MULTIPLE-CONTAMINANT WATER NETWORK SYNTHESIS

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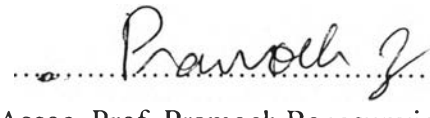

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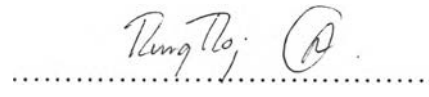

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ABSTRACT

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Water is the main resources for process industry. Many industrial companies pay very high cost in each year for the water usage. The saving on water usage decreases the operating and capital costs of company. Water network synthesis can help reduce the water usage. This work uses General Algebraic Modelling System program (GAMS) for generating the water network system with multiple contaminants by using Mixed-Integer non-liner programming model (MINLP) with objective function minimizing fresh water usage and wastewater. The initialization step starts with non-liner programming (NLP) to estimate the initial water flow rate before final design step minimizing fresh water. This work uses data from the literature of Savelski et al. (2003) and Koppol et al. (2003) as a case study of water/wastewater network to compare with the result of our study. Our water network with multiple contaminants is represented as grid diagrams and process flow diagram using lower fresh water usage than one from case study process.

บทคัดย่อ

กิตติชัย พวงทอง : การออกแบบและการบริหารการจัดการน้ำดีและน้ำเสียในอุตสาหกรรมอย่างเป็นระบบ ภายใต้สภาวะน้ำที่มีสิ่งเจือปนมากกว่าหนึ่งชนิด (Multiple-contaminant Water Network Synthesis) อ. ที่ปรึกษา : ผศ. ดร. กิติพัฒน์ สีมานนท์ 172 หน้า

น้ำ เป็นวัตถุดิบหลักที่สำคัญในกระบวนการอุตสาหกรรม โรงงานส่วนใหญ่จ่ายเงินค่าน้ำเป็นจำนวนมากในแต่ละปี การลดปริมาณการใช้น้ำสามารถช่วยลดรายจ่ายของค่าน้ำในโรงงานได้ การจัดการการไหลของน้ำหรือการบริหารการจัดการน้ำจึงเป็นหนึ่งในวิธีที่สามารถลดปริมาณการใช้น้ำลงได้ ด้วยการสร้างเป็นเครือข่ายการไหลของน้ำในโรงงาน ในงานวิจัยนี้ได้ใช้โปรแกรม General Algebraic Modelling System program (GAMS) ในการคำนวณอัตราการไหล และสร้างเครือข่ายการไหลของน้ำใช้ในแต่ละยูนิต โดยใช้เทคนิค non-liner programming (NLP) เพื่อหาปริมาณการไหลของน้ำเริ่มต้นในแต่ละยูนิต ก่อนที่จะสร้างเป็นเครือข่ายการใช้น้ำด้วยโมเดล Mixed-Integer non-liner programming (MINLP) ซึ่งมีวัตถุประสงค์เพื่อลดปริมาณการใช้น้ำดี และลดการปล่อยน้ำเสีย โดยงานวิจัยนี้ ได้ใช้ข้อมูลจากงานวิจัยของ Savelski et al. (2003) และ Koppol et al. (2003) ในการสร้างเป็นโมเดลศึกษา ซึ่งผลลัพธ์ที่ได้แสดงในรูปกริดไดอะแกรม และแผนภาพการไหลของน้ำ โดยมีการใช้น้ำลดลงน้อยกว่าข้อมูลที่แสดงในงานวิจัยตัวอย่าง

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