

**CATALYTIC PYROLYSIS OF WASTE TIRE USING COBALT- AND IRON-
MODIFIED CATALYSTS**

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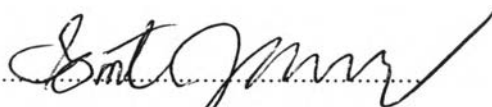
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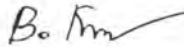
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ABSTRACT

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Pyrolysis of waste tire not only an alternative technique to handle waste tire problem, but also can recover worthy products such as petrochemicals, and light olefins, for examples, from waste tire. In order to increase the value of pyrolysis products, a catalyst is used in this process. In this work, the effects of Fe- and Co-modified catalysts on waste tire-derived products were studied. 5 wt.% Co and Fe supported on different zeolites; namely, HMOR, HBeta, HZSM-5, and KL, were tested for waste tire pyrolysis. The results showed that using both Fe-loaded catalysts and Co-loaded catalysts can enhance the production of valuable hydrocarbons, which are benzene, toluene, xylenes, styrene, cumene, and cyclohexane, except 5%Co/HBeta and 5%Fe/HBeta. In addition, 5%Fe/HMOR was the best catalyst for producing benzene, xylenes and cyclohexane. 5%Fe/HZSM-5 produced the highest yield of cumene, 5%Co/KL produced the highest yield of toluene, and HBeta can be used to produce ethylbenzene. Moreover, Fe-loaded catalysts gave a higher amount of total petrochemicals than Co-loaded catalysts. It can be concluded that Fe-loaded catalysts exhibited a better petrochemical production than Co-loaded catalysts. In addition, sulfur content in oils was reduced with using all catalysts. Namely, sulfur in oils was reduced with using pure zeolites, and further reduced with using both Co-loaded catalysts and Fe-loaded catalysts. Furthermore, the lowest sulfur in oil (0.728 wt.%) was achieved from using 5%Fe/HZSM-5.

บทคัดย่อ

สุทธิพงษ์ หมื่นพล: การปรับปรุงตัวเร่งปฏิกิริยา โคบอลต์และไอรอนในปฏิกิริยาไพโรไลซิสยางรถยนต์หมดสภาพ (Catalytic Pyrolysis of Waste Tire Using Co- and Fe-modified Catalysts) อ. ที่ปรึกษา : รศ. ดร. ศิริรัตน์ จิตการคำ 117 หน้า

กระบวนการไพโรไลซิสยางรถยนต์เสื่อมสภาพเป็นทางเลือกหนึ่งที่ใช้ในการจัดการกับปัญหาขยะยางรถยนต์ นอกจากนี้ทำให้ได้ผลิตภัณฑ์ที่มีมูลค่ากลับมาใช้ใหม่ เช่น สารปิโตรเคมีและสารโอเลฟิน ในงานวิจัยนี้เป็นการศึกษาผลกระทบที่เกิดจากการปรับปรุงตัวเร่งปฏิกิริยาโคบอลต์และไอรอน ต่อผลิตภัณฑ์ที่เกิดจากปฏิกิริยาไพโรไลซิสยางรถยนต์หมดสภาพโดยใช้โลหะโคบอลต์ และโลหะไอรอนปริมาณร้อยละ 5 โดยน้ำหนัก บนซีโอไลต์ชนิดต่างๆ ได้แก่ เอชเมอร์, เอชเบต้า, เอชซีเอสเอ็มไฟว์ และ เคเอล ผลการทดลองพบว่า การปรับปรุงตัวเร่งปฏิกิริยาไอรอนและโคบอลต์ทุกตัว ยกเว้น โคบอลต์บนซีโอไลต์ชนิดเอชเบต้าและไอรอนบนซีโอไลต์ชนิดเอชเบต้า นั้นสามารถเพิ่มการผลิตสารไฮโดรคาร์บอนที่มีมูลค่าได้เพิ่มขึ้นซึ่งได้แก่ เบนซีน, โทลูอีน, ไซลีน, สไตรีน, คิวมีน และ ไซโคลเฮกเซน นอกจากนี้ยังพบว่าตัวเร่งปฏิกิริยาไอรอนบนซีโอไลต์ชนิด เอชซีเอสเอ็มไฟว์สามารถใช้ผลิตเบนซีน, ไซลีน และ ไซโคลเฮกเซน ได้ในปริมาณสูงที่สุด ตัวเร่งปฏิกิริยาไอรอนบนซีโอไลต์ชนิดเอชซีเอสเอ็มไฟว์สามารถใช้ผลิตคิวมีนได้สูงที่สุด ตัวเร่งปฏิกิริยาโคบอลต์บนซีโอไลต์ชนิดเคเอลสามารถผลิต โทลูอีนในปริมาณสูงที่สุด และซีโอไลต์ชนิดเอชเบต้าผลิตเอทิลเบนซีนได้มากที่สุด แต่โดยรวมพบว่าการใช้ตัวเร่งปฏิกิริยาที่ปรับปรุงตัวด้วยไอรอนสามารถใช้ผลิตสารปิโตรเคมีได้อย่างมีประสิทธิภาพมากกว่าการใช้ตัวเร่งปฏิกิริยาที่ปรับปรุงด้วยโคบอลต์ นอกจากนี้ยังพบอีกว่าปริมาณกำมะถันในน้ำมันลดลงเมื่อใช้ตัวเร่งปฏิกิริยาในทุกกรณี โดยเมื่อใช้ซีโอไลต์พบว่าปริมาณกำมะถันในน้ำมันลดลง และลดลงมากขึ้นเมื่อใช้ตัวเร่งปฏิกิริยาจากการปรับปรุงตัวเร่งปฏิกิริยาโคบอลต์และไอรอน โดยตัวเร่งปฏิกิริยาไอรอนบนซีโอไลต์ชนิดเอชซีเอสเอ็มไฟว์สามารถปริมาณกำมะถันในน้ำมันได้มากที่สุด

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