

**FUNCTIONALIZED NATURAL RUBBER:  
RUBBER PARTS FOR GASOHOL RESISTANCE**



**Khantharat Phothiphon**

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**By:** Khantharat Phothiphon  
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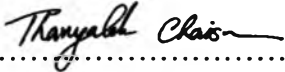
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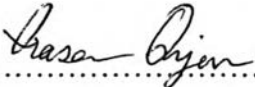
Accepted by the Petroleum and Petrochemical College, Chulalongkorn University, in partial fulfillment of the requirements for the Degree of Master of Science.

  
..... College Dean  
(Asst. Prof. Pomthong Malakul)

**Thesis Committee:**

  
.....  
(Assoc. Prof. Rathanawan Magaraphan)

  
.....  
(Dr. Thanyalak Chaisuwan)

  
.....  
(Dr. Orasa Onjun)

## ABSTRACT

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Keywords: Dynamic vulcanization/ Thermoplastic vulcanizate (TPV)/ Natural Rubber (NR)/ Poly(3-hydroxybutyrate-co-3-hydroxyvalerate) (PHBV)/ Poly(vinylidene fluoride) (PVDF)/ Conventional vulcanization system (CV system)/ Efficient vulcanization system (EV system)/ 2,5-Bis(tert-butylperoxy)-2,5-dimethylhexane (DBPH)/ Epoxidized soybean oil (ESO)

Nowadays, the global warming and the increasing of oil price lead to use petroleum resources carefully and reduce the use of petroleum by using other alternative energy resources. Gasohol is the one of those alternative energy which important for automobile and has a widely use in Thailand. It is a kind of the combination between gasoline and ethanol or hydrocarbon and polar solvent. The material which can resist deteriorating from gasohol is limited. NR and PHBV do not dissolve in ethanol which can be developed to be a thermoplastic vulcanizate (TPV) incorporated with PVDF, the high chemical resistant. The TPV is derived from dynamic vulcanization process which has a melt mixing of polymers and vulcanization reaction by peroxide, DBPH, is occur at the same time. The results found that the increasing amount of DBPH provides the high mechanical properties and reduce the degree of swelling in gasohol. The addition of ESO can improve the mechanical properties and the resistance to swell from gasohol with the swelling percentage lower 50 and 150 % at the temperatures of 25 and 100 °C, respectively. The morphology of TPV was also improved. The rubber phase was deformed into particles with the sized of 1 micron and had well dispersed in thermoplastic phase.

## บทคัดย่อ

คันธารัตน์ โภธิผล : การปรับปรุงยางธรรมชาติเพื่อใช้งานด้านชิ้นส่วนยางทนน้ำมัน แก๊สโซฮอล์ (Functionalized Natural Rubber: Rubber Parts for Gasohol Resistance) อ.ที่ปรึกษา : รองศาสตราจารย์ ดร.รัตนวรรณ มกรพันธุ์ 116 หน้า

จากสภาวะโลกร้อนในปัจจุบันประกอบกับราคาน้ำมันที่พุ่งสูงขึ้นทำให้มีการใช้พลังงานจากปิโตรเลียมลดน้อยลงและทดแทนโดยใช้พลังงานทางเลือกอื่นๆ เพิ่มมากขึ้น น้ำมันแก๊สโซฮอล์เป็นหนึ่งในพลังงานทางเลือกที่จำเป็นสำหรับยานพาหนะที่ใช้น้ำมันเป็นเชื้อเพลิง ซึ่งใช้กันอย่างแพร่หลายในประเทศไทย แก๊สโซฮอล์ได้จากการผสมน้ำมันเบนซินกับเอทานอลที่สัดส่วนต่างๆ ซึ่งก็คือของผสมระหว่างไฮโดรคาร์บอนที่ไม่มีหัวกับตัวทำละลายมีหัว ดังนั้นวัสดุที่สามารถทนทานได้ทั้งสารละลายมีหัวและไม่มีหัวจึงค่อนข้างมีจำกัดและมีราคาแพง ด้วยสมบัติของยางธรรมชาติซึ่งมีมากมายในประเทศไทยและพลาสติกชีวภาพอย่าง PHBV ที่ไม่ละลายในเอทานอลนั้น สามารถนำมาพัฒนาเป็นวัสดุที่สามารถทนแก๊สโซฮอล์ร่วมกับพลาสติกทนสารเคมีสูงอย่าง PVDF ได้ กลายเป็นวัสดุใหม่ที่เรียกว่า เทอร์โมพลาสติกยางวัลคาไนซ์ (Thermoplastic vulcanizate: TPV) วัสดุเทอร์โมพลาสติกยางวัลคาไนซ์นี้เตรียมได้จากเทคนิคการคงรูปแบบพลวัต (dynamic vulcanization) ซึ่งเป็นการผสมพลาสติกในสภาวะหลอมเหลวไปพร้อมๆ กับการคงรูปแบบด้วยสารคงรูปเปอร์ออกไซด์อย่าง DBPH ผลการศึกษาพบว่า เมื่อเพิ่มปริมาณสารคงรูป DBPH สมบัติทางกลและสมบัติการต้านทานต่อการบวมพองในน้ำมันแก๊สโซฮอล์จะเพิ่มขึ้นด้วย เมื่อใส่น้ำมันถั่วเหลืองอีพ็อกซิไดซ์ซึ่งเป็นสารช่วยผสมชีวภาพลงไปของผสมที่มีส่วนผสมของวัสดุทั้งสามในสัดส่วน NR/PVDF/PHBV เท่ากับ 50/40/10 พบว่า สารช่วยผสมมีบทบาทสำคัญในการลดความเหนียวและปรับปรุงความเข้ากันได้ของวัสดุทั้งสาม รวมทั้งปรับปรุงสมบัติทางกล สมบัติการต้านทานต่อการบวมพองในน้ำมันแก๊สโซฮอล์ที่ดีขึ้น โดยมีเปอร์เซ็นต์การบวมพองไม่เกิน 50 และ 150 % ที่อุณหภูมิ 25 และ 100 องศาเซลเซียส ตามลำดับ สารช่วยผสม ESO ยังช่วยปรับปรุงโครงสร้างสัณฐานวิทยาของวัสดุเทอร์โมพลาสติกยางวัลคาไนซ์โดยทำให้ยางกระจายตัวเป็นอนุภาคนาขนาดเล็กประมาณ 1 ไมครอน อยู่ในเฟสของเทอร์โมพลาสติกด้วย

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