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**LABORATORY STUDY ON METAL CORROSION
BY DIMETHYLMERCURY**

Mister Aran Wasantakorn

**A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Science**

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พิมพ์ต้นฉบับบทคัดย่อวิทยานิพนธ์ภายในกรอบสี่เหลี่ยมนี้เพียงแผ่นเดียว

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ปรอทไดเมทิลเป็นสารปรอทอินทรีย์ตัวหนึ่งที่เกิดร่วมกับโลหะปรอทในก๊าซธรรมชาติ ซึ่งได้มีการรายงานเกี่ยวกับโลหะปรอทอยู่เนืองๆ ว่าเป็นตัวการของการกัดกร่อนท่อลำเลียงและอุปกรณ์ผลิตก๊าซธรรมชาติ อาทิ เช่น เครื่องแลกเปลี่ยนความร้อนอลูมิเนียม เป็นต้น ดังนั้น การวิจัยนี้จึงมุ่งทำการศึกษาการกัดกร่อนโลหะเหล็กกล้าคาร์บอนและอลูมิเนียมในห้องปฏิบัติการด้วยสารปรอทไดเมทิล เพื่อตรวจสอบอัตราการกัดกร่อนและรูปแบบการกัดกร่อนที่ปรากฏ โดยใช้เมธานอลสัมบูรณ์และปิโตรเลียมอีเทอร์ที่มีจุดเดือด 80° - 100° ๕ เป็นตัวทำละลายปรอทไดเมทิลเพื่อเตรียมสารละลายกัดกร่อน ผลการทดลองพบว่า หลังจากแช่แผ่นโลหะทดสอบทั้งสองชนิดในสารละลายกัดกร่อนดังกล่าวนานกว่า 700 ชั่วโมง สารละลายปรอทไดเมทิลในเมธานอลกัดกร่อนอลูมิเนียมได้มากกว่าเหล็กกล้าประมาณ 9 เท่าที่อุณหภูมิปกติ และให้อัตราการกัดกร่อนสูงกว่าสารละลายที่มีปิโตรเลียมอีเทอร์เป็นตัวทำละลายโดยเฉพาะโลหะอลูมิเนียม ส่วนรูปแบบการกัดกร่อนที่ปรากฏมีลักษณะเป็นการกัดกร่อนแบบสม่ำเสมอทั่วผิวหน้า (uniform corrosion) โดยที่ลักษณะปรากฏบนแผ่นอลูมิเนียมจะเด่นชัดกว่าของเหล็กกล้า

การเติมกรดเกลือลงในสารละลายกัดกร่อนปรอทไดเมทิลในอัตราส่วนความเข้มข้นของกรดต่อความเข้มข้นของปรอทไดเมทิลเป็น 1:1 จะให้อัตราการกัดกร่อนโลหะเพิ่มขึ้นสูงมาก โดยเฉพาะในกรณีของสารละลายปรอทไดเมทิลในเมธานอลจะให้อัตราการกัดกร่อนอลูมิเนียมสูงอย่างมหาศาลถึง 746 มิลลิกรัม/ตารางเดซิเมตร/วัน ซึ่งสูงกว่าการกัดกร่อนโดยสารละลายกัดกร่อนปรอทไดเมทิลที่ไม่เติมกรดถึง 700 เท่า และสูงกว่าการกัดกร่อนของสารละลายกรดเกลือในเมธานอลประมาณ 40 เท่า การเติมกรดเพียงเล็กน้อยจะช่วยเพิ่มศักยภาพการกัดกร่อนโลหะของสารปรอทไดเมทิลได้อย่างน่ากลัว การเติมก๊าซไฮโดรเจนซัลไฟด์ (H_2S) แทนที่กรดเกลือในสารละลาย จะได้ผลของอัตราการกัดกร่อนโลหะใกล้เคียงกับผลที่ได้จากการเติมกรดเกลือมาก ทั้งนี้เนื่องจากกรดเกลือหรือไฮโดรเจนซัลไฟด์ไปแตกพันธะระหว่างคาร์บอนกับเมอร์คิวรีในโมเลกุลของปรอทไดเมทิลทำให้เกิดเกลืออินทรีย์ของปรอทซึ่งสามารถกัดกร่อนโลหะต่าง ๆ ได้ดี โดยเฉพาะโลหะอลูมิเนียม

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ปีการศึกษา ๒๕๓๗

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As discovered dimethylmercury (DMM) is also one of organomercury compounds in natural gas, and the mercury metal is well known to drastically corrode natural gas pipelines and other accessories made from metal, such as aluminium heat exchanger. The objective of this work is thus to study the effect of the dimethylmercury compound on the corrosion of carbon steel and aluminium metal in the laboratory. Furthermore, rate and form of corrosion are also investigated as well.

Absolute methanol and petroleum ether with the boiling point in the range of 80-100°C were chosen as solvents to dissolve dimethylmercury. The results showed that after immersing carbon steel and aluminium specimens in the dimethylmercury solution for more than 700 h. at ambient temperature, aluminium specimens were remarkably corroded as compared to carbon steel, 9 times stronger, and the corrosion rate of aluminium specimens was also higher in the petroleum ether media. Corrosion appearance was rather in the uniform corrosion for both types of specimens even though aluminium seemed to show more obvious. Adding trace amount of HCl or H₂S into the corrosive solution enhanced corrosion potential of dimethylmercury on metal remarkably, about 700 times higher than ones containing dimethylmercury solution without acid, and about 40 times higher than ones containing acid solution, but without dimethylmercury in the system. Especially in the case of aluminium specimens immersed in the dimethylmercury solution, the rate was rather frightening, 746 mg/sq.decimeter/day. The reason for this remarkable increase of the corrosion rate is that the acid molecule could break the bond between mercury and methyl group in the dimethylmercury to form inorganic salt which could then corrode metal easily, especially aluminium metal.

ภาควิชา..... สหสาขาวิชาปิโตรเคมี - โพลีเมอร์

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ศูนย์วิทยาศาสตร์
จุฬาลงกรณ์มหาวิทยาลัย

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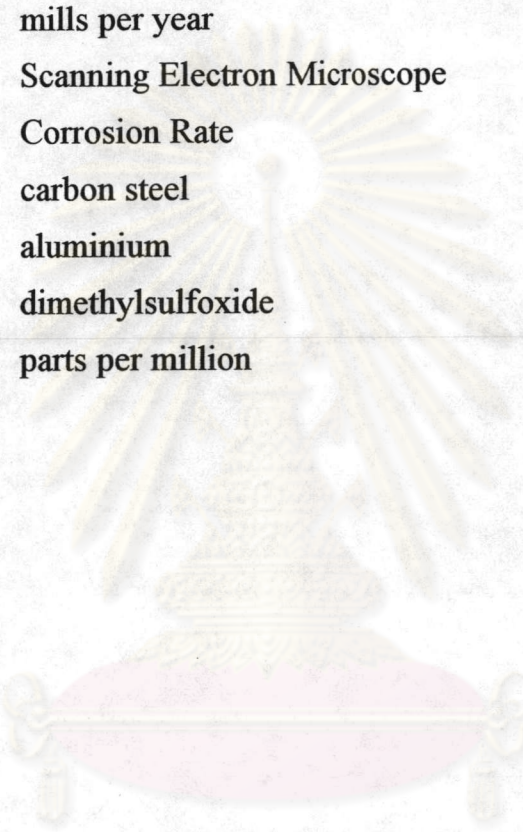
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ABBREVIATIONS

DMM	=	dimethylmercury
PE	=	petroleum ether
mdd	=	milligrams per sq. decimetre per day
mpy	=	mills per year
SEM	=	Scanning Electron Microscope
C.R.	=	Corrosion Rate
CS	=	carbon steel
Al	=	aluminium
DMSO	=	dimethylsulfoxide
ppm	=	parts per million



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