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สำหรับหอกลิ้นชนิดหลายองค์ประกอบ



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DYNAMICS COMPARTMENTAL MODEL FOR
MULTICOMPONENT DISTILLATION

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A dynamic compartmental model for multicomponent distillation based on the reduced order technique is applied to a selected actual column, the Debutanizer of Bangchack Petroleum Industry.

In the compartmental method, the dynamic behaviour of the column is obtained after the dynamic simulation has been identified with the aid of computer software. A design case of the column, Debutanizer, is used as an initial condition. The present application results, $\pm 15\%$ step changes in feed flow rate, shows that the dynamic responses for bottom, top, and each intermediate stages have an accuracy, not higher than 17% deviation, against a full-order model, which has been calculated by the existing steady state program (PRO II), at the same conditions. Furthermore, the comparison of the compartment's selection, four-and five-compartment, are also given a different of 3%.

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งานวิจัยนี้เป็นการสร้างแบบจำลองทางพลศาสตร์แบบแบ่งส่วนสำหรับหอกลั่นชนิดหลาย-
องค์ประกอบ โดยการประยุกต์เทคนิคการลดอันดับเพื่อใช้ในการคำนวณ โดยเลือกทำการวิเคราะห์หอกลั่น
ตีบิวทาโนเซอร์ของโรงกลั่นน้ำมันบางจากปิโตรเลียม

จากหลักการของการแบ่งส่วน สามารถคำนวณพฤติกรรมทางพลศาสตร์ของหอกลั่นโดยการพัฒนา
บนโปรแกรมไมโครคอมพิวเตอร์ การศึกษาเปลี่ยนแปลงทางพลศาสตร์ใช้สภาวะเริ่มต้นจากข้อมูลการออกแบบ
หอกลั่นตีบิวทาโนเซอร์ และทำการเปลี่ยนอัตราการผลิตของสายป้อนเพิ่มขึ้นและลดลงครั้งละ 15% ผลของ-
การเปลี่ยนแปลงทางพลศาสตร์ที่ได้ของชั้นล่าง ชั้นบน รวมทั้งชั้นที่อยู่ระหว่างกลางให้ค่าที่ถูกต้องใกล้เคียงกับ
แบบจำลองเต็มรูปแบบซึ่งคำนวณจากโปรแกรมการคำนวณหอกลั่นที่สภาวะคงตัว (PRO II) โดยมีค่าเบี่ยง-
เบนไม่เกิน 17% นอกจากนี้ยังได้ทำการเปรียบเทียบผลต่างระหว่างการแบ่งส่วนทั้งแบบ 4 ส่วน และ
5 ส่วน พบว่ามีความแตกต่างกันอยู่เพียง 3%

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NOMENCLATURES**LATIN CAPITAL AND LOWERCASE LETTERS**

| | |
|------------|---|
| A, B | Parameters in Redlich-Kwong equation; parameters in Soave-Redlich-Kwong equation |
| A1, A2, A3 | Constants in Antoine vapor pressure equation |
| <i>a</i> | Activity of a component in a mixture |
| a, b | Constants in van der Waals equation; constants in Redlich-Kwong equation; constants in Soave-Redlich-Kwong equation |
| C | Number of components in a mixture |
| C1, C2 | Integration constants |
| C_p | Molal specific heat |
| D | Distillate flow rate |
| E | Murphee plate efficiency based on the vapor phase |
| F | Feed flow rate |
| G | Gibbs free energy |
| h | Liquid enthalpy per mole |
| H | Vapor enthalpy per mole |
| K | Vapor-liquid equilibrium ratio (K-value) |
| L | Liquid flow rate; liquid flow rate in rectifying section |
| M | Liquid mass hold up; molecular weight |
| n | Number of mole; number of component |
| N | Number of stage |
| P | Pressure |

| | |
|-------|--|
| Q | Heat transfer rate |
| R | Universal gas constant |
| S | Sidestream flow rate; entropy |
| T | Temperature |
| U | Internal energy |
| V | Vapor flow rate; volume; vapor flow rate in rectifying section |
| v | Specific volume |
| x | Mole fraction in liquid phase |
| y | Mole fraction in vapor phase |
| y^* | Vapor mole fraction in equilibrium with liquid composition leaving stage |
| Z | Compressibility factor |
| z | Mole fraction |

GREEK LETTERS

| | |
|-----------|--|
| ω | Acentric factor |
| γ | Activity coefficient |
| μ | Chemical potential |
| ρ | Density |
| f | Fugacity |
| ϕ | Fugacity coefficient of a component in mixture |
| f° | Fugacity of a pure species |
| λ | Heat of vaporization |
| \bar{v} | Partial molal volume |
| v° | Pure species fugacity coefficient |

SUBSCRIPTS

| | |
|------|--|
| D | Distillate |
| F | Feed |
| G | Gas |
| L | Liquid phase |
| S | Sidestream |
| V | Vapor phase |
| i | Particular component; at phase interface |
| i, j | Particular component i in a stream leaving stage j |