



**UNIVERSITI PUTRA MALAYSIA**

***RADIATION SYNTHESIS AND CHARACTERIZATION OF  
MICRO AND NANO PARTICLES OF ACRYLATED PALM OLEIN  
FOR USE IN DRUG DELIVERY***

**RIDA ANAK TAJA**

**FS 2013 2**



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MICRO AND NANO PARTICLES OF ACRYLATED PALM OLEIN  
FOR USE IN DRUG DELIVERY**

**By**

**RIDA ANAK TAJAU**

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in  
Fulfilment of the Requirements for the Degree of Master of Science**

**January 2013**

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in fulfilment of the requirement for the degree of Master of Science

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**Chair: Nor Azowa binti Ibrahim, PhD**  
**Faculty: Science**

Emulsion polymerization and crosslinking reaction of acrylated palm olein (APO) in the presence of anionic and nonionic group surfactants were carried out by gamma irradiation. The critical micelle concentration (CMC) and formation of micro micelles as well their properties were determined their relationship to the control parameters such as APO and surfactant concentration, storage time and irradiation effect. The dynamic light scattering (DLS), fourier transform infrared (FTIR) spectroscopy and transmission electron microscopy (TEM) were used to characterize the size, the irradiation effect and the chemical structure of the micro and nanoparticle.

Size of the APO micro and nanoparticles can be varied by changing the formulation and the irradiation dose. Size of the APO micro and nanoparticle is in the range of 77 to 500 nanometer (nm) when the system was irradiated with gamma ray at irradiation doses from 0.36 to 25 kGy.

Using thymoquinone as a model bioactive compound, a drug loaded APO micro and nanoparticles were synthesized. Size of the thymoquinone-loaded APO micro or nanoparticle was in the range of 140 to 300 nanometer after irradiation using gamma irradiator. The presence of the bioactive and surface active compounds in the micro and nanomicelles determined the particle size and stability, and the bioactive release rate.

This radiation-induced method provides a free initiator induced and easy to control process as compared to that of the classical or chemical initiator process. This study showed that radiation-induced initiator method which involves polymerization and crosslinking in the microemulsion is very promising for the synthesis of micro and nanoparticles.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia  
sebagai memenuhi keperluan untuk ijazah Master Sains

**SINTESIS PENYINARAN DAN PENCIRIAN  
MIKRO DAN NANO PARTIKEL MINYAK SAWIT OLEIN TERAKRILAT  
UNTUK KEGUNAAN PENGHANTARAN UBAT**

Oleh

**RIDA ANAK TAJAU**

**Januari 2013**

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Pempolimeran emulsi dan tautsilang minyak sawit olein terakrilat (APO) bersama surfaktan anionik dan bukan ionik dilakukan dengan kaedah sinaran. Pembentukan pada kepekatan misel genting (CMC) dan misel-mikro dikaitkan dengan saiz partikel ke atas kesan parameter seperti kepekatan APO dan surfaktan, kesan penstoran dan kesan sinaran telah dikaji. Kaedah seperti penyelerakan cahaya dinamik (DLS), spektrokopi inframerah (FTIR) dan mikroskopi transmisi elektron (TEM) digunakan untuk pencirian saiz, kesan dos penyinaran dan struktur kimia partikel mikro dan nano.

Pada dan di atas kepekatan misel genting (CMC), pelbagai kepekatan makromonomer (APO) diformulasikan untuk pembentukan sistem misel-mikro. Misel-mikro pada CMC telah dipilih untuk kajian lanjut penyelidikan ke atas pembentukan tautsilang dalam dan antara molekul.

Saiz partikel mikro dan nano APO adalah pelbagai dan bergantung kepada formulasi dan dos penyinaran terhadap sampel. Saiz partikel mikro dan nano APO adalah di antara 77 hingga 500 nanometer (nm) selepas disinarkan terhadap penyinaran gamma pada dos penyinaran yang berbeza di antara 0.36 hingga 25 kGy.

Timokuinon telah digunakan sebagai bahan aktif dalam sistem mikro-nano misel yang telah dibangunkan di atas. Kehadiran sebatian bioaktif dalam mikro-nano misel menentukan saiz partikel dan perlepasan sebatian bioaktif. Saiz partikel mikro dan nano APO yang mengandungi timokuinon adalah di antara 140 to 300 nanometer selepas disinarkan menggunakan penyinaran gamma.

Kaedah rangsangan-sinaran yang digunakan dalam kajian ini adalah bebas daripada penggunaan bahan kimia dan proses adalah mudah berbanding kaedah klasik atau proses kimia. Kajian ini menunjukkan kaedah sinaran untuk pempolimeran dan tautsilang mikroemulsi berpontesi besar digunakan untuk penghasilan partikel mikro dan nano.

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I certify that an Examination Committee has met on **date of viva voce** to conduct the final examination of **Rida anak Tajau** on her **degree** thesis entitled "**Radiation synthesis and characterization of micro and nano particles of acrylated palm olein for use in drug delivery**" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the student be awarded the Master of Science.

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## DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or at any other institution.



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