for alginate and $7.2 \pm 1.2 \mu\text{m}$ for maltodextrin. The surface charge of all samples was measured to confirm the physicochemical stability of the carriers, with negative charges observed in all samples. The low values in the control sample indicate the tendency of free cells to aggregate, highlighting the role of carriers in maintaining system stability. SEM micrographs demonstrated successful cell immobilization and reduced porosity in the carriers containing maltodextrin. These results confirm the effectiveness of polysaccharide carriers in cell immobilization and protection, as well as their potential for industrial use.

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Keywords: immobilization, brewery yeast, polysaccharide-based carriers, freeze-drying technique

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