

PENGEMBANGAN SINBIOTIK MIKROENKAPSULASI DAN PENERAPANNYA PADA YOGURT SUSU KAMBING

INTISARI

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Manfaat probiotik telah memperluas aplikasinya secara signifikan dalam produk makanan fungsional. Namun, mempertahankan viabilitas dan stabilitas mereka selama transit gastrointestinal dan penyimpanan tetap menjadi tantangan. Penelitian ini bertujuan untuk mengetahui ko-enkapsulasi *Lactocaseibacillus casei* F2 dengan inulin atau pati dari biji durian dalam matriks sodium alginat menggunakan teknologi ekstrusi dan kitosan sebagai bahan pelapis. Viabilitas strain di bawah kondisi gastrointestinal dan yogurt selama penyimpanan pada 4°C juga diamati. Hasil penelitian menunjukkan bahwa populasi sel *L. casei* F2 yang bertahan hidup setelah dienkapsulasi dengan 3% inulin atau 1% pati dan dilapisi kitosan jauh lebih tinggi daripada sel bebas di bawah kondisi gastrointestinal simulasi ($p < 0,05$). Selain itu, empat sampel yogurt diproduksi, termasuk sampel dengan *L. casei* F2, yogurt probiotik dengan ko-enkapsulasi inulin atau pati dan pelapisan kitosan, serta kontrol (tanpa probiotik). Karakteristik fisik, kimia, sensoris, dan mikrobiologis sampel yogurt diselidiki selama penyimpanan selama 21 hari pada 4°C. Keasaman, pH, kapasitas menahan air, kecerahan, kehijauan, dan kekuningan yogurt berada dalam kisaran 1,16–1,30, 4,03–4,13, 43,93–59,53%, 93,01–94,14, -3,16–-2,84, dan 9,39–10,59 pada hari ke-21 penyimpanan. Selain itu, viskositas, kekerasan, kohesivitas, dan konsistensi yogurt berada dalam kisaran 2825–5112, 19,97–29,78, 436,62–729,24, dan -22,83–-14,45. Kelangsungan hidup *L. casei* F2 dalam yogurt fungsional tetap di atas 6 Log CFU/mL hingga hari ke-21 penyimpanan. Di samping itu, yogurt probiotik yang mengandung *L. casei* F2 ko-enkapsulasi dengan inulin dan dilapisi kitosan menerima skor penerimaan keseluruhan yang lebih tinggi dibandingkan dengan perlakuan lainnya ($p < 0,05$). Secara keseluruhan, respons terbaik ditemukan pada mikrokapsul probiotik yang dilapisi kitosan dan ko-enkapsulasi dengan inulin.

Kata kunci: probiotik, enkapsulasi, makanan fungsional, stabilitas gastrointestinal

DEVELOPMENT OF MICROENCAPSULATED SYNBIOTIC AND ITS APPLICATIONS IN GOAT MILK YOGURT

ABSTRACT

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The benefits of probiotics have significantly expanded their application in functional food products. However, preserving their viability and stability throughout gastrointestinal transit and storage is challenging. This study aimed to investigate the co-encapsulation of *Lacticaseibacillus casei* F2 with inulin or starch from durian seed in a sodium alginate matrix using extrusion technology and chitosan as a coating material. The viability of the strains under gastrointestinal conditions and yogurt during storage at 4°C was also assessed. The results displayed that the surviving population of *L. casei* F2 cells encapsulated with 3% inulin or 1% starch and coated with chitosan was significantly higher than free cells under simulated gastrointestinal conditions ($p < 0.05$). In addition, four yogurt samples were produced, including samples with free *L. casei* F2, probiotic yogurt with co-encapsulation with inulin or starch and coating with chitosan, and control (no probiotic). The physical, chemical, sensorial, and microbial characteristics of yogurt samples were investigated during storage for 21 days at 4°C. The acidity, pH, water holding capacity, lightness, greenness, and yellowness of the yogurts were in the range of 1.16–1.30, 4.03–4.13, 43.93–59.53%, 93.01–94.14, -3.16–-2.84, and 9.39–10.59 on the 21st day of storage, respectively. Additionally, viscosity, firmness, cohesiveness, and consistency of yogurt were in the range of 2825–5112, 19.97–29.78, 436.62–729.24, -22.83–-14.45. The survival of *L. casei* F2 in the functional yogurt remained above 6 Log CFU/mL by the 21st day of storage. In addition, the probiotic yogurt containing co-encapsulated *L. casei* F2 with inulin coated with chitosan received a higher overall acceptance score than the other treatments ($p < 0.05$). Overall, the best response was seen in probiotic microcapsules that were coated in chitosan and co-encapsulated with inulin.

Keywords: probiotics, encapsulation, functional food, gastrointestinal stability