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Corrosion in Fuel System Component Material by Premium Fuel Mixed with Bioethanol

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Abstract—This research to decide how much percentage of bioethanol in the corrosion, the influence of long corrosion rate, and the resulting corrosion product. The corrosion method used in this study is the immersion method using a premium fuel solution mixed with bioethanol. The data in question are. Corrosion weight with multiple linear regression. The composition of the immersion solution was examined with the XRF analyzer. The corrosion process occurs first on the fuel composition of P80-E20, P15-E85, P50-E50 in comparison to the fuel composition of P100, and E100. The highest average value of corrosion rate of carbon steel material was 188,347 mpy at E100-P0 immersion solution. The highest average value of corrosion rate of stainless steel material is 20,738 mpy in P15-E85 immersion solution. The highest mean value of corrosion rate of brass material was 55,019 mpy in P50-E50 immersion solution. Corrosion occurs due to the oxidation process of metal elements in the test material. Element content of Fe in material of carbon steel 98,152% decrease abortion 18,175% after the immersion, the stainless steel material element content of Fe at 17,346% decrease abortion 5,706%, and Cu element in abortion materials brass amounted to 67,034% decrease after immersion to 46,394% was increased , The resulting corrosion product is uniformly corroded.
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Index Terms— Bioethanol as a premium fuel mix, fuel tank and fuel pump, thorough corrosion

1 Introduction

All Biofuels are being promoted globally as an alternative source of energy for fossil fuels in transportation applications in line with global policies to reduce greenhouse gas emissions and consumption of crude oil. Among the available biofuels, bioethanol is an attractive option with a huge resource advantage for production, the process of simple manufacturing techniques, without having to build a new infrastructure [1].

Bioethanol is one of the energy sources of the future. Simple, cost-effective processing and relatively short production times make bioethanol the replacement solution for fossil fuels. Bioethanol is made from a variety of raw materials and widely used bioethanol raw materials such as hide, manioc skin and banana peel. Raw materials are derived from plants that grow a lot in Indonesia, which can be long term.

Bioethanol is a fuel with hygroscopic properties that absorbs water from the atmosphere. This results in bioethanol being corrosive. The use of bioethanol fuel as an additive fuel in automobiles has advantages, namely, conventional fuel savings and increased octane of fuel. The weakness of bioethanol that is corrosive so that it can degrade material quality especially fuel system material. In another study, the use of 20% bioethanol mixture on premium leads to the corrosion of automotive components. The most susceptible components to corrosion are copper and carbon steel components [2]. Department of Environment Australia and Heritage, explains 20% bioethanol contains 1% water [3].

liquid metal, as a liquid metal stock in the event of shrinkage and feeding for metal fluid to cast products in the event of depreciation. Therefore, the riser size must be well calculated so that enhancer efficiency can be optimized. The purpose of this research is to know the mechanical properties of cast propeller products by using riser, applying the use of riser in order to produce cast without flaw

2 Material And Research Method Material

2.1 Material

The test material is the material component of the fuel system of the gasoline engine, which is the fuel tank, and the fuel pump. Material of carbon steel fuel tank containing Fe 79.95%, stainless steel fuel pump material containing Fe 11.64% and brass containing 20.64% Cu. Material carbon steel formed coupon model with the size of 2 x 1 x 0.5 mm, stainless steel and brass material ring model with a height of 5 mm.

2.2 Research Methodology

Research titled Corrosion Material Fuel System of Bioethanol. Is a study to study the corrosion that occurs in the material components of the fuel system, the tank and fuel pump components due to the use of bioethanol fuel. Tank material formed by the coupon / square model and the fuel pump component material formed by the ring model to obtain the dip treatment in the mixed solution of gasoline and bioethanol. The corrosion analysis was carried out in the form of measuring the weight loss of the sample (weight loss), the measurement of pitting corrosion (pitting factor), the hardness test and the analysis of the chemical content of the immersion solution.

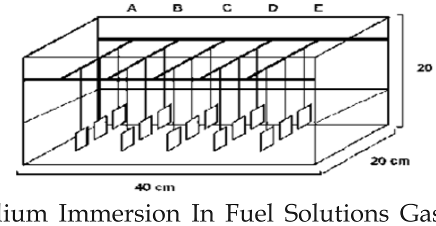

Fig 1. Medium Immersion In Fuel Solutions Gasoline mixed with Bioethanol

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Fig 2. Test materials. Fuel electrical pumps.

Fig 3. Test materials. Fuel tanks.

Fig 4. Electrical pump component material is cut into pieces of the ring model.

Fig 5. Tank material, after forming strip plate model, then cut.

3 Result And Discussion

Bioethanol is a fuel (ethyl alcohol with the chemical formula C_2H_5OH) that is made from biofuels. Bioethanol is a colorless liquid that is not colored when used, does not cause pollution, and when burned, bioethanol produces carbonic acid (carbon dioxide or CO_2) and water. The applicable bioethanol standards (based on premium specifications) refer to ASTM (American Standard Test Materials).

Raw materials for bioethanol production can be obtained from a variety of cassava, corn, wheat (Shorgum) and other such ingredients. Sugar plants such as molasses, coconut palm, palm sugar and the like can also be used as raw materials for bioethanol production. Also cellulose plants like rice straw, onggok (tapioca waste), janggel (tuna).

Metals can corrode bioethanol in a premium fuel solution blended with bioethanol due to the hygroscopic nature of bioethanol. [10]. Bioethanol is a pure compound, so that water can dissolve in every percentage, while the premium consisting of many hydrocarbons has a phase separation against bioethanol. [5].

Mixing ethanol in gasoline has the potential to accelerate corrosion of fuel system components due to increased moisture content and the presence of organic acids. Phase separation of the ethanol-gasoline fuel mixture can result in more aggressive corrosion of metal fuel system components. [3]. In addition, the addition of ethanol to gasoline causes

Oxygen in the gasoline and ethanol mixture causes the solution of first class fuel / gasoline buildup in the form of rubber remnants that clog filter and other fuel system components. Gum is caused by deposits that form on the components of the compounds in the fuel. Gum can also be the result of fuel-soluble E20 on premium fuel. [6]. Gasoline / Premium exposed to oxygen react to form gum (soft resin) [4]. The presence of gumming is not expected as this causes clogging in the fuel channels and increases the corrosion rate of the fuel system.

There are two types of ethanol available on the market according to the water content in ethanol - this is related to the ethanol purification process itself: hydrated (hydrous) alcohol resulting from fermentation and direct distillation of biomass (sugar cane, corn, rice, beets, etc .) has a purity above 94% (± 6.8% water) and anhydrous alcohol is an advanced hydrated alcohol distillation and drying process to achieve a purity of greater than 99.3% (<0.7% water) [8].

Water and ethanol dissolve easily from one another.[10]. The separation phase between gasoline-ethanol depends on the water content in ethanol, the ambient temperature and the chemical composition of gasoline [7].

3.1 Corrosion Rate

The final corrosion rate, carbon steel material with fuel composition P80-E20 value of 4.149 mpy, on the fuel composition P15-E85 value of 4.159 mpy, the composition of fuel P50-E50 value of 4.513 mpy, the composition of fuel P0-E100 value of 66.092 mpy , on the fuel composition P100-E0 value 44,643 mpy.

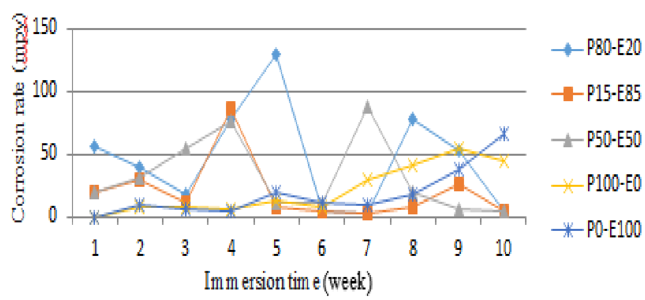

Fig 6. Corrosion rate of soaking time (carbon steel material)

The final corrosion rate on the stainless steel material with the fuel composition and the P80-E20 value of 0.950 mpy on the value of the fuel composition P15-E85 of 0.428 mpy based on the value of the fuel composition P50-E50 of 0.516 mpy on the fuel composition P0-E100 Value 37.148 mpy, on the fuel composition P100-E0 value 40.346 mpy.

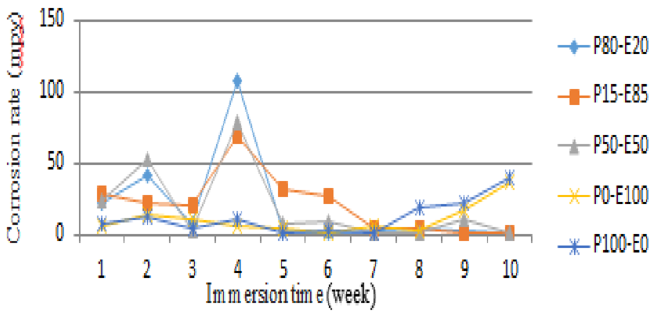

Fig 7. Corrosion rate of soaking time (stainless steel material)

The final corrosion rate on brass material with fuel composition and P80-E20 is 93.828 mpy, for fuel composition P15-E85 value 22.818 mpy, for fuel composition P50-E50 value 87.277 mpy, for a composition of fuel P0-E100 value 80.685 mpy The fuel composition of P100 -E0 is 2,684 mpy.

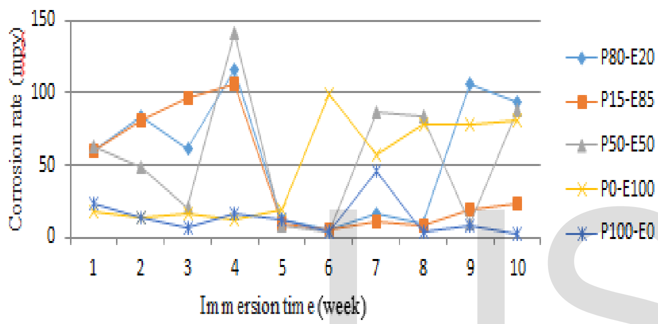

Fig 8. Corrosion rate of soaking time (brass material)

3.2 Corrosion Mechanism

Corrosion occurs due to the oxidation process of metal elements in the test material. Fe content of Fe element in carbon steel material 98.152% decreases its content after immersion 18.175%, in stainless steel material, Fe content decreases from 17.346% to 5.706%, and Cu on brass material content of 67.034% decreases to 46.394% after immersion.

Fig 9. Material carbon steel before immersion.

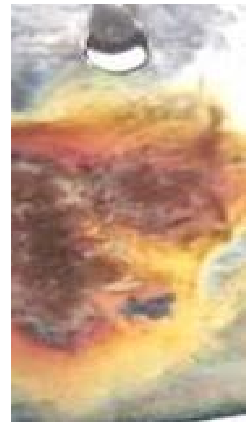

Fig 10. Material carbon steel after immersion.

Fig11. Material stainless steel before immersion.

Fig12. Material stainless steel after immersion.

Fig 13. Material brass before immersion.

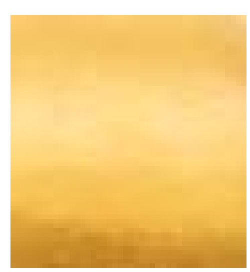

Fig 14. Material brass after immersion.

4 Conclusion

1. corrosion occurs first in an immersion solution with a fuel composition of P80-E20, E85-P15, P50-E50 compared to the fuel composition, P100 and E100
   a) The corrosion rate ends, in C-steel with the composition of the fuel E20 P80 value is 4.149 mpy, the fuel composition P15-E85 4.149 mpy value, the fuel composition P50-E50 value is 4.513 mpy, the fuel composition P0- E100 value 66,092 mpy, on the fuel composition P100-E0 value 44,643 mpy.
   b) the end of the corrosion rate, the stainless steel material with the composition of the fuel and the P80-E20 value is 0.950 mpy, the fuel composition P15-E85 value 0.428 mpy, the fuel composition P50-E50 value is 0.516 mpy, the fuel composition P0- E100 value 37.148 mpy, on the fuel composition P100-E0 value 40.346 mpy
   c) The corrosion rate late material brass with fuel composition and P80-E20 value 93.828 mpy, the fuel composition P15-E85 value 22.818 mpy, the fuel composition P50-E50 value 87.277 mpy, the fuel composition P0-E100 value 80.685 mpy, the fuel composition from P100-E0 is 2,684 mpy.
2. The resulting corrosion product is uniform corrosion.
3. The corrosion caused by the electrochemical process in which the metal is soaked in a solution of gasoline mixture and bioethanol undergoes oxidation and reduction reactions so that the Fe content in carbon steel material 98.152% decreases after immersion to 18.175%, the Fe Element content in 17.346% stainless steel material decreases after immersion to 5.706% and the content of Cu elements in brass material 67.034% decreased after immersion to 46.394%.

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