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Effect Of Napthalene Mixture with Gasoline Fuel on Gasoline Engine Performance

Yuniarto Agus Winoko[1], Afifur Rohman [2]
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***Abstract*— Naphthalene is a chemical hydrocarbon compound with the chemical formula C10H16O. Napthalene is a simple polycyclic aromatic hydrocarbon compound, in the form of a white crystalline solid with a characteristic odor and detectable by the sense of smell at concentrations as low as 0.08 ppm. As an aromatic compound, napthalene's structure consists of a pair of linked arene groups or benzene rings. Objective: To determine the ratio of the power produced by a gasoline engine using a mixture of naphthalene with 90 fuel compared to the use of pure fuel in the engine. Knowing the effect of exhaust emissions produced by gasoline engines using 90 octane fuel, with a mixture of naphthalene and without a mixture of naphthalene. The method used in this study was experimental, tested only with pertalite fuel, Pertamax and added camphor (Napthalene) consisting of 5gr, 10gr, 15gr with 2lt volume of 90 octane fuel fuel. The conclusion is expected that the addition of napthalene has an effect on power and exhaust emissions.**

Keywords—Naphthalene, Octane 90, power and exhaust emissions

I. Introduction

Naphthalene is an organic compound that is often added to fuel oil. The addition of naphthalene to fuel can improve combustion quality and reduce exhaust emissions. Fuel types, such as 90 octane, affect engine performance, efficiency and exhaust emissions. The octane scale measures a fuel's ability to prevent engine knocking.

To get perfect combustion by improving the fuel composition, of course, this condition improves engine performance as well. One way to increase the octane rating of the fuel is by mixing napthalene ($C_{10}H_{16}0$) in powder form into the fuel until it dissolves. Napthalen has chemical properties with the formula phthalic anhydride and Maleic Anhydride molecule C8H4O3 and physical properties with the molecular formula C10H8, molecular weight 128.16 gram/mol, physical form Crystalline solid, white color, melting point 80.2 oC, boiling point 217.9 oC, density (25 oC) 1.175 gram/ml or (90 oC) 0.97021 gram/ml, viscosity (80.3 oC) 0.96 cp or (90 oC) 0.846 cp.

Knocking on the engine is the effect of incomplete combustion in the engine's combustion chamber and greatly affects the efficiency of the engine. Knocking occurs because the quality of the gasoline is low or the mixing of the fuel is not ideal. So for optimal fuel you can mix gasoline with naphthalene. Where Naphthalene can increase the octane number so that the combustion process is more perfect, so that naphthalene can be used to save fuel oil and improve engine performance.

Based on previous research which stated that the use of 90 octane fuel mixed with napthalene the octane value produced in peremium was from 88 to 90, the addition of napthalene to exhaust emissions the higher the octane value contained in the fuel, the ignition must also be higher. early so that the process of burning fuel and air can be close to perfect, while the exhaust emissions make it clear that the concentration of CO is directly proportional to the mixture of fuel and air inhaled so that the concentration of CO will decrease because the oxygen coming from the air is sufficient to fulfill the reaction with carbon to form CO2

Naphthalene is a white crystalline, volatile solid with a camphor odor. It sublimes at room temperature (the transition of a substance directly from the solid to the gaseous phase). Naphthalene is insoluble in water and soluble in benzene, absolute alcohol, ether, carbon tetrachloride, carbon disulfide, hydronaphthalene, and in fixed and essential oils. Naphthalene is produced from the distillation of petroleum and the distillation of coal tar. It is used as a chemical intermediate in the production of phthalic anhydride, naphthol, and chlorinated naphthalene. It is also used in smokeless powders, cutting fluids, lubricants, antiseptics, synthetic resins, tanning products, preservatives, textile chemicals, emulsifiers, and shine counters. It is also found in combustion processes including burning waste, tobacco smoke, coal tar smoke, and oil spills.

Power is the work produced by a machine per unit of time in an experiment which can be formulated as follows:

$P=(2.\pi.n.T)/60000$

Where: p = power (Kw)

n= engine speed (rpm) T= torque moment (N.m)

Meanwhile, to measure the power (Hp) as follows:

$P=(T.n)/5252$

Where: p = power (Hp)

n= engine speed (Rpm) T= torque moment (lbs.ft)

Yuniarto Agus Winoko is with Departement of Mechanical Engineering, State Polytechnic of Malang, Malang, 65141, Indonesia. E-mail: dhimazyuni@gmail.com

Afifur Rohman is with Departement of Mechanical Engineering, State Polytechnic of Malang, Malang, 65141, Indonesia.
E-mail: Afifur58@gmail.com

Characteristics	Unit	Min Limit	Max Limit
research octane number(RON)	RON	90.0	-
oxidation stability	Menit	360	-
sulfur content	% m/m	-	0.05[2)]
lead content (Pb)	g/l	-	0.002[2)]
phosphorus content	mg/l	-	-
metal content(Mn, Fe, dll)	mg/l	-	-
silicon content	mg/kg	-	-
oxygen content	% m/m	-	2.7
aromatic content	% v/v	-	-
benzene content	% v/v	-	-
Distilasi:			
10% evaporation volume	°C	-	74
50% evaporation volume	°C	77	125
90% evaporation volume	°C	130	180
Residue Final Boiling Point	°C	-	215
	% vol	-	2.0
sediment	mg/l	-	1
vapor pressure	kPa	45	70
density	kg/m^3	715	770

Octane 90 Fuel is a non-subsidized liquid fuel to replace 90 octane fuel because the government only allows the use of premium fuel for the lower middle class, with this fuel replacement not only is the price more expensive than 90 octane, but octane and other advantages Other advantages allow Pertalite itself to be greenish in color with an octane rating of 90, a sulfur content of 0.05% m/m (500ppm equivalent) and a maximum specific gravity of 770kg/m3 of at least 715kg/m3 (15oc). has compression ranging from 9.1: 1 to 10.1: 1, especially vehicles that already use electronic fuel injection technology (Directorate General of Oil and Gas.

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II. METHOD

Mix pertalite fuel with naphthalene, Fill the measuring cup with pure pertalite fuel and pertalite with naphthalene mixture, Turn on the engine, Wait for a while (about 5 minutes), so that the engine heats up, Stabilize engine rotation, Turn on the stopwatch, Wait until the fuel is in in the measuring cup down by 10 ml, Record the time needed to spend 10 ml of fuel, and record the exhaust emissions, Reduce steps 5 to step 7 by 2 times, Wait a while until the engine speed stabilizes, Perform procedures such as steps 5 to with step 8, and repeating the test above using pertalite mixed with naphthalene 5gr, 10gr, 15gr.

III. Results and Discussion

At 4000 rpm engine speed for the lowest power, which is in a 10 gram mixture with a value of 1 Hp, then for the highest rotation, it is in a 0 gram (pure) mixture with a power value of 1.7 Hp, from this power value the difference is obtained from the Power value lowest to highest is 0.7 Hp. At 4500 rpm the lowest power is in a 5 gram mixture with a value of 1.4 Hp, then for the highest rotation it is in a 10 gram and 15 gram mixture with a power value of 2.4 Hp, from this power value the difference is obtained from Power value lowest to highest is 1 Hp. At 5000 rpm engine speed, the lowest power is in a 5 gram mixture with a value of 2.4 Hp, then for the highest rotation, it is in a 15 gram mixture with a power value of 2.9 Hp, from this power value the difference is obtained from the lowest power value to the highest is 0.5 Hp. . At 5500 rpm engine speed for the lowest power, which is in a mixture of 5 grams and 10 grams with a value of 3.2 Hp, then for the highest rotation, which is in a mixture of 15 grams with a power value of 3.4 Hp, from this power value the difference is obtained from lowest to highest Power value is 0.2 Hp. . At 6000 rpm engine speed for the lowest power, namely in a mixture of 0 grams (pure) with a value of 4.1 Hp, then for the highest rotation, it is in a mixture of 10 grams with a power value of 5 Hp, from this power value the difference is obtained from the Power value lowest to highest is 0.9 Hp. . At engine speed of 6500 rpm the lowest power is in a mixture of 0 grams with a value of 6.4 Hp, then for the highest rotation it is in a mixture of 10 grams with a power value of 7.1 Hp, from this power value the difference is obtained from the lowest power value to the highest is 0.7 Hp. . At 7000 rpm engine speed for the lowest power, namely in a mixture of 0 grams (pure) and 5 grams with a value of 8.5 Hp, then for the highest rotation, namely in a mixture of 15 grams with a power value of 8.7 Hp, from this power value the difference obtained from the lowest power value to the highest is 0.2 Hp. . At 7500 rpm the lowest power is in a 10 gram mixture with a value of 9.3 Hp, then for the highest rotation it is in a mixture of 0 grams (pure), 5 grams and 15 grams with a power value of 9.4 Hp, from a value the power difference obtained from the lowest power value to the highest is 0.1 hp. At 8000 rpm engine speed obtained the same power value.

AVERAGE POWER (HP)

ENGINE ROTATION (RPM)	pure 90 octane	5gram	10gram	15gram
4000	1.7	1.1	1	1.2
4500	1.9	1.4	2.4	2.4
5000	2.6	2.4	2.8	2.9
5500	3.3	3.2	3.2	3.4
6000	4.1	4.3	5	4.6
6500	6.4	6.6	7.1	6.8
7000	8.5	8.5	8.6	8.7
7500	9.4	9.4	9.3	9.4
8000	10.2	10.2	10.2	10.2

IV. Conclusion

From the graphic images that have been obtained, it shows that the higher the engine speed (rpm), the greater the power produced, then what causes the different power values is the ratio of 90 octane fuel to the napthalene mixture. The lowest power is at 4000 rpm with 10 grams of napthalene mixture and the highest power is at 8000 rpm with the presence or absence of 5 grams, 10 grams and 15 grams of napthalene mixture. This shows that the addition of napthalene to 90 octane fuel will not produce the same Power value every rotation until 8000 rpm produces the same Power.

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