

สมบัติการไหลและเสถียรภาพของเชื้อเพลิงผสมถ่านหินกับน้ำมันเตา



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วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิศวกรรมศาสตรมหาบัณฑิต

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สมนึก จีระธัญญาสกุล : สมบัติการไหลและเสถียรภาพของเชื้อเพลิงผสมถ่านหินกับน้ำมัน เคา (RHEOLOGICAL PROPERTY AND STABILITY OF COAL-OIL MIXTURE FUEL) อ.ที่ปรึกษา : รศ.ดร.ภัทรพรหม ประศาสน์สารกิจ, รศ.ดร.สมชาย ไอลสุวรรณ, 117 หน้า.

เทคโนโลยีเชื้อเพลิงผสมถ่านหินกับน้ำมัน เคา (COM) ได้พัฒนาขึ้นเพื่อให้ทดแทนน้ำมัน เคา ในอุปกรณ์การเผาไหม้ที่ใช้น้ำมัน เคา เป็นเชื้อเพลิง สมบัติของเชื้อเพลิงผสมขึ้นอยู่กับลักษณะของถ่านหินและของเหลว งานวิจัยนี้เป็นการศึกษาสมบัติการไหลและเสถียรภาพของเชื้อเพลิงผสมถ่านหินกับน้ำมัน เคา โดยใช้ถ่านหินในประเทศประเภทซบิซิมินัส และบิซิมินัส ส่วนน้ำมัน เคา ใช้น้ำมัน เคา เบาเบอร์ 1 และน้ำมัน เคาหนักเบอร์ 6 ตัวแปรที่ทำการศึกษาคือ ความเข้มข้นของถ่านหิน (10-50%) ชนิดของถ่านหินและน้ำมัน เคา อุณหภูมิ (40-80 °C) ขนาดอนุภาคถ่านหิน (-75, 75-90 และ 90-106 ไมครอน) และชนิดของตัวเติม

พฤติกรรมของเชื้อเพลิงผสมแบ่งเป็นสองลักษณะ โดยแสดงพฤติกรรมของไหลแบบนิวโตเนียนที่ความเข้มข้นของถ่านหินต่ำ ส่วนที่ความเข้มข้นของถ่านหินสูงมีพฤติกรรมแบบบิงแฮมพลาสติก ค่าความเค้นครากของเชื้อเพลิงผสมแตกต่างกันไปตามชนิดของถ่านหินและชนิดของน้ำมัน เคา สำหรับความหนืดพบว่ามีค่าเพิ่มขึ้น เมื่อความเข้มข้นของถ่านหิน เพิ่มขึ้นหรือ ใช้น้ำมัน เคาที่มีความหนืดสูงขึ้น ตลอดจนการใช้ขนาดถ่านหิน เล็กกลงทำให้ความหนืดของเชื้อเพลิงผสมเพิ่มขึ้น การเพิ่มของอุณหภูมิทำให้ความหนืดลดลงได้

ในการศึกษาเสถียรภาพของเชื้อเพลิงโดยเทคนิคการตกตะกอน เชื้อเพลิงผสมของ 25% ของถ่านหินบ้านปูและ 2% ตัวเติมเอทโธมิน C-20 ผสมในน้ำมัน เคา เบาเบอร์ 1 และใช้ 30% ถ่านหินบ้านปูและ 1% ตัวเติมเอทโธมิน C-20 ผสมในน้ำมัน เคาหนักเบอร์ 6 มีค่าอัตราส่วนการนอนกัน 0.61 และ 0.49 ตามลำดับ ผลการทดลองแสดงว่าเสถียรภาพของเชื้อเพลิงผสมอยู่ในรูปของโครงข่ายและมีการนอนกันแบบหลวม ๆ และตัวเติมแบบแคดอออนทำให้ระบบมีเสถียรภาพกว่าตัว เติมชนิดอื่น

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SOMNUK GEERATHUNYASKOOL : RHEOLOGICAL PROPERTY AND STABILITY OF COAL-OIL MIXTURE FUEL. THESIS ADVISOR : ASSO.PROF.PATTARAPAN PRASASSARAKICH, Ph.D., ASSO.PROF.SOMCHAI OSUWAN, Ph.D., 117 PP.

Coal-Oil Mixture (COM) has been developed with the potential for substitution of fuel oil in the combustion equipment designed for fuel oil. The COM properties are strongly dependent on the characteristics of coal and the medium of suspensions. The rheological properties and stability of COM have been studied using subbituminous and bituminous coals in Thailand, light #1 fuel oil and heavy #6 fuel oil. Variables investigated are coal concentrations (10-50%), coal types, fuel oil types, temperature (40-80°C), particle size distribution (-75, 75-90 and 90-106 microns) and additive types.

The COM is classified as a Newtonian fluid at low coal concentration and Bingham plastic model at high coal concentrations and had different yield stress for various types of coal and fuel oil. The COM viscosity is found to increase with coal concentration, increasing fuel oil viscosity, coal fineness and decreasing temperature.

In the study of COM stability using a sedimentation column, sedimentation ratio from the settling behavior of 25 wt% Ban Pu coal with 2 wt% Ethomeen C-20 in LFO and 30 wt% Ban Pu coal with 1 wt% Ethomeen C-20 in HFO are 0.61 and 0.49 respectively. This result led to interpretation of COM stability in terms of network stability rather than classical isolated colloidal particle stability. The screening shows that cationic additives are the most effective additives.

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