

**CONTROLLED TRANSDERMAL IONTOPHORESIS OF  
SULFOSALICYLIC ACID FROM POLYPYRROLE/POLY(ACRYLIC ACID)  
HYDROGEL**



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## ABSTRACT

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Transdermal drug delivery system is a system that delivers a drug into a body at a desired site and rate. The conductive polymer-hydrogel blend between polypyrrole (PPy) doped with an anionic drug and poly(acrylic acid) (PAA) were developed as a matrix/carrier for the transdermal drug delivery in which the characteristic releases depend on the electrical field applied. The PAA films and their blend films were prepared by solution casting using ethylene glycol dimethacrylate (EGDMA) as a crosslinking agent. A mechanical blending of PPy particles and PAA matrix was then carried out. The thermal properties were investigated by means of the thermogravimetric analysis and differential scanning calorimeter analysis. Moreover, an electrical conductivity of the polypyrrole and drug-loaded polypyrrole was measured by using a two-point probe meter. The drug diffusions of blended PPy/PAA hydrogels and the non-blended ones were determined by using a modified Franz-diffusion cell with an acetate buffer, pH 5.5, at 37 °C, for a period of 48 hours in order to investigate the effects of crosslinking ratio and electric field strength. Amounts of the released drug were measured by UV-Visible spectrophotometry. The diffusion coefficient of the drug was calculated through the Higuchi equation, with and without an electric field and at various crosslinking ratios. The diffusion coefficient decreases with the crosslinking ratio with and without the conductive polymer. The diffusion coefficients are greater at the applied electric field of 1.0 V by an order of magnitude relative to those without electric field.

## บทคัดย่อ

พริฐภา จันทร์ไสย์ : การควบคุมการใช้กระแสไฟฟ้าปลดปล่อยซัลโฟซาลิซิลิกเอซิดจากพอลิอะคริลิก/พอลิไพโรลไฮโดรเจล (Controlled Transdermal Iontophoresis of Sulfosalicylic Acid from Polypyrrole/Poly(acrylic acid) Hydrogel) อ.ที่ปรึกษา: รศ.ดร.อนุวัฒน์ ศิริวัฒน์ 174 หน้า

การปลดปล่อยยาผ่านผิวหนังเป็นการส่งผ่านยาเข้าสู่ร่างกายในบริเวณที่ต้องการตามอัตราที่เหมาะสม ในงานวิจัยนี้ได้พัฒนาการผสมพอลิเมอร์ที่สามารถนำไฟฟ้าได้ กับ ไฮโดรเจลเข้าด้วยกัน กล่าวคือ พอลิไพโรลซึ่งมียาเกาะอยู่และพอลิอะคริลิกเป็นตัวส่งผ่านยาในระบบส่งผ่านยาทางผิวหนังซึ่งขึ้นอยู่กับการใช้กระแสไฟฟ้าเป็นตัวกระตุ้น สารเชื่อม โยงเอทิลีนไกลคอลไดเมทาคริเลทถูกใช้ในการเตรียมแผ่นพอลิอะคริลิกไฮโดรเจลและแผ่นผสมระหว่างพอลิไพโรลกับพอลิอะคริลิกไฮโดรเจล ซึ่งการแพร่ผ่านของยาจากแผ่นพอลิอะคริลิกไฮโดรเจลและแผ่นผสมระหว่างพอลิไพโรลกับพอลิอะคริลิกไฮโดรเจลได้ทำการศึกษาโดยใช้ modified Franz-Diffusion cell ที่บรรจุสารละลายบัฟเฟอร์ระดับพีเอช 5.5 และอุณหภูมิ 37 องศาเซลเซียส เป็นเวลา 48 ชั่วโมง โดยพิจารณาผลของปริมาณสารเชื่อม โยงและกระแสไฟฟ้า ปริมาณยาที่ถูกปลดปล่อยได้วิเคราะห์ด้วยเครื่อง UV-Visible spectrophotometer และใช้สมการ Higuchi พิจารณาอัตราการแพร่กระจายของยาซึ่งมีปริมาณของสารเชื่อม โยงแตกต่างกันในสถานะที่มีกระแสไฟฟ้าและไม่มีกระแสไฟฟ้า จากการศึกษาพบว่า อัตราการแพร่กระจายของยาลดลงเมื่อปริมาณสารเชื่อม โยงเพิ่มขึ้น และอัตราการแพร่กระจายของยาเพิ่มขึ้นในสถานะที่มีกระแสไฟฟ้า 1 โวลต์ สำหรับคุณสมบัติเกี่ยวกับความร้อนศึกษาโดยใช้เครื่อง thermal gravimetric analyzer และเครื่อง differential scanning calorimeter นอกจากนี้ค่าการนำไฟฟ้าของพอลิไพโรลและพอลิไพโรลที่ผสมยาได้ทำการศึกษาโดยใช้เครื่อง two-point probe meter

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