www.ijiarec.com

ISSN:2348-2079

Volume-6 Issue-1

International Journal of Intellectual Advancements and Research in Engineering Computations

Experimentation and numerical analysis of biofuel applied in automotive fuel tank

Balakrishnan M[1], Murthi M K[2]

[1]PG Scholar, [2]Professor

Department of Mechanical Engineering, Nandha Engineering College,
Erode-52, Tamil Nadu, India.

[1]balamsdan@gmail.com,[2]murthi_mk@rediffmail.com,

Abstract - Modern trends emission control in this automotive world successfully introduced alternative fuels, as a biofuel is getting more significance to replace diesel fuel entirely or moderately. However, big challenge in corrosion of advanced materials in biodiesel is a major concern as this can reduce vehicle efficiency. This research focused to investigate the corrosion deformation of carbon steeled material at 10 different temperatures such as atmospheric temperature, 50 and 60 °C. Stabling absorption tests in pure diesel, biodiesel in 50% diesel, pure biodiesel were carried out for 720hr.past literature only realized techniques was upgraded. At the completion of the tests, corrosion performance quality's was examined by weight loss measurements techniques exposed metal surface. Biofuel's were analyzed by using computational fluid dynamic oxidation analyzer and Microscopic in mandate to investigate the change in acidity and oxidation of fuel respectively upon exposure in different bio fuels inspected phase one. After this proto type Fuel tank unfolded Surface was examined by optical SEM images dispersive Gaping inspecting. Corrosion products were inspecting by SEM techniques also comparing with simulation contour Results monitoring that the corrosion of automotive mild steel material increase of worm heating, the water content and oxidation products are increased or decreased are evaluating our work will processing simulation with the experiment.

Index words - Corrosion, Biofuel, Fuel tank.

I. INTRODUCTION

Currently, fossil fuels are the main resources of energy meeting the world requirements. The fossil-based resources, such as gasoline, petro-diesel and natural gas are limited and insufficient for the future world's energy demands.

II. LITERATURESURVEY

1. B. Singha, John Korstadb, Y.C. et al. [5]reported to the currently designed engines use gasoline or petro diesel as fuel. Alternative fuels such as biodiesel raise the issue of corrosion in CI engine parts that come into contact with the fuel. This review demonstrates that corrosion is higher with biodiesel than petro diesel fuel. The rate of corrosion is influenced by temperature, water content, microbial growth, and type of feedstock used for synthesis of biodiesel. Feedstock with higher concentrations of unsaturated fatty acids has greater oxidation rates. The commonly employed metals such as aluminum, copper, copper alloys, and steel to some extent, were found to be prone to corrosion. Pitting corrosion has been common in the metals that have been tested for their corrosiveness in biodiesel. However, stainless steel was found to be immune to pitting corrosion. Corrosion was found to cause swelling in the elastomers. The polar nature of the elastomers dissolved in the biodiesel caused the corrosion

2. H.B.Shao, J.M.Wang et al. [7]said that the corrosion process of aluminum in biodiesel follows a behavior similar to that encountered when aluminum is exposed to an aqueous or ethanol alkaline solution. The corrosion current density and free corrosion potential change as a function of the purity of the biodiesel. The results also show that the polarization curves and impedance data were strongly affected by the ohmic potential drops from the electrolyte. The electrochemical data provide a quantitative indicator of the biodiesel quality, and they can potentially substitute the ASTM D130 standard. Further work is

being performed with the aim of exploring the potential use of aluminum corrosion measurement as a quality determination of biodiesel.

3. D.F. Aktas, J.S. Lee et al. [8]said that the local current distribution and corrosion on carbon steel in biodiesel due to water contamination was monitored and mapped for the first time using the WBE technique. While most carbon steel electrodes corroded when exposed to ion-containing tap water, the cathodes were mainly formed at the biodiesel–water interface. The anodic current distribution in water showed a positive correlation with the distance from the biodiesel–water interface and the biodiesel concentration gradient in water. With the fast growth of biodiesel industry, these findings from the WBE method offer new ways to characterize the metal corrosion in biodiesel and provide insights in developing corrosion preventionstrategies. The technique can also be used to study the heterogeneous electrochemistry on materials exposed to multiphase systems.

4. Katherine M. Richard et al. [14] said that the global use of biodiesel fuel blends derived from fatty acid methyl esters (FAME) is increasing; driven by legislation derived from political, economic and environmental factors. The presence of FAME biodiesel changes the operating environment of the engine and after treatment devices, affecting the performance characteristics and requirements of the lubricant. As part of a wider research project into the impact of biologically-sourced fuels on crankcase lubricant performance, this paper documents the impact of biodiesel on corrosion-related performance. The effect of FAME biodiesel on lubricant corrosion control and the differences in performance due to FAME source are described. Mechanistic studies into the corrosive nature of FAME are reported. Novel lubricant technologies tailored to control the negative impact of FAME in the crankcase are demonstrated.It has been observed that the corrosion performance of diesel engine oils is negatively affected by the presence of FAME. This behavior is seen across multiple commercial heavy-duty diesel oils. The natural source of the FAME has an impact on the corrosively, with highly saturated PME having the least impact. It has been shown that the number of double bonds in the fatty acid chain correlates with the FAME-induced corrosion.

III. EXPERIMENTAL PROCEDURE

Inordertoperformexperimentaltests,theenginewas connectedtoanEddyCurrentdynamometer.Theobjectiveistosimulaterealisticvehicleoperatingconditions inthetestbed.AsshowninFig.3.1,twoaxialfanswith accompaniedductingwereemployedtogeneratetheair flowovermovingvehicle.TheenginewasSItype,L-4, 1.3literwithamulti-pointfuelinjection(MPFI)system. TheFuel tankwasathree-wayFuel tankmodel inwhichitspropertiesaresummarizedin Table2. The thickness of NiCr thermocouples used in the experiment was1mm.Severalthermocouplesprotrudedtheirheads 5 mm out of the channels for measuring the inflow gas temperature. Alongradialdirection,theywerelocatedat thepositionswithrcoordinatesof0.2R,0.5Rand1R.The differentialpressuretransducerwasadigitaltypewithdiaphragmsensorcalibratedbetween0-50mbar.Exhaustgas velocitywasmeasuredbyvane. Torqueandenginespeed weremeasuredbytheEddyCurrentdynamometer.Pollutant concentrations, namely CO and HC were measured by anAVLmodel4000gasanalyzerbeforeandafterFuel tankinordertodetermineitsconversionefficiency indifferentconditionsofengineloadandenginespeed.A schematic installation of thermocouples, differential pressuretransducer,andgasanalyzerisshowninfig. The Fuel tank under the test is shown in Fig

Fig 1 Experimental setup

IV. RESULT AND DISCUSSION

ExhaustAir velocitywasmeasuredbyvane. Torqueandenginespeed weremeasuredbytheEddyCurrentSensor.Pollutant concentrations, namely Hight were measured by anSΠ model2000Biofuel analyzerbeforeandafterFuel tankinordertodetermineitsconversionefficiency indifferentconditionsofengineloadandenginespeed.

Solution ID #	Mass change at 1 month (g)	Mass change at 2 months (g)	Mass change at 3 months (g)
STI-1	-0.1014 ± 0.0919	-0.0280 ± 0.0045	-0.0353 ± 0.0077
STI-2	0.0053 ± 0.0026	-0.0059 ± 0.0173	0.0091 ± 0.0007
STI-3	-0.0144 ± 0.0697	0.0131 ± 0.0099	0.0138 ± 0.0117
STI-4	0.0067 ± 0.0458	-0.0480 ± 0.0835	-0.0084 ± 0.0235
STI-5	-0.0227 ± 0.0309	-0.00175 ± 0.0008	-0.0005 ± 0.0008
STI-6	0.0072 ± 0.0044	-0.0126 ± 0.0556	-0.0455 ± 0.0612
STI-7	0.0013 ± 0.0047	0.0063 ± 0.0090	0.0054 ± 0.0094
STI-8	-0.0195 ± 0.0158	0.3100 ± 0.4397	-0.0171 ± 0.0291
STI-9	-0.0075 ± 0.0025	0.0578 ± 0.0873	-0.0004 ± 0.0023
STI-10	-0.0405 ± 0.0479	-0.0429 ± 0.0532	-0.0392 ± 0.0571
STI-11	0.4078 ± 0.5791	0.0060 ± 0.0035	0.0090 ± 0.0008
STI-12	$-0.0048 \pm 7.07\times10^{-5}$	0.0037 ± 0.0041	0.0057 ± 0.0023
STI-13	-0.0029 ± 0.0031	-0.0354 ± 0.00580	-0.0342 ± 0.0016
STI-14	-0.0019 ± 0.0064	0.0024 ± 0.0002	0.0048 ± 0.0001
STI-15	-0.3216 ± 0.4890	0.0028 ± 0.0044	0.0018 ± 0.0006
STI-16	-0.0066 ± 0.0112	-0.0265 ± 0.0339	-0.0218 ± 0.0342

Fig2 Experimentation Analysis Visual Effects

Table 1 Experimentation Analysis.

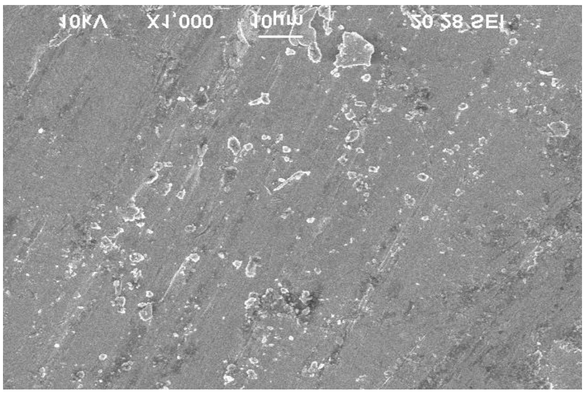
Fig 3Scanning Electron Microscope (SEM) -Biofuel – Neem B50

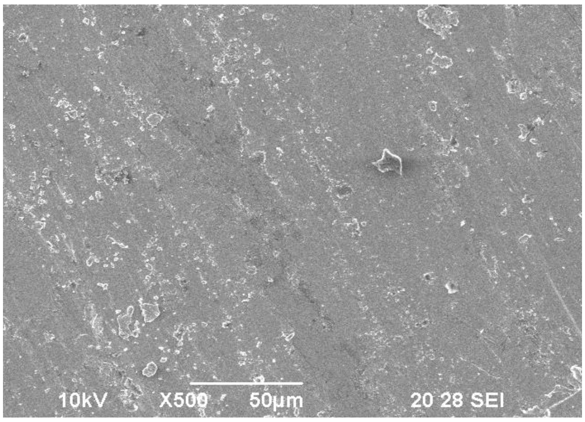

Fig 4The SEM images of Mild Steel 50µm × 500

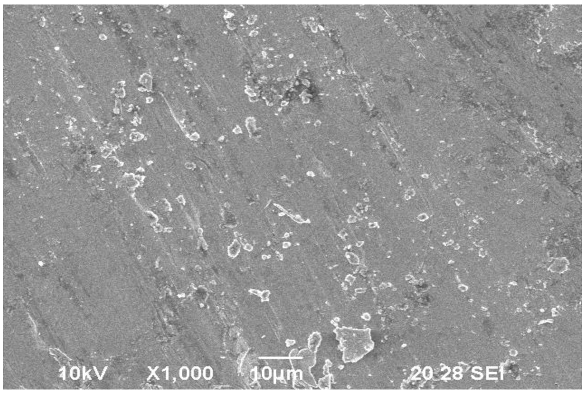

Fig 5 The SEM images of Mild Steel 10µm × 1000

From the Fig 5 it was observed that there will be a fine film is visible which reduce the corrosion of the material that means it increase the lubricating property of the material. The black portions represent the MoS2. Moreover the SEM image shows the uniformity in the distribution.

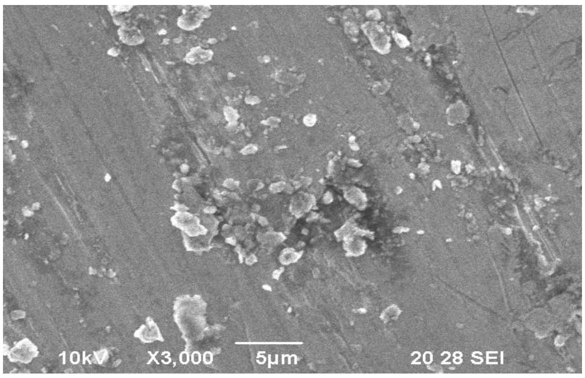

Fig 6 The SEM images of Mild Steel 5µm × 3000

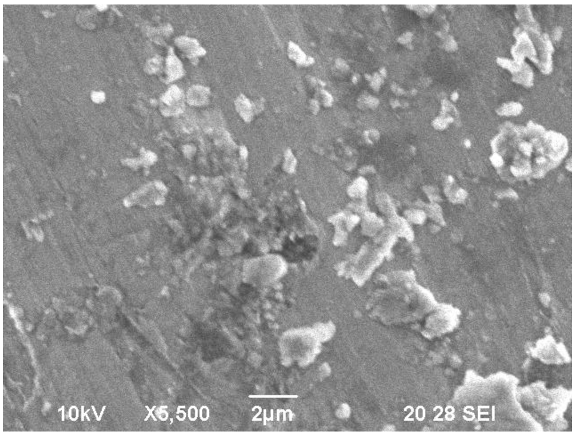

Fig 7 The SEM images of Mild Steel 2µm × 5500

The image shows the unevenness of the specimen and hence the white patches here and there are seen. During SEM the hard particles creates voids which are seen in the image

V.CONCLUSION

Reinforcementimprovesthe Mild steel material hardnesstoanextentof15%whencomparedwithbase Mild steel Material bonding. The Tensile strength improves to an extent of 21% due to the addition of Mild Steel. Results from SEM convey the presence of reinforcement and uniform distribution.Finally comparing numerical results are to consumed old cause material in Aluminum alloy vs without coating material with coating alloy to comparing thermalbonding material should be very quickly and effectively and without failure to be consist to apply bonded material causes in Better performance analysis in Aluminum causes material in room temperature perfectly bonded in different load conditions in natural thermal conduction.

REFERENCES

[1] Brajesh Kumar Mishra and Dr. Rajat Kumar The Production Of Biodegradable Fuel From Nonedible Oilseed In India: A Review IOSR Journal of Applied Chemistry (IOSRJAC) ISSN : 2278-5736 Volume 1, Issue 1 (May-June 2012), PP 43-46

[2] Umer Rashid, Farooq Anwar ,Amer Jamil and Haq Nawaz Bhatti JatrophaCurcas seed oil as a viable source for biodiesel Pak. J. Bot., 42(1): 575-582, 2010

[3] Siddharth Jain, M.P. Sharma Study of oxidation stability of Jatrophacurcas biodiesel/ diesel blends Volume 2, Issue 3, 2011 pp.533-542

[4] HannyJohanesBerchmans, Shizuko Hirata Biodiesel production from crude Jatrophacurcas L. seed oil with a high content of free fatty acids Bioresource Technology 99 (2008) 1716–1721

[5] Emil Akbar, ZahiraYaakob, SitiKartomKamarudin, Manal Ismail, JumatSalimon Characteristic and Composition of JatrophaCurcas Oil Seed from Malaysia and its Potential as Biodiesel Feedstock Feedstock, European Journal of Scientific Research ISSN 1450-216X Vol.29 No.3 (2009), pp.396-403

[6] PurabiMazumdar, VenuBabuBorugadda , Vaibhav V Goud and LingarajSahoo Effect of storage parameters on stability of Jatropha-derived biodiesel Mazumdar et al. International Journal of Energy and Environmental Engineering 2013, 4:13

[7] Sudheer Nandi Performance of C.I Engine by Using Biodiesel-Mahua Oil. American Journal of Engineering Research (AJER) e-ISSN : 2320-0847 p-ISSN : 2320-0936 Volume-02, Issue-10, pp-22-47

[8] RamningAmol M., DhotePriya S. and Ganvir V.N. Production of Neem Oil Methyl Ester (NOME) from Oscillatory Baffled Reactor Research Journal of Recent Sciences Vol. 2(ISC-2012), 223-228 (2013)

[9] OlugbengaOlufemiAwolu and Stephen KolawoleLayokun,Optimization of two-step transesterification production of biodiesel from neem (Azadirachtaindica) oil Awolu and Layokun International Journal of Energy and Environmental Engineering 2013 2013, 4:39

[10] H. Muthu, V. SathyaSelvabala , T. K. Varathachary , D. KiruphaSelvaraj, J. Nandagopal and S. Subramanian Synthesis of biodiesel from neem oil using sulfated

zirconia via Tranesterification ISSN 0104-6632 Vol. 27, No. 04, pp. 601 - 608, October - December, 2010

[11] Shruthi H. Heroor and S.D. Rahul Bharadwaj,Production of Bio-fuel from Crude Neem Oil and its Performance International Journal of Environmental Engineering and Management. ISSN 2231-1319, Volume 4, Number 5 (2013), pp. 425-32

[12] K. Anbumani and Ajit Pal Singh Performance of mustard and neem oil blends with diesel fuel in C.I. engine vol. 5, no. 4, april 2010 ISSN 1819-6608 ARPN Journal of Engineering and Applied Sciences

[13] Bobade S.N. and KhyadeV.B.Detail study on the Properties of PongamiaPinnata (Karanja) for the Production of Biofuel Research Journal of Chemical Sciences Vol. 2(7), 16-20, July (2012)

[14] B.Baiju,M.K. Naik, L.M. Das A comparative evaluation of compression ignition engine characteristics using methyl and ethyl esters of Karanja oil Renewable Energy 34 (2009) 1616–1621

[15] Brajesh Kumar Mishra and Dr. Rajat Kumar The Production Of Biodegradable Fuel From Nonedible Oilseed In India: A Review IOSR Journal of Applied Chemistry (IOSRJAC) ISSN : 2278-5736 Volume 1, Issue 1 (May-June 2012), PP 43-46

[16] M. MohibbeAzam ,AmtulWaris, N.M. Nahar Prospects and potential of fatty acid methyl esters of some non-traditional seed oils for use as biodiesel in India Biomass and Bioenergy 29 (2005) 293–302

[17] Padhi, S.K., Singh, R.K. Optimization of esterification and transesterification of Mahua (MadhucaIndica) oil for production of biodiesel J. Chem. Pharm. Res., 2010, 2(5):599-608.

[18] M.K.Ghosal, D.K.Das, S.C.Pradhan and N.Sahoo Performance Study of Diesel Engine by using Mahua Methyl Ester (biodiesel) and its Blends with Diesel Fuel College of Agricultural Engineering and Technology Orissa University of Agriculture and Technology, Bhubaneswar-751003, India

[19] Saroj K. Padhi and R. K. Singh Non-edible oils as the potential source for the production of biodiesel in India: A review J. Chem. Pharm. Res., 2011, 3(2):39-49.

[20] DamingHuang ,Haining Zhou, Lin Lin Biodiesel: an Alternative to Conventional Fuel Daming Huang et al. / Energy Procedia 16 (2012) 1874 – 1885.

BIOGRAPHY

BALAKRISHNAN.M completed his Bachelor Degree in Automobile Engineering with first class in the year 2012-2015 from ASL Paul's College of Engineering and technology, Coimbatore. He is currently pursuing his Master Degree in Engineering Design at Nandha Engineering College, Erode. He participated in several workshops and he has one year industrial experience in Sakthi Auto Components Ltd.

MURTHI.M.K has completed B.E - Mechanical Engineering with first class in 1999 from Bharathiyar University, Coimbatore. Also, he completed his Master Degree in Annamalai University. He is currently working as Professor and Head at Department of Mechanical Engineering in Nandha Engineering College, Erode. His research areas are alternate fuels, biodiesel, emission control etc.