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Hydrogenation of Rubber Seed Oil



Miss Waraporn Tanakulrungsank

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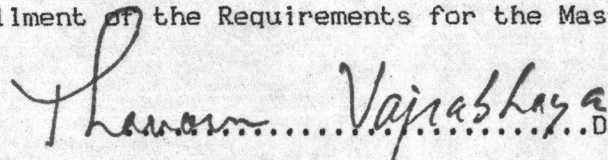
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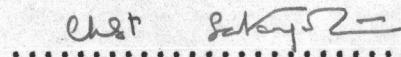
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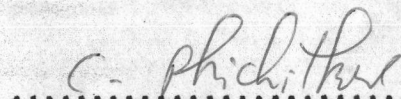
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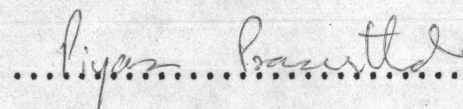
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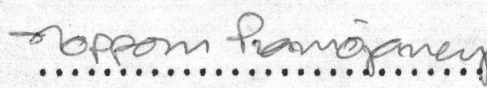
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บทคัดย่อ

การศึกษาการไฮโดรจิเนตของน้ำมันเมล็ดยางพาราภายใต้ภาวะต่างๆ กัน โดยใช้ตัวเร่งปฏิกิริยานิกเกิล จะได้ผลิตภัณฑ์ที่เป็นซีผึ้ง ซึ่งมีลักษณะเป็นของแข็งกึ่งของเหลวจนกระทั่งเป็นของแข็ง มีสีเหลืองอ่อนเช่น เมื่อหลอมเหลวจะใสสีเหลืองอ่อน กลิ่นของน้ำมันเมล็ดยางพาราจะจางลง เมื่อใช้ตัวเร่งปฏิกิริยานิกเกิล Nyse1 HK-4 ซึ่งเป็นตัวเร่งอุตสาหกรรม พบว่ามีประสิทธิภาพดีที่สุด อัตราการเกิดปฏิกิริยาเป็นปฏิกิริยาอันดับหนึ่ง ซึ่งมีค่าคงที่ของการเกิดปฏิกิริยาแปรผันตามอุณหภูมิ ความดันไฮโดรเจน ความเข้มข้นของตัวเร่งปฏิกิริยา และความเร็วของการกวน ค่าพลังงานกระตุ้นของปฏิกิริยาเท่ากับ 14.5 กิโลแคลอรีต่อโมล ที่ความดันไฮโดรเจน 150 ปอนด์ต่อตารางนิ้ว ความเข้มข้นของตัวเร่งปฏิกิริยา 0.2% นิกเกิลต่อน้ำหนักของน้ำมันยางพารา อัตราเร็วของการกวน 700 รอบต่อนาที และอุณหภูมิในช่วง 120°C ถึง 180°C สำหรับภาวะที่เหมาะสมในการไฮโดรจิเนตโดยใช้ตัวเร่งปฏิกิริยานิกเกิล Nyse1 HK-4 คือ อุณหภูมิ 180°C ความดันไฮโดรเจน ไม่น้อยกว่า 120 ปอนด์ต่อตารางนิ้ว ความเข้มข้นของตัวเร่งปฏิกิริยา 0.2% นิกเกิลต่อน้ำหนักของน้ำมันยางพารา และความเร็วของการกวน 700 รอบต่อนาที สำหรับตัวเร่งปฏิกิริยาที่เตรียมขึ้นเอง คือ ตัวเร่งนริซิมเตดที่มีนิกเกิล 41.8% และตัวเร่งอิมเพรกเนตที่มีนิกเกิล 9.3% บนอะลูมินา 325-400 เมช เมื่อทำการไฮโดรจิเนต จะได้อัตราการเกิดปฏิกิริยาช้ากว่าเมื่อใช้ตัวเร่งปฏิกิริยานิกเกิล Nyse1 HK-4 ในเวลาที่เท่ากัน ภายใต้ภาวะการทดลองที่อุณหภูมิ 160°C ความดันไฮโดรเจน 150 ปอนด์ต่อตารางนิ้ว ความเข้มข้นของตัวเร่งปฏิกิริยา 0.2% นิกเกิลต่อน้ำหนักของน้ำมันยางพารา และความเร็วของการกวน 700 รอบต่อนาที



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#### ABSTRACT

The study of the hydrogenation of rubber seed oil under varying reaction conditions using nickel catalyst produced light yellow-colored waxes which were semisolid to solid. When the waxes were melted, they were transparent, clear and yellow color. The nickel catalyst Nysel HK-4 which was the best commercial catalyst was used for study the hydrogenation rate. The order of the reaction was the first order reaction and the global reaction rate constants were proportional to the reaction temperature, hydrogen pressure, catalyst concentration and agitation speed. The apparent activation energy at 150 psig, 0.2% Ni in oil, 700 rpm and the temperature range from 120°C to 180°C was 14.5 kcal/mole. The optimum operating condition was reaction temperature of 180°C, hydrogen pressure not less than 120 psig, catalyst concentration of 0.2% Ni in oil and agitation of 700 rpm. The comparison of the in-house catalysts with the nickel catalyst Nysel HK-4, the hydrogenation rate of the 41.8% Ni precipitated catalyst and the 9.3% Ni on alumina impregnated catalyst were slower than that which occurred at the same time of the Nysel HK-4 catalyst under the condition of 160°C, 150 psig, 0.2% Ni in oil and 700 rpm.

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## NOMENCLATURE

A	=	Frequency Factor, $\text{min}^{-1}$
A.V.	=	Acid value, mg of KOH per g of oil
d	=	Diameter of pore
$E_{act}$	=	Activation energy, kcal/mole
I.V.	=	Iodine value, centigrams of iodine absorbed per gram of oil
k	=	Overall rate constant, $\text{min}^{-1}$
m.p.	=	Melting point, $^{\circ}\text{C}$
n	=	Mole of hydrogen consumed
$\Delta P$ or $P_1$	=	Hydrogen consumed, psi
R	=	Gas constant, $1.987 \text{ cal mole}^{-1} \text{ K}^{-1}$
T	=	Reaction temperature, $^{\circ}\text{C}$ or K
t	=	Time of penetration
V	=	Volume of hydrogen consumed, L
x	=	Penetrated distance
$\gamma$	=	Surface tension
$\eta$	=	Viscosity of liquid