

**DEVELOPMENT OF NATURAL RUBBER MATRIX USING IN
ELECTRICAL STIMULI TRANSDERMAL DRUG DELIVERY
APPLICATION**

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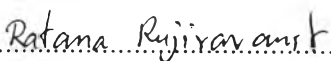
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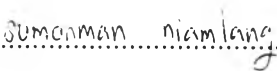
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ABSTRACT

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The transdermal drug delivery system (TDDS) is a system to transport the specific dose of drug into the blood system through the skin. TDDS has been continuously developed and improved for suing with a wide variety of drug molecules. In this work, the influence under effect of the electrical potential and plasticizers were studied for the drug delivery system. Indomethacin (IN), an anti-inflammatory drug, was used as an inoic drug model which added in plasticizers to develope the efficient drug transportation. The drug-loaded plasticizer was mixed with natural rubber latex (NR) to prepare a transdermal patch by UV-curing method. The permeation of indomethacin in phosphate-buffered saline (PBS) buffer (pH 7.4) through IN-loaded NR film was carried out by a modified Franz diffusion cell at a control temperature at 37 °C. UV-visible spectrometer was used to dertermine the amount of drug permeation. The results confirmed that an electrical potential and plasticizer can develope the diffusion of drug from a patch through the skin by generating electro-repulsive force.

บทคัดย่อ

สรุพลิต ชวงศ์อภิชาติ : การพัฒนาแผ่นบรรจุยาจากยางธรรมชาติ เพื่อประยุกต์ใช้ในแผ่นนำส่งยาโดยควบคุมด้วยกระแสไฟฟ้า (Development of Natural Rubber Matrix using in Electrical Stimuli Transdermal Drug Delivery Application)

อ. ที่ปรึกษา : ศ.ดร. อนุวัฒน์ ศิริวัฒน์ 156 หน้า

ระบบนำส่งยาผ่านทางผิวหนังถูกพัฒนาและเพื่อเพิ่มประสิทธิภาพของการรักษา โดยหลีกเลี่ยงการถูกทำลายของยาจากระบบทางเดินอาหาร หรือการเกิดเมตาบอลิซึมของยาที่ตับ นอกจากนี้ยังช่วยรักษาระดับปริมาณยาในเลือดให้คงที่ แต่เนื่องจากธรรมชาติของผิวหนังที่เป็นเยื่อเลือกผ่านจึงส่งผลเป็นข้อจำกัดในการแพร่ผ่านของยาจากชั้นผิวหนังไปยังอวัยวะเป้าหมายและจำกัดประเภทของยา ซึ่งทำให้ประสิทธิภาพในการรักษาลดลง ดังนั้นจึงได้มีการใช้กระแสไฟฟ้าเพื่อลดข้อจำกัดดังกล่าว เป็นผลทำให้ระบบนี้สามารถใช้ได้กับยาหลากหลายชนิดและทำให้การรักษามีประสิทธิภาพดีขึ้น งานวิจัยนี้ศึกษาการปลดปล่อยยาอินโดเมธาซินที่บรรจุในแผ่นยางธรรมชาติผสมพลาสติกไซเซออร์ โดยใช้ Modified-Franz diffusion cell ในฟอสเฟตบัฟเฟอร์ ซาลินที่ค่าพีเอช 7.4 อุณหภูมิ 37 องศาเซลเซียส ผลการทดลองพบว่าปริมาณการปลดปล่อยยาอินโดเมธาซินเพิ่มขึ้นเมื่อเพิ่มปริมาณพลาสติกไซเซออร์ และปริมาณความแรงของกระแสไฟฟ้าในแผ่นยางธรรมชาติ เนื่องจากเกิดแรงผลักทางไฟฟ้าระหว่างประจุลบของยาและประจุลบบนขั้วไฟฟ้าที่วางบนแผ่นยาง

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ABBREVIATIONS

Avg	Average
DPNR	Deproteinized Natural Rubber
DCNR	Double-centrifuged Natural Rubber
FTIR	Fourier Transform Infrared Spectromerter
IN	Indomethacin
PCz	Polycarbazole
SD	Standard deviation
SEM	Scanning Electron Microscope
TG-DTA	Thermogravimetry Differential Thermal Analyzer
TDDS	Transdermal Drug Delivery System
UV-visible	UV-visible spectrophotometer

LIST OF SYMBOLS

M_s	weight of the sample after submersed in the buffer solution (g)
M_d	weight of sample after submersed in the buffer solution (g)
M_i	initial weight of the sample (g)
ν_e	the number of chains in a real network per unit volume
V_1	the molar volume of solvent
V_r	the polymer volume fraction in swollen state
χ	the Flory interaction parameter of natural rubber
A	the weight of sample measured in air (g),
B	the weight of sample measured in MeOH (g),
M_t	amounts of drug release at time (mg)
M_{∞}	amounts of drug release at time infinity (mg)
M_t/M_{∞}	fractional of drug release
k	kinetic constant (h^{-n})
k_H	Higuchi kinetic constant (h^{-n})
n	diffusion scaling exponent
Q	amount of material flowing through a unit cross-section of barrier (g/cm^2)
C_0	initial drug concentration in the film (g/cm^3)
D	diffusion coefficient of a drug (cm^2/s)
t	time (h)