

SPRAY DRIED PRODIGIOSIN FROM *Serratia marcescens* AS A FOOD COLORANT

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COLORANT

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To my beloved mother and father

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ABSTRACT

Pigments from microorganisms can serve as an alternative source to replace synthetic pigments used in the food industry. Natural pigments have some limitations including solubility, sensitivity and short stability upon exposure to light, pH and high temperature. Thus, encapsulation *via* spray drying can be employed to enhance the pigment's properties. In this study, spray-dried microcapsules containing red pigment (prodigiosin) extracted from *Serratia marcescens* was produced using κ -carrageenan and maltodextrin as encapsulation agents. The effect of spray-drying parameters on the encapsulation yield (EY), particle size, moisture content and colour intensity of the prodigiosin microcapsules at different ratios of prodigiosin/encapsulation agent were studied. The most intense colour was obtained for the 1:1 ratio (volume ratio of prodigiosin in ethyl acetate to κ -carrageenan solution) using 200°C inlet temperature, feed flow rate of 60 m³/h, air pressure of 1.5 bar and feed rate of 3 mL/min. The encapsulated pigment is most stable in powder form at 0°C when stored in the dark, and thus has superior stability compared to pigment in its free form. Characterization of spray-dried prodigiosin using FTIR and FESEM confirmed that the particles were properly coated with encapsulating agents. The morphology showed the particles were regular shaped spheres with mean diameters between 0.5 μ m and 5 μ m. Finally, the particles were successfully applied to milk, yogurt and carbonated drinks. The results suggest that the spray-dried prodigiosin can be useful as a food colorant under the above optimum operating conditions.

ABSTRAK

Pigmen yang diekstrak daripada mikroorganisma boleh dijadikan sebagai sumber alternatif bagi menggantikan pigmen tiruan dalam industri pemakanan. Pigmen semulajadi mempunyai beberapa kelemahan termasuk keterlarutan, kepekaan dan kestabilan yang rendah terhadap cahaya, pH dan suhu yang tinggi. Justeru itu, pengkapsulan melalui pengeringan sembur boleh digunakan bagi menambahbaik ciri pigmen tersebut. Dalam kajian ini, pemikrokapsulan secara pengeringan sembur bagi pigmen merah (prodigiosin) yang diekstrak daripada *Serratia marcescens* telah dihasilkan dengan menggunakan κ -karagenan dan maltodekstrin sebagai agen pengkapsulan. Kesan pengeringan sembur terhadap beberapa parameter seperti hasil pengkapsulan, saiz zarah, kandungan kelembapan dan keamatan warna prodigiosin yang telah dikapsulkan pada nisbah prodigiosin / agen pengkapsulan yang berbeza telah dikaji. Keamatan warna yang paling tinggi diperolehi pada nisbah 1:1 (nisbah isipadu prodigiosin di dalam etil asetat terhadap larutan κ -karagenan) dengan menggunakan suhu masukan 200°C, kadar aliran suapan 60 m³ / h, tekanan udara 1.5 bar dan kadar suapan 3 mL / min. Prodigiosin yang telah dikapsulkan lebih stabil dalam bentuk serbuk pada 0°C apabila disimpan di tempat yang gelap dan kestabilannya lebih baik berbanding pigmen yang tidak dikapsulkan. Pencirian serbuk prodigiosin menggunakan FTIR dan FESEM mengesahkan bahawa zarah prodigiosin telah disalut sepenuhnya dengan agen pengkapsulan. Analisis morfologi menunjukkan partikel prodigiosin berbentuk sfera dan berdiameter di antara 0.5 μ m dan 5 μ m. Akhir sekali, serbuk prodigiosin tersebut telah berjaya diaplikasikan pada susu, yogurt dan minuman berkarbonat. Hasil kajian mendapati serbuk prodigiosin boleh digunakan sebagai pewarna makanan dengan menggunakan parameter optimum yang tersenarai di atas.