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PHYSICOCHEMICAL AND FUNCTIONAL PROPERTIES OF HYDROCOLLOID SYSTEMS CONTAINING ROSE CACTUS (*Pereskia bleo*) MUCILAGE-PROTEIN COACERVATE FOR DYSPHAGIA-ORIENTED BEVERAGE EMULSION

NOR ALIA BINTI CHE NOZID

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Main Supervisor : Nor Hayati binti Ibrahim, Ph.D

Co-Supervisor : Prof. Sakinah binti Harith, Ph.D

Faculty : Faculty of Fisheries and Food Science

Rose cactus mucilage (RCM) obtained from the leaves of *Pereskia bleo* can potentially form a complex coacervate via electrostatic interaction with proteins. However, no study has been conducted on RCM-protein coacervates to discover their emulsifying, water holding capacity, solubility and rheological effects on food emulsions. This study aimed to determine the best pH and mixing ratio for coacervate formation using RCM and proteins; whey protein isolate (WPI), pea protein isolate (PPI), and soy protein isolate (SPI). These coacervates could be used in dysphagia-oriented beverage emulsions (DOEs). RCM exhibited anionic polysaccharide properties with zeta potential ranging from -5.8 to -23.3 mV at pH 3-9. RCM-protein coacervates at different mixing ratios (RCM:protein; 0:10 to 10:0) were then prepared at pH 3.6 for optimum coacervation based on zeta potential, yield, turbidity, and emulsifying properties. The best mixing ratios of 3:7 (RCM-WPI), 8:2 (RCM-PPI), and 9:1 (RCM-SPI) were chosen for their significant ($p < 0.05$) emulsion stabilisation effect. RCM-PPI and RCM-SPI coacervates demonstrated significantly ($p < 0.05$) higher water holding capacity (434.15-445.08%) compared to RCM-WPI. These coacervates also exhibited shear-thinning behaviour, with higher elastic rather than

viscous properties and consistent high solubility at 30-90°C. The electrostatic interaction in all coacervates was contributed by hydrogen bonds detected at 3319.49-3336.85 cm^{-1} in their Fourier transform infrared spectroscopy spectra and their particles showed distinctive morphological characteristics, as observed by scanning electron microscopy. Overall, the RCM-PPI coacervate displayed the most desirable physicochemical properties, making it suitable for use in DOEs. Based on the response surface methodology approach, optimal RCM-PPI coacervate and locust bean gum (LBG) ranges were identified as11.4-13.2% and 0.4-0.6%, respectively, giving the DOEs with required rheological properties. The pH (3.44-3.46) of the optimised DOEs were appropriate for consumption as beverage emulsions, with their droplet size, turbidity loss rate and lipid oxidation being low enough to impart the stability. The optimised formulation designated as F1 (11.4% of RCM-PPI coacervate and 0.6% of LBG) appeared to have the best properties and stability. This study opens a new perspective on using RCM-PPI coacervate in ready-to-eat dysphagia diets, under the honey-like category, owing to their appealing physicochemical properties and stability.

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CIRI-CIRI FIZIKOKIMIA DAN KEFUNGSIAN SISTEM HIDROKOLLOID YANG MENGANDUNGI 'COACERVATE' LENDIR DAUN KAKTUS MAWAR (*Pereskia bleo*)-PROTEIN DI DALAM EMULSI MINUMAN BERORIENTASIKAN DISFAGIA

NOR ALIA BINTI CHE NOZID

JUN 2023

Penyelia : Nor Hayati binti Ibrahim, Ph.D

Penyelia Bersama : Prof. Sakinah binti Harith, Ph.D

Fakulti : Fakulti Perikanan dan Sains Makanan

Lendir kaktus mawar (RCM) yang diperoleh daripada daun *Pereskia bleo* berpotensi membentuk kompleks 'coacervate' melalui interaksi elektrostatik dengan protein. Walau bagaimanapun, tiada kajian telah dijalankan ke atas 'coacervate' RCM-protein untuk mengetahui kesan pengemulsi, kapasiti pegangan air, keterlarutan, dan reologi terhadap emulsi makanan. Kajian ini bertujuan untuk menentukan keadaan pH dan nisbah percampuran terbaik untuk pembentukan 'coacervate' menggunakan RCM dan protein; pencilan protein whey (WPI), pencilan protein kacang (PPI) dan pencilan protein soya (SPI). 'Coacervate' ini boleh digunakan dalam emulsi minuman berorientasikan disfagia (DOEs). RCM mempamerkan sifat polisakarida anionik dengan nilai potensi zeta antara -5.8 hingga -23.3 mV pada pH 3-9. 'Coacervates' RCM-protein yang terdiri daripada pelbagai nisbah percampuran (RCM:protein; 0:10 hingga 10:0) kemudiannya disediakan pada pH 3.6 untuk penyatuan optimum berdasarkan potensi zeta, hasil, kekeruhan, dan sifat pengemulsi. Nisbah pencampuran terbaik pada 3:7 (RCM-WPI), 8:2 (RCM-PPI), dan 9:1 (RCM-SPI) telah dipilih kerana kesan penstabilan emulsi mereka yang signifikan ($p < 0.05$). 'Coacervates' RCM-PPI dan RCM-SPI menunjukkan kapasiti pegangan air (434.15-445.08%) yang lebih tinggi

secara signifikan ($p < 0.05$) berbanding RCM-WPI. ‘Coacervates’ ini juga menunjukkan kelakuan ‘shear-thinning’, dengan sifat elastik yang lebih tinggi daripada sifat likat dan keterlarutan tinggi yang konsisten pada 30-90°C. Interaksi elektrostatik dalam semua ‘coacervates’ disumbangkan oleh ikatan hidrogen yang dikesan pada 3319.49-3336.85 cm^{-1} dalam spektrum spektroskopi inframerah Fourier transformasi dan menunjukkan ciri morfologi zarah yang tersendiri, dikaji melalui mikroskop elektron pengimbas. Keseluruhannya, ‘coacervate’ RCM-PPI mempamerkan sifat fizikokimia yang paling diingini, menjadikannya sesuai untuk digunakan dalam DOEs. Berdasarkan pendekatan metodologi tindak balas permukaan, julat optimum ‘coacervate’ RCM-PPI dan gam kacang lokus (LBG) ialah masing-masing 11.4-13.2% dan 0.4-0.6%, memberikan DOEs dengan sifat reologi yang diperlukan. pH (3.44-3.46) bagi DOEs yang dioptimumkan adalah sesuai untuk digunakan sebagai emulsi minuman, dengan saiz titisan, kadar kehilangan kekeruhan, dan pengoksidaan lipidnya cukup rendah untuk memberikan kestabilan. Formulasi yang dioptimumkan, ditetapkan sebagai F1 (11.4% RCM-PPI dan 0.6% LBG) menunjukkan sifat dan kestabilan yang terbaik. Kajian ini membuka perspektif baharu tentang penggunaan ‘coacervate’ RCM-PPI dalam diet disfagia sedia-untuk-dimakan di bawah kategori ‘honey-like’ kerana sifat fizikokimia dan kestabilan yang menarik.