Effect of storage duration on the fuel properties of different biodiesel blends

N. Tamaldin[1,2,*], F. Harun[1], Y. Humairak[1], M.H.M. Husin[1,2], M.F.B. Abdollah[1,2]

[1)] Faculty of Mechanical Engineering, Universiti Teknikal Malaysia Melaka, Hang Tuah Jaya, 76100 Durian Tunggal, Melaka, Malaysia
[2)] Centre for Advanced Research on Energy, Universiti Teknikal Malaysia Melaka, Hang Tuah Jaya, 76100 Durian Tunggal, Melaka, Malaysia

[*]Corresponding e-mail: noreffendy@utem.edu.my

Keywords: High blending; storage; properties

ABSTRACT – In this paper, the impacts of biodiesel properties are identified according to the storage condition and weight percentage of the fuel in a period of time. The samples used are standard diesel (STD), B7x, B8x and B9x were stored for 5 weeks. There are three fuel properties being tested which are flash point, density and water content. All experiment carried out are according to respective ASTM standard. The properties changes of biodiesel were not significant throughout five weeks' time due to the short time of storage except for water content.

1. INTRODUCTION

The global production of biodiesel has been rapidly grown about three to four decades back which major production comes from Indonesia and Malaysia in Southeast Asia [1]. Biodiesel is generally made up from the vegetables oils or animal fats with an addition of catalyst and alcohol [2-3]. The advantages of biodiesel over diesel fuel are higher cetane number, non-toxic, better lubricity and environmental friendly [4-5]. Whereas the disadvantages of biodiesel include cold kick start, low energy burst, higher copper strip corrosion and higher viscosity [5]. The productions of biofuesls are more costly than diesel because of insufficient animals and plants fat to totally replace fossil fuel [6].

On the other hand, the enrichment of oxygen in palm oil biodiesel promoted the further oxidation of carbon monoxide (CO) during combustion process [7]. However, the higher content of biodiesel could affect the engine for long use because of corrosion [8-9]. With all factors been stated, this study will analyze the properties effect of high blending biodiesel storage up to 5 weeks duration.

2. METHODOLOGY

There are three types of blend biodiesel need to be prepared which are B7x, B8x and B9x by using lab scale blending machine. The blending machine mechanism consists of rotating blade, motor to rotate the blade, heating coil and double layered tank. The mixture to be blend depends on the ratio given. The standard diesel used is from conventional fuel which consists of 7% of biodiesel. Therefore, the mixture of 70% of biodiesel (B100) and 30% of standard diesel will produce B7x which x is uncertainty value between 5-7 % of biodiesel. The mixture was heated at 70°C before starting to blend for one hour [7]. This is to ensure the mixture is ready to blend. The process was repeated for B8x and B9x.

For flash point identification, the sample of 5ml fuel is put into the closed cup chamber of SETA Flash Point. Then, light up the fire source for a respective period until 'Flash' appear on screen. Density of the biodiesel was determined by using hydrometer. While, to indicate the water content of biodiesel, Trivector Spectro machine was being used by pour the mixture of sample and solvent inside testing chamber and the water content result shown on the monitor.

3. RESULTS AND DISCUSSION

Properties of all samples were taken right after blending process. This is a reference data of the actual reading of each sample at ambient temperature (25°C).

Table 1 Properties of fuel sample for 0th week.

Fuel	**Types of fuel (week 0th)**			
parameter	**STD**	**B7x**	**B8x**	**B9x**
Flash point (°C)	90	120	128	138
Density (kg/m^3)	850	870	870	875
Water content (%)	0	9	10	17.7
Acid value (mgNaOH/g)	0.20	12.01	13.03	14.02

As per theory, flash point will be decrease because the increment of alcohol in a fuel. In Figure 1 shows, graph is near to constant as the storage duration increase. It shows that the samples are stable and safe to be store because flash point is important parameter for biodiesel while handling, storage and safety when it used in transportation [10]. In Figure 2, density for all samples gives uneven trend but also near to constant. It explains that there is no significant effect to the density of high blending biodiesel as duration time increase.

Besides, water content gives increase trend as shown in Figure 3. It is because biodiesel content –OH

bonding and while storage the biofuels is react to the surrounding and the samples will oxidise. Consequently, the fuel will degrade and could effect to the component engine because of corrosion.

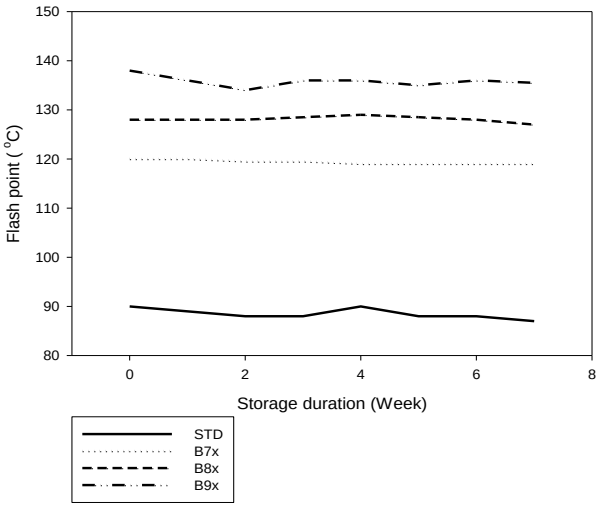

Figure 1 Flash point against storage.

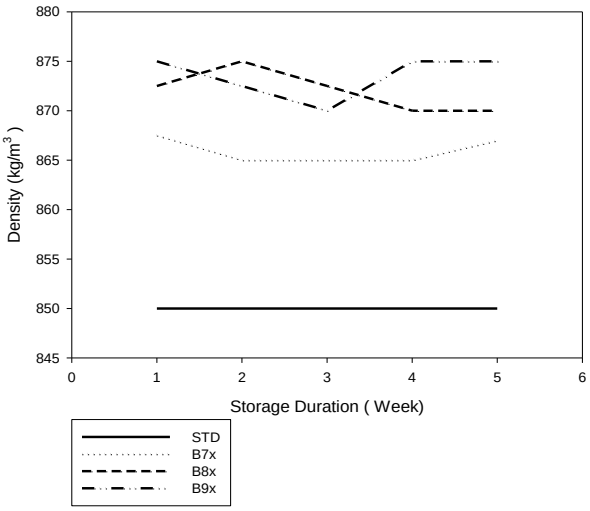

Figure 2 Density against storage duration.

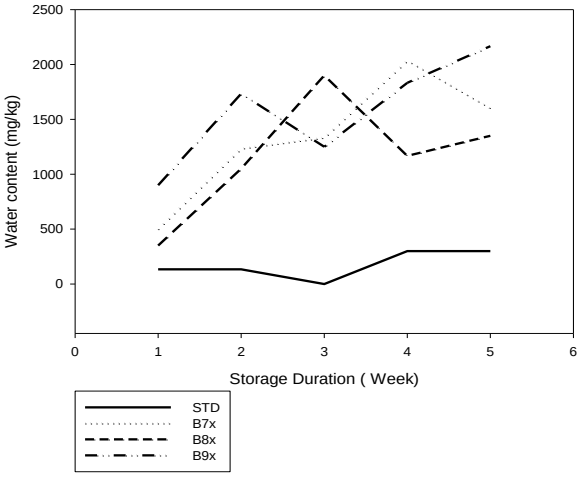

Figure 3 Water content against storage duration.

4. CONCLUSION

The properties changes of biodiesel were not significant throughout five weeks' time except for water content. As a conclusion, high blending biodiesel is stable and no degradation happens within storage duration.

ACKNOWLEDGEMENT

The authors would like to be obliged to Universiti Teknikal Malaysia Melaka (UTeM) for providing laboratory facilities and financial assistance under MTUN grant project no. RAGS/1/2014/TK06/FKM/B00071.

REFERENCES

[1] P. Oliver, J. Bhattacharya, C.H. Teoh (ed), *The palm oil controversy in Southeast Asia: A transnational perspective.* Mainland Press Pte. Ltd. Singapore; 2013.

[2] B.R. Moser. "Biodiesel production, properties and feedstocks," *Fuels*. pp 286-347, 2013.

[3] E. Christensen and R.L. McCornick, *Long-term storage stability of biodiesel and biodiesel blends*, Denver. United States; 2014.

[4] M.M. Noor, A. P. Wandel and T. Yusaf,. "Analysis of recirculation zone and ignition position of non-premixed bluff-body for biogas mild combustion," *International Journal of Automotive and Mechanical Engineering*, vol. 8, pp. 1176-1186, 2013

[5] P. Saxena, S. Jawale, M.H. Joshipura, "A review on prediction of properties of biodiesel and blends of biodiesel," *in Proceedings of 3rd Nirma University International Conference on Engineering*, 2013, pp. 395-402.

[6] S.A. Paes, "Production of edible mushroom and degradation of antinutritional factors in jatropha biodiesel residues," *LWT-Food Science and Technology*, pp. 575-580, 2013.

[7] A. Khalid, N. Tamaldin,, M. Jaat, M.F. Ali, B. Manshoor, I. Zaman, "Impacts of biodiesel storage duration on fuel properties and emission," *Procedia Engineering*, vol. 68, pp. 225-230, 2013.

[8] M.H. Mat Yasin, R. Mamat, A.F. Yusop, R. Rahim, A. Aziz, L.A. Shah, "Fuel physical characteristics of biodiesel blends fuels with alcohol as additive," *Procedia Engineering*, vol. 53, pp. 701-706, 2013.

[9] S.S. Wirawan, A.H. Tambunan, M. Djamin, and H. Nabetani, "The effect of palm biodiesel fuel on the performance and emission of the automotive diesel engine," *Agricultural Engineering International: the CIGR Ejournal*, Manuscript EE 07 005. Vol. X. April, 2008.

[10] A. Khalid, N. Mustaffa, B. Manshoor, H. Zakaria, A. J. Alimin, M. Leman and A. Sadikin., "The comparison of preheat fuel characteristics of biodiesel and straight vegetable oil," *Applied Mechanics and Materials*, vol 465-466, pp. 161-166, 2014.