ENERGY INTEGRATION OF GAS SEPARATION PLANT: RETROFIT OF GAS SEPARATION UNIT, DESIGN OF STABILIZER UNIT AND SENSITIVITY ANALYSIS OF PROPANE/LPG PRODUCTION

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ABSTRACT

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Gas separation plant (GSP) of PTT Company is considered as a case study in this research work to minimize energy consumption in the process, which is simulated by commercial simulation software, PROII. There are three subtopics, the first one is the retrofit of gas separation unit and the second one is the energy efficient design of stabilizer unit for the future construction. Both topics are related with pinch analysis concept, using the combination of heat exchanger network and column targeting technique. Studying sensitivity analysis of propane and LPG production is the last topic. The goal is to minimize heat duty of distillation column by varying side drawn tray location and column pressure. In the gas separation unit, two options were presented by adding side reboiler and repiping hot streams. The maximum energy saving is 9.26 and 10.86 % of cold and hot utility consumption. Similarly, the grass root design of the stabilizer unit, the integration technique can save cold and hot utility consumption about 47.63 and 17.40 %. Finally, at side drawn tray no. between 5 and 30 and increasing pressure of 0.3 bar are selected as the condition for producing propane and LPG.

บทคัดย่อ

พงศกร สุวรรณาพิสิทธิ์: การบูรณาการความร้อนในโรงแยกก๊าซธรรมชาติ (Energy Integration of Gas Separation Plant: Retrofit of Gas Separation Unit, Design of Stabilizer Unit and Sensitivity Analysis of Propane/LPG Production) อ. ที่ปรึกษา: ดร. กิติพัฒน์ สีมานนท์ ดร.วิวรรณ ธรรมมงคล และ นาย นิพนธ์ คนองชัยยศ 187 หน้า ISBN 974-9651-86-3

งานวิจัยนี้เป็นการศึกษาหาความเป็นไปได้เพื่อลดการใช้พลังงานในกระบวนการแยกก๊าซธรรมชาติของ บริษัท ปตท. จำกัด มหาชน โปรแกรมจำลองกระบวนการ PROII PROVISION ถูกนำมาประยุกต์เพื่อใช้ในการหาคุณสมบัติทางพลังงานกลวิทยา งานวิจัยนี้ได้แบ่งออกเป็น 3 หัวข้อย่อย ได้แก่ การบูรณาการทางความร้อนในหน่วยแยกก๊าซธรรมชาติ, การบูรณาการทางความร้อนและออกแบบเครือข่ายเครื่องแลกเปลี่ยนความร้อนในหน่วยสเตบิไลซ์เซอร์ และการศึกษาผลกระทบในด้านพลังงานเพื่อการผลิตโพรเพน และ ก๊าซหุงต้ม ใน 2 หัวข้อแรกจะเป็นการประยุกต์หลักการของเทคโนโลยีพินช์ ส่วนหัวข้อสุดท้ายเป็นการหาตำแหน่งของชั้นสมดุลย์ที่ใช้ในการผลิตก๊าซหุงต้มและศึกษาผลของการเพิ่มความดันในหอกลั่นที่มีต่อการใช้พลังงานในหอ จากการศึกษาพบว่าในส่วนของหน่วยแยกก๊าซการเพิ่มเครื่องแลกเปลี่ยนความร้อน (side reboiler) ในหอกลั่นจะสามารถลดการใช้พลังงานลงได้มากที่สุดถึง 9.26 และ 10.86 % ของพลังงานในการหล่อเย็นและการให้ความร้อน สำหรับในหน่วยสเตบิไลเซอร์ก็พบว่าการบูรณาการความร้อนสามารถช่วยลดการใช้พลังงานได้ถึง 47.63 และ 17.40 % ของพลังงานในการหล่อเย็นและการให้ความร้อน และการเพิ่มความดันของหอกลั่นแยกโพรเพนอีก 0.3 บาร์และผลิตก๊าซหุงต้มที่ชั้นสมดุลย์ระหว่าง 5 ถึง 30 เป็นสภาวะที่เหมาะสมในการผลิต

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