



APPENDICES

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่

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APPENDIX A

CHEMICAL AND PHYSICAL PROPERTIES OF THE CHEMICALS USED FOR NIOSOMAL PREPARATION

1. Polyoxyethylene-2-stearyl ether (Brij 72)

Synonym	Brij 72, polyethylene glycol octadecyl ether
Chemical formula	C ₂₂ H ₄₆ O ₃
Molecular weight	358.60 g/mol
Appearance	wax like
HLB	4.9
Melting point	44-45°C
Chemical structure	chemical structure of polyoxyethylene-2-stearyl ether is shown in Fig. A.1

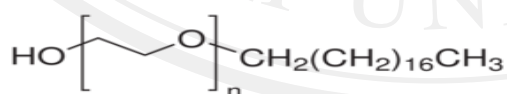


Figure A.1 Chemical structure of polyoxyethylene-2-stearyl ether

2. Cholesterol

Synonym	cholesterin, cholesterine, cholesteryl alcohol, dythol, provitamin D, cholest-5-en-3 β -ol, 3- β -hydroxycholest-5-ene
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Chemical formula	$C_{27}H_{46}O$
Molecular weight	386.67 g/mol
Appearance	white odorless crystalline powder
Melting point	148-150 °C
Chemical structure	chemical structure of cholesterol is shown in Figure A.2

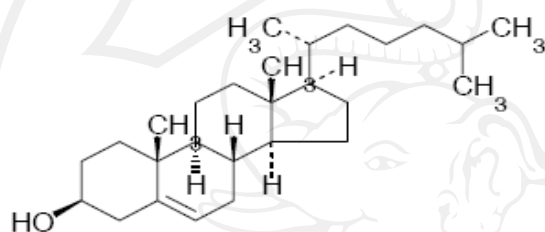


Figure A.2 Chemical structure of cholesterol

3. Dimethyl dioctadecyl ammonium bromide (DDAB)

Synonym	-
Chemical formula	$C_{38}H_{80}NBr$
Molecular weight	630.95 g/mol
Appearance	white powder
Melting point	160°C
Chemical structure	chemical structure of dimethyl dioctadecyl ammonium bromide is shown in Figure A.3

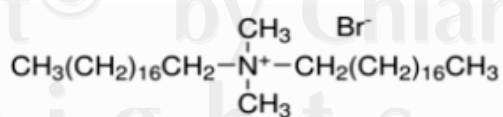


Figure A.3 Chemical structure of dimethyl dioctadecyl ammonium bromide

4. Dicetyl phosphate (DP)

Synonym	dihexadecyl phosphate
Chemical formula	$C_{32}H_{67}O_4P$
Molecular weight	546.85 g/mol
Appearance	white powder
Melting point	74-75°C
Chemical structure	chemical structure of dicetyl phosphate is shown in Figure A.4

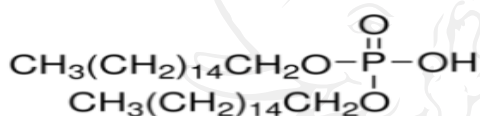


Figure A.4 Chemical structure of dicetyl phosphate

APPENDIX B

CALCULATION OF NIOSOMAL COMPOSITIONS

The amount of each composition in niosomal formulations was calculated from the following equation:

Required amount (g) = molar ratio in the formulation \times concentration of the nanovesicles (Molar) \times required volume (L) \times molecular weight (MW)

For example:

1. To prepare 20 ml of neutral vesicles (20 mM) with non-ionic surfactant Brij 72/cholesterol at 7:3 molar ratio

(MW of Brij72 = 358.60 g/mol and MW of cholesterol = 386.67 g/mol)

The required amounts of Brij72 and cholesterol were as the following:

$$\text{Brij72 (g)} = (7/7+3) \times (20 \times 10^{-3}) \times (20 \times 10^{-3}) \times 358.60 = 0.1004 \text{ g}$$

$$\text{Cholesterol (g)} = (3/7+3) \times (20 \times 10^{-3}) \times (20 \times 10^{-3}) \times 386.67 = 0.0464 \text{ g}$$

2. To prepare 20 ml of cationic vesicles (20 mM) with non-ionic surfactant

Brij72/cholesterol/DDAB at 7:3:0.65 molar ratio

(MW of Brij72 = 358.60 g/mol, MW of cholesterol = 386.67 g/mol and MW of

DDAB = 630.95 g/mol)

The required amounts of Brij72, cholesterol and DDAB were as the following:

$$\text{Brij72 (g)} = (7/7+3+0.65) \times (20 \times 10^{-3}) \times (20 \times 10^{-3}) \times 358.60 = 0.0943 \text{ g}$$

$$\text{Cholesterol (g)} = (3/7+3+0.65) \times (20 \times 10^{-3}) \times (20 \times 10^{-3}) \times 386.67 = 0.0436 \text{ g}$$

$$\text{DDAB (g)} = (0.65/7+3+0.65) \times (20 \times 10^{-3}) \times (20 \times 10^{-3}) \times 630.95 = 0.0154 \text{ g}$$

3. To prepare 20 ml of anionic vesicles (20 mM) with non-ionic surfactant Brij72/cholesterol/DP at 7:3:0.65 molar ratio

(MW of Brij72 = 358.60 g/mol, MW of cholesterol = 386.67 g/mol and MW of DP = 546.85 g/mol)

The required amounts of Brij72, cholesterol and DP were as the following:

$$\text{Brij72 (g)} = (7/7+3+0.65) \times (20 \times 10^{-3}) \times (20 \times 10^{-3}) \times 358.60 = 0.0943 \text{ g}$$

$$\text{Cholesterol (g)} = (3/7+3+0.65) \times (20 \times 10^{-3}) \times (20 \times 10^{-3}) \times 386.67 = 0.0436 \text{ g}$$

$$\text{DP (g)} = (0.65/7+3+0.65) \times (20 \times 10^{-3}) \times (20 \times 10^{-3}) \times 546.85 = 0.0134 \text{ g}$$

APPENDIX C

CERTIFICATE OF APPROVAL FOR THE USES OF ANIMALS



Certificate of Approval
For Use of Animals
Faculty of Medicine, Chiang Mai University

Protocol Number: 25 / 2554
Title of project: Evaluation of transfollicular delivery, skin irritation and efficacy of fatty acid ester entrapped in niosomes and hair formulation containing fatty acid ester in niosomes for canities treatment
Principal investigator: Professor Aranya Manosori
Affiliation: Faculty of Pharmacy

The Faculty of Medicine, Chiang Mai University, supported by the results of Animal Ethics committee review, that the use of animals in the project conforms with international and national guidelines for ethical conduct on the care and use of animals,

Hereby approves the research proposal to be conducted under its proposed scheme. The approval is effective from 16 November 2011

Bannakij Lojanapiwat, M.D.
Professor

Chair

Date 27 December 2011

Niwes Nantachit, M.D.
Associate Professor

Dean

Date 27 December 2011



หนังสืออนุมัติการใช้สัตว์
คณะแพทยศาสตร์ มหาวิทยาลัยเชียงใหม่

หมายเลขโครงการ: ๒๕ / ๒๕๕๔
ชื่อโครงการวิจัย: การทดสอบการนำส่งสารผ่านเซลล์รูชมชน การทดสอบการระคายเคืองผิวหนัง และการทดสอบประสิทธิภาพของตำรับนีโอโซมเก็บกักเอสเทอร์ของกรดไขมันในนีโอโซม และตำรับเครื่องสำอางที่มีนีโอโซมเก็บกักเอสเทอร์ของกรดไขมันในนีโอโซม เป็นส่วนประกอบเพื่อใช้รักษาภาวะผมหงอก

ชื่อหัวหน้าโครงการวิจัย ศาสตราจารย์ อรุณญา มโนสร้อย
สังกัด: ภาควิชาวิทยาศาสตร์เภสัชกรรม คณะเภสัชศาสตร์

คณะแพทยศาสตร์ โดยความเห็นชอบของคณะกรรมการจรรยาบรรณการใช้สัตว์ ได้พิจารณาโครงการวิจัย แล้ว เห็นว่าไม่ขัดต่อแนวทางสากลและประเทศในการปฏิบัติเกี่ยวกับการดูแลและใช้สัตว์

จึงอนุมัติให้ดำเนินการภายในขอบเขตของโครงการวิจัยที่เสนอมานี้ ทั้งนี้มีผลตั้งแต่วันที่ ๑๖ พฤศจิกายน ๒๕๕๔

(ศาสตราจารย์นายแพทย์ให้บรรณกิจ โลจนาภิวัฒน์) (รองศาสตราจารย์ นายแพทย์นิเวศน์ นันทจิต)

ประธานคณะกรรมการ

คณบดี

จรรยาบรรณการใช้สัตว์ทดลอง

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วันที่... ๒๗ ๕ ๒๕๕๔

CURRICULUM VITAE

Name Miss Puxvadee Chaikul

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Education

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2002-2004 Master of Science (Pharmacology), Chiang Mai University, Thailand

2008-2013 Ph.D. candidate, Faculty of Pharmacy, Chiang Mai University,
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Working Experiences

Apr, 1998–May, 2002 Hospital pharmacist at Chiang Rai Hospital,
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Sep, 2004-Jan, 2005 Community pharmacist at Siam Makro Public Company
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Feb, 2005-Nov, 2005 Hospital pharmacist at Sriburin Medical Company
Limited, Chiang Rai, Thailand

Dec, 2005-present Lecturer at School of Cosmetic Science, Mae Fah
Luang University, Chiang Rai, Thailand

Scholarships

2003-2004 Scholarship from Graduate School, Chiang Mai University, Thailand

2004 Scholarship for research project from Faculty of Medicine Endowment

Fund for Medical Research, Chiang Mai University, Thailand

2008-2011 Scholarship from the Strategic Scholarships Fellowships Frontier
 Research Network, The Office of the Higher Commission, Ministry of
 Education, Thailand

International Scientific Publications

1. **Chaikul P**, Manosroi J, Manosroi W, Manosroi A. Melanogenesis enhancement of saturated fatty acid methyl esters in B16F10 melanoma cells. *Adv Sci Lett.* 2012; 17: 251-6.
2. Manosroi A, **Chaikul P**, Abe M, Manosroi W, Manosroi J. Melanogenesis of methyl myristate loaded niosomes in B16F10 melanoma cells. *J Biomed Nanotech.* 2013; XX: XX-XX.
3. Manosroi A, Kietthanakorn B, Chankhampan C, Chuenpitayaton S, Ruksiriwanich W, **Chaikul P**, Boonpisuttinant K, Kumguan K, Sainakham M, Manosroi W, Manosroi J. Biological activities of Hemp (*Cannabis sativa* L var. *sativa*) leaf and seed extracts. *Adv Nat Prod.* 2013; XX: XX-XX.
4. Manosroi A, Ruksiriwanich W, **Chaikul P**, Manosroi W, Manosroi J. 5α -reductase inhibition and melanogenesis induction of the selected Thai plant extracts. *Adv Nat Prod.* (review article)

Scientific Presentations

1. Manosroi J, Khonsung P, **Chaikul P**, Manosroi A. Anti-hypertensive activity of medicinal plant extracts selected from the Thai-Lanna Medicinal Recipe Database Manosroi II. *J Thai Trade Altern Med.* 2010;8:58. (Poster presentation)

2. Manosroi A, **Chaikul P**, Prasitpuripreecha C, Charoenchai L, Rungseevijitprapa W. Melanogenesis induction activity and protein content of Thai herbal extracts loaded in niosomes in B16F10 mouse melanoma cells. J Thai Trade Altern Med. 2010;8:52. (Poster presentation)
3. **Chaikul P**, Rojanasthien N, Kongtawelert P, Lumlertkul D, Sangdee C. Correlation of hyaluronan level and immunosuppressive drug levels in renal transplant patients at Maharaj Nakorn Chiang Mai Hospital. Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand (Poster presentation).