

PREDICTION OF GASOLINE EMISSION

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A Thesis Submitted in Partial Fulfilment of the Requirements
for the Degree of Master of Science
The Petroleum and Petrochemical College, Chulalongkorn University
in Academic Partnership with
The University of Michigan, The University of Oklahoma,
and Case Western Reserve University

2000

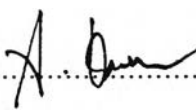
ISBN 974-334-149-8

- 5 31.81 2545


I 1935 9020

Thesis Title : Prediction of Gasoline Emission
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ดาวิน กุศลรยาวิวัฒน์ : การคาดคะเนการปลดปล่อยของไอน้ำมัน(Prediction of Gasoline Emission) อ. ที่ปรึกษา : รศ. ดร. สุเมธ ชวเดช อ. ดร. ปราโมช รั้งสรรพวิจิตร และ ดร. ธวัช ฉัตรชู-พงศ์ 67 หน้า ISBN 974-334-149-8

วัตถุประสงค์ของงานวิจัยนี้ เพื่อศึกษาการปลดปล่อยของไอน้ำมันจากถังเก็บ และ ประเมินแบบจำลองที่สามารถใช้คาดคะเนการปลดปล่อยนี้ ในการทดลองนี้ใช้น้ำมันไร้สารตะกั่ว มีค่าออกเทน 95 ถังเก็บจำลองทำด้วยแก้วมีเส้นผ่านศูนย์กลางภายนอก 8 ± 0.5 เซนติเมตร ความสูง 10 ± 0.5 เซนติเมตร และปริมาตร 410 ± 15 มิลลิเมตร ถังเก็บมีท่อระบายซึ่งมีเส้นผ่านศูนย์กลางภายใน 0.5 เซนติเมตร และเปลี่ยนความสูงได้จาก 15, 30 และ 45 เซนติเมตร ผลจากการทดลองแสดงให้เห็นถึงปริมาณการปลดปล่อยของน้ำมันเพิ่มขึ้นเมื่อเพิ่มอุณหภูมิและความสูงของท่อระบายลดลง ปริมาณน้ำมันเริ่มต้นในถังเก็บมีผลกระทบน้อยมากต่อการปลดปล่อยของน้ำมัน พื้นฐานของแบบจำลองที่เสนอในงานวิจัยนี้ประกอบด้วย การแพร่ของไอน้ำมัน, การขยายตัวของน้ำมัน และการขยายตัวของไอของน้ำมัน การคาดคะเนจากแบบจำลองในงานวิจัยนี้ให้ผลที่สอดคล้องด้วยดีกับข้อมูลที่ได้จากการทดลองเมื่อเปรียบเทียบกับแบบจำลองอื่นที่ได้รับการยอมรับ

ABSTRACT

4171027063: PETROCHEMICAL TECHNOLOGY PROGRAM

KEYWORD: Prediction / Gasoline / Emission

Sawin Kulchanyavivat : Prediction of Gasoline Emission.
Thesis Advisors : Assoc. Prof. Sumaeth Chavadej, Dr. Pramoch Rangsunvigit and Dr. Thawach Chatchupong, 67 pp, ISBN 974-334-149-8

The purpose of this study was to investigate the emission of gasoline vapor from storage tanks and to evaluate the best model that can be used to predict this emission. Unleaded gasoline with 95 octane number was used in this experiment. In this experimental study, a simulated storage tank was made of glass with 8 ± 0.5 cm outside diameter, 10 ± 0.5 cm in height and 410 ± 15 ml in volume. It had a release vent tube having 0.5 cm inside diameter and variable height from 15, 30 and 45cm. The experimental results showed that the amount of gasoline emission increased with increasing temperature and decreasing vent height. Initial gasoline volume had very little effect on the gasoline emission rate. The model proposed in this work was derived by recognizing that the emission consists of diffusion, liquid expansion and vapor expansion of gasoline. The predictions from the model gave exceptionally good agreement with the experimental data in comparison with two well-known published models.

ACKNOWLEDGEMENTS

This research could not be completed without contribution from many supporters who had strongly influence on this work over the past two years.

A lot of worth suggestion, knowledge including many necessary facilities were provided by Assoc. Prof. Dr. Sumaeth Chavadej, thesis advisor.

Dr. Pramoch Rangsunvigit, thesis co-advisor, gave strong assistance during the beginning of the experimental and modeling work, plus useful suggestion.

Dr. Thawach Chatchupong, thesis co-advisor, who provided necessary data and information related to this work.

Moreover, the author would like to thank the National Energy Policy Office, Department of Land Transport, Department of Pollution Control and Department of Public and Municipal Works for some useful information for this work also the Petroleum Authority of Thailand (PTT) for the unleaded gasoline used in the experiment.

Finally, I would like to thank all my friends, also the staff of the Petroleum and Petrochemical College for their assistance. Furthermore, special thanks goes to my family for the encouragement throughout my study.

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LIST OF SYMBOLS

A	=	vent cross-sectional area
D	=	tank diameter
D_G	=	molar diffusivity of gasoline to air
D_W	=	molar diffusivity of water to air
H_{VO}	=	vapor space outage
I	=	daily total solar insolation factor
J_{AZ}	=	molar flux of component A in z direction
K_E	=	vapor space expansion factor
K_S	=	vented vapor saturation factor
L_D	=	loss from diffusion
L_{LE}	=	losses from liquid expansion
L_{VE}	=	loss from vapor expansion
L_S	=	standing storage loss
M_A	=	molecular weight of air
M_V	=	vapor molecular weight
M_G	=	molecular weight of gasoline
M_W	=	molecular weight of water
P_A	=	atmospheric pressure
P_{BP}	=	breather vent pressure setting
P_{BV}	=	breather vent vacuum setting
P_{VA}	=	true vapor pressure
P_{VN}	=	vapor pressure at minimum liquid temperature
P_{VX}	=	vapor pressure at maximum liquid temperature
ΔP_B	=	breather vent pressure setting range
ΔP_V	=	daily vapor pressure range
R	=	the ideal gas constant

T_{AA}	=	daily average ambient temperature
T_{AN}	=	daily minimum ambient temperature
T_{AX}	=	daily maximum ambient temperature
T_B	=	liquid bulk temperature
T_{LA}	=	daily average liquid surface temperature
ΔT_A	=	daily ambient temperature range
ΔT_V	=	daily temperature range
V_L	=	volume of liquid gasoline
V_V	=	vapor space volume
W_V	=	vapor density
$y_{gasoline\ final}$	=	final vapor mole fraction of gasoline
$y_{gasoline\ initial}$	=	initial vapor mole fraction of gasoline
Δz	=	vent height
α	=	thermal expansion coefficient
α_A	=	tank paint solar absorbance
α_L	=	liquid expansion coefficient
α_V	=	vapor expansion coefficient
Σv_A	=	group contribution value for air
Σv_W	=	group contribution value for water