

**-PERMEATION STUDY OF INDOMETHACIN FROM
POLYCARBAZOLE/NATURAL RUBBER BLEND FILM FOR ELECTRIC
FIELD CONTROLLED TRANSDERMAL DELIVERY**

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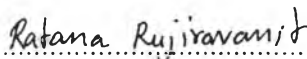


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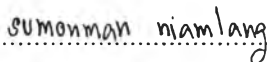
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ABSTRACT

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The transdermal drug delivery system (TDDS) is an alternative route to the transport of medical species into the blood system through the skin. This method has been continuously developed and improved to overcome limitations and is now suitable for a wide variety of drug molecules. In this work, the influence of the electric field and conductive polymer used for the drug delivery system was investigated. Indomethacin, an anti-inflammatory drug, was loaded into polycarbazole (PCz), which is a conductive polymer to promote the efficient transportation of the drug. The drug-loaded PCz was blended with natural rubber (NR) to form a transdermal patch. The permeation of indomethacin in phosphate-buffered saline (PBS) buffer (pH 7.4) through PCz/DCNR film was carried out by a modified Franz diffusion cell at a maintained temperature at 37 °C. UV-visible spectrometer was used to detect the amount of drug released. The results confirmed that an electric field can improve the diffusion of drug from a membrane through the skin by generating electrorepulsive force.

บทคัดย่อ

พรวลัย ทองคำ : การควบคุมการปลดปล่อยยาภายใต้กระแสไฟฟ้าจากพอลิคาร์บาโซล/
ยางธรรมชาติ (Permeation Study of Indomethacin from Polycarbazole/Natural Rubber
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อ. ที่ปรึกษา : ศ.ดร. อนุวัฒน์ ศิริวัฒน์ 164 หน้า

ระบบนำส่งยาผ่านทางผิวหนังถูกพัฒนาเพื่อเพิ่มประสิทธิภาพของการรักษา โดย
หลีกเลี่ยงการถูกทำลายของยาจากระบบทางเดินอาหาร หรือการเกิดเมตาบอลิซึมของยาที่ตับ
นอกจากนี้ยังช่วยรักษาระดับปริมาณยาในเลือดให้คงที่ แต่เนื่องจากธรรมชาติของผิวหนังที่เป็นเยื่อ
เลือกผ่านจึงเป็นข้อจำกัดในการแพร่ผ่านของยาจากชั้นผิวหนังไปยังอวัยวะเป้าหมายและจำกัด
ประเภทของยา ซึ่งทำให้ประสิทธิภาพในการรักษาลดลง ดังนั้นจึงได้มีการใช้กระแสไฟฟ้าเพื่อลด
ข้อจำกัดดังกล่าว ทำให้ระบบนี้สามารถใช้ได้กับยาหลากหลายชนิดและทำให้การรักษามี
ประสิทธิภาพดีขึ้น งานวิจัยนี้ศึกษาการปลดปล่อยยาอินโดเมธาซินที่บรรจุในแผ่นยางธรรมชาติ
และแผ่นยางธรรมชาติผสมพอลิคาร์บาโซล โดยใช้ Modified-Franz diffusion cell ในฟอสเฟต
บัฟเฟอร์ซาลินที่ค่าพีเอช 7.4 อุณหภูมิ 37 องศาเซลเซียส ผลการทดลองพบว่าปริมาณยาอินโด
เมธาซินลดลงเมื่อเพิ่มปริมาณสารเชื่อมขวางในแผ่นยางธรรมชาติ และปริมาณเพิ่มขึ้นเมื่อเพิ่ม
ความแรงของกระแสไฟฟ้าเนื่องจากเกิดแรงผลักทางไฟฟ้าระหว่างประจุลบของยาและประจุลบ
บนขั้วไฟฟ้าที่วางบนแผ่นยาง นอกจากนี้พบว่าพอลิคาร์บาโซลในแผ่นยางธรรมชาติผสมพอลิคาร์
บาโซลช่วยเพิ่มการแพร่ผ่านของยาอินโดเมธาซินผ่านผิวหนัง

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ABBREVIATIONS

Avg	Average
CPs	Conductive Polymers
DCNR	Double-centrifuged Natural Rubber
FTIR	Fourier Transform Infrared Spectrometer
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)