UNIVERSITI TEKNOLOGI MARA

OPTIMISATION AND CHARACTERISATION OF OCTENYL SUCCINIC ANHYDRIDE (OSA) MODIFIED SAGO STARCH AND ITS CAPABILITY TO STABILISE EMULSION

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(Science)

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

The demand for natural, biodegradable and renewable emulsifier has led to new market for modified starch. Sago starch has met the requirements and becomes good candidates for emulsion stabilization. However, a major barrier of native sago starch is the lack of hydrophobic properties, thus the starch require to be modified with octenyl succinic anhydride (OSA) to provide amphiphilic properties. The aim of this study was to optimize the reaction condition in preparation of OSA sago starch, analyzing the physicochemical properties and determine the emulsifying ability of modified starch. The characterisation includes determination of amylose content, thermal properties and morphology of starch. Three types of starches were used as comparison which was sago starch, gelose 80 and commercial starch. The optimisation via response surface methodology (RSM) has obtained the optimum condition for the preparation of OSA sago starch was at 5% OSA concentration, pH 7.20 and reaction time of 9.65h which produced degree of substitution (DS) of 0.0120 (OSA sago starch) and 0.0145 (OSA gelose 80). The DS was found to be important, since it affect the physicochemical and emulsification properties of OSA starch. The FT-IR analysis evidenced the successful synthesis of OSA starch with the presence of two new groups at 1717 cm^{-1}(stretch of ester carbonyl group) and 1569 cm^{-1} (assymetric stretch of vibration of a carboxylate $RCOO^-$). The particle size was significantly ($p<0.05$) increased (sago starch: from 29.05 to 29.89 µm; gelose 80: from 9.79 to 20.37 µm) due to swelling phenomenon with less damage was seen to occur on the surface of granule. The significant reduction ($p<0.05$) in amylose content of sago starch from 30.18% to 25.27% and gelose 80 starch from 78.47% to 70.70% as esterification was preferentially occur at amorphous region. For thermal properties, OSA starches displayed significantly ($p<0.05$) lower gelatinization temperature and enthalphy with the ability to prevent retrogradation. The physicochemical properties was generally affected by DS and this was proved by reduction in surface tension which was more pronounced in OSA gelose 80 (54.87 mN/m) as compared with OSA sago starch (58.40 mN/m). The emulsifying properties of OSA sago starch were dependent on the concentration used. At low concentration (4 and 5%), the droplet size was inconsistent as the size keep increasing during storage. Emulsion with 6% OSA sago starch shows the largest droplet, however it give significantly lower CI, high viscosity values and the droplet was closely packed which make it able to stabilize emulsion to a certain extent. The emulsion stabilized by OSA sago starch and OSA gelose 80 shows a bimodal distribution, indicating that the emulsion contain heterogenous droplet. The OSA commercial starch demonstrated better emulsifying properties when compared with the other OSA starches. It produced stable emulsion with smallest droplet, supported by clear unimodal distribution, low surface tension and less aggregation as shown by confocal laser scanning calorimetry (CLSM). The work in this thesis shows the potential of sago starch and its ability to become an emulsifier.

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TABLE OF CONTENTS