Revista Ibero-Americana de Ciências Ambientais
Ibero-American Journal of Environmental Sciences

Out, Nov 2018 - v.9 - n.8

ISSN: **2179-6858**

This article is also available online at:
www.sustenere.co

The influence of soybean biodiesel and diesel on corrosion of SAE 1020 carbon steel.

The national demand for biodiesel is growing considerably and studies have been able to prove that biodiesel presents itself able to trigger corrosive processes on metal parts. This study aims to evaluate the SAE 1020 carbon steel corrosion rate by weight loss after accelerated aging in soybean biodiesel samples (B100) and in diesel with the addition of 5% biodiesel (B5 S500) at storage temperature (25°C) and engine operating temperature (100°C), for a period of 10 consecutive days. The SAE 1020 carbon steel specimens (12.5 x 75 x 3mm) were taken from the same steel plate, sanded, cleaned and degreased sequentially with alcohol 98% and 100% acetone and submitted to ultrasonic bath in 100% acetone for 180 seconds. After the corrosion test at 25°C and 100°C, it was observed the formation of deposits corrosion in SAE 1020 carbon steel blades, in the cases of soybean biodiesel samples (B100) and diesel (B5 S500). After the test at 100°C, it was also observed a color change, in the case of soybean biodiesel samples (B100). The SAE 1020 carbon steel corrosion rate, subjected to soybean biodiesel (B100) and diesel (B5 S500), increased with temperature, being more pronounced in the specimens subjected to corrosion tests with soybean biodiesel (B100).

Keywords: Biodiesel; SAE 1020 carbon steel; Corrosion.

Influência do biodiesel e do diesel de soja na corrosão do aço carbono SAE 1020.

A demanda nacional por biodiesel está crescendo consideravelmente e estudos têm comprovado que o biodiesel se apresenta capaz de desencadear processos corrosivos em peças metálicas. Este trabalho tem como objetivo avaliar a taxa de corrosão do aço carbono SAE 1020 por perda de peso após envelhecimento acelerado em amostras de biodiesel de soja (B100) e em diesel com adição de 5% de biodiesel (B5 S500) à temperatura de armazenamento (25 ° C) e temperatura ambiente (100 ° C), por um período de 10 dias consecutivos. As amostras de aço carbono SAE 1020 (12,5 x 75 x 3 mm) foram retiradas da mesma placa de aço, lixadas, limpas e desengorduradas sequencialmente com álcool 98% e 100% acetona e submetidas a banho ultrassônico em 100% de acetona por 180 segundos. Após o ensaio de corrosão a 25 ° C e 100 ° C, observou-se a formação de depósitos de corrosão nas lâminas de aço carbono SAE 1020, nos casos das amostras de biodiesel de soja (B100) e diesel (B5 S500). Após o teste a 100 ° C, também foi observada uma mudança de cor, no caso das amostras de biodiesel de soja (B100). A taxa de corrosão do aço carbono SAE 1020, submetida ao biodiesel de soja (B100) e ao diesel (B5 S500), aumentou com a temperatura, sendo mais pronunciada nos corpos-de-prova submetidos ao teste de corrosão com biodiesel de soja (B100).

Palavras-chave: Biodiesel; Aço carbono SAE 1020; Corrosão.

Topic: **Engenharia de Materiais**

Reviewed anonymously in the process of blind peer.

Received: **07/10/2018**
Approved: **08/11/2018**

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DOI: 10.6008/CBPC2179-6858.2018.008.0014

Referencing this:
PEREIRA, R. G.; MORAES, J. O. M.; PARDAL, J. M.. The influence of soybean biodiesel and diesel on corrosion of SAE 1020 carbon steel. **Revista Ibero-Americana de Ciências Ambientais**, v.9, n.8, p.158-167, 2018. DOI: http://doi.org/10.6008/CBPC2179-6858.2018.008.0014

INTRODUTION

The corrosion of materials by different agents is an important subject with application in different areas, such as: cosmetic; pipelines; concrete; automotive and fuels (HAYASHI, 1991; TAKAO et al., 1991; CHAOUCHE et al., 2011; OKA, 1986; GENG et al., 2009). The present study aims to investigate the corrosion of SAE 1020 carbon steel when exposed to soybean biodiesel (B100) and commercial diesel (B5 S500 - diesel with 5% of biodiesel and maximum of 500ppm of sulfur) at different test temperatures.

Due to the problems related to shortages and environmental damage generated by the use of fossil fuels and the impossibility of direct use of vegetable oils in engines, researchers have invested resources in finding some alternatives. Biodiesel is an alternative fuel that is becoming accepted in a steadily growing number of countries around the world (KNOTHE, 2005; DERMIBAS, 2009; PEREIRA et al., 2007; PEREIRA et al., 2011; PEREIRA et al., 2012; PEREIRA et al., 2014; GÜLÜM et al., 2015; ALMEIDA et al., 2015; ÖZTÜRK, 2015; CAI et al., 2015; NAUTIYAL et al., 2014; GIWA et al., 2014)

Brazil is a privileged country presenting large arable land area and wide variety of oil believed to be potential sources of convertible vegetable oils into biodiesel. In the country there are, for example the production of: soybean; castor; cotton; sunflower; peanuts; canola and palm, in addition to *jatropha curcas*, babussu and macaúba (PERES, 2006).

THEORETICAL REVIEW

Soybean production

Vegetable oils are obtained predominantly from grains of different plant species. The oil extraction can be made by physical process (pressing) or chemical (solvent). The solvent extraction produces better results, but the more traditional way is physical extraction, which uses mechanical and hydraulic presses to crush the grains. A mixed extraction (mechanical/solvent) can also be done. Selecting the type of extraction depends on two factors: the productive capacity and oil content.

Soybean (*Glycine max* (L.) Merrill) is a very versatile grain that gives rise to products widely used by agro-chemical industry and food industry. Besides is a raw material for extraction of oil for biofuel production. Soybean has about 25% of oil content in grain. In the agribusiness world, soybean production is, among the economic activities in recent decades, the most prominent. This can be attributed to several factors, such as structuring of a large international market related to trade in products of soybean, oilseed consolidation as an important source of vegetable protein and increased development and delivery of technologies that made possible the expansion of soy exploration for various regions of the world.

The largest producers of soybeans are: United States of America, Brazil, Argentina, India and China. According to FAO (2018), in 2016, the soybean world production was around 335×10^6t in a harvested area of 122×10^6 ha corresponding a yield of $2.7 t.ha^{-1}$. According to FAO (2018), in 2016, Brazil was: the second country in soybean production with 96296714 t; the second country in harvested area with 33153679 ha and the thirteenth country in yield with $2.9046 t.ha^{-1}$ (table 1, table 2 and table 3).

Table 1: Soybean production in 2016 (top 10).

Country	**Soybean area harvested in 2016 (ha)**
United States of America	33482430
Brazil	33153679
Argentina	19504648
India	11500000
China, mainland	6639113
Paraguay	3370000
Canada	2190500
Russian Federation	2120014
Ukraine	1859400
Bolivia	1336399

Table 3: Soybean yield in 2016 (top 15).

Country	**Soybean yield in 2016 ($t.ha^{-1}$)**
Turkey	4.3219
Georgia	3.7592
Italy	3.7539
United States of America	3.5006
Egypt	3.5000
Serbia	3.1610
Greece	3.1112
Croatia	3.1047
Austria	3.0648
Argentina	3.0146
Slovenia	2.9955
Spain	2.9815
Brazil	2.9046
Germany	2.7333
Belize	2.7276

Biodiesel background

Biodiesel is known as monoalkyl, such as methyl and ethyl, esters of fatty acids. Biodiesel can be produced from a number of sources, including recycled waste vegetable oil, oil crops, animal fats and algae oil. Biodiesels play an important role in meeting future fuel requirements in view of their nature (less toxic), and have an edge over conventional diesel as they are obtained from renewable sources (DEMIRBAS, 2009).

The regulations for biodiesel have been developed in different countries where its use is permitted. In the USA, the standard for biodiesel is set by the technical standard ASTM D 6751, the European Union is related with the standard EN 14214 and in Brazil is set by the ANP (National Agency of Petroleum, Natural Gas and Biofuels) resolution n.45 from 25.08.2014.

The transesterification process is used to transform triglycerides into esters, or biodiesel. In the process of transesterification, the triglycerides found in different kinds of oils and fats react with alcohol, usually methanol or ethanol to produce esters and glycerin. For the reaction to occur it is necessary to use a catalyst. In the transesterification process, a triglyceride molecule reacts with an alcohol molecule causing the separation of one of the fatty acids of the triglyceride, producing a diglyceride and an ester.

This diglyceride reacts with a second molecule of alcohol that takes another fatty acid, forming a second ester and a monoglyceride. Finally, a third molecule of alcohol reacts with the monoglyceride, forming the third ester and a molecule of glycerin. The reactions occurring are reversible, and the stoichiometric ratio is three moles of alcohol for each mole of oil being processed. The reaction can be carried out with concentrations of alcohol in excess, as this reduces time and increases the conversion efficiency of the process (LANG et al., 2001).

The transesterification process using methanol and base catalyst is the most commonly used to produce biodiesel. The catalysts commonly used are sodium hydroxide (NaOH) or potassium hydroxide (KOH). The catalyst is diluted in alcohol and then added the oil. The product is ester (biodiesel) and crude glycerin which is separated from the ester by decanting or centrifuging. Repeated washing processes are performed by adding acidified water in the reaction products. This mixture is stirred lightly and serves to remove residual glycerine soap, catalyst and serves as a neutralising agent of the fuel. The washing process is repeated until the biodiesel becomes clear. The main drawbacks of the process are the presence of water on some of the reagents and the high level of Free Fatty Acids (FFA) in the raw material. In both cases, the transesterification reaction is replaced by a saponification reaction.

The transesterification process can also be developed using acid catalysts and non-homogeneous catalysts. In the case of acid catalysts, the process time is longer, but do not have drawbacks with the water content and FFA. In the case of non-homogeneous catalysts, these bring benefits to: reducing the washing process; product separation and reuse of catalysts. According to National Agency of Petroleum, Natural Gas and Biofuels (ANP), the Brazilian production of biodiesel in august 2018 reached 486156m^3 and the main raw materials used to produce biodiesel were soybean oil (74,14%) and beef tallow (11,80%). The total production of biodiesel in Brazil in 2017 was 4289856m^3 (ANP, 2018).

In Brazil, biodiesel must comply with ANP quality specifications in its Resolution n.45 of 25.08.2014. It can be used pure or mixed with diesel in various proportions. The percentage of biodiesel mixed with diesel is indicated by the number after letter B. The mixture of 2% biodiesel to petroleum diesel is called B2 and so on, up to pure biodiesel, called B100. Federal Law 11,097/2005 that introduced biodiesel determined consecutive increases in the blend with diesel, delegating authority to the ANP to regulate and supervise the commercialization of biofuels. Currently, the percentage is 10% (B10) started in March 2018, according to the text of Law 13,263 of 23.03.2016.

Biodiesel has become more attractive as alternative fuel for automobiles because of its environmental benefits and the fact that it is made from renewable sources. However, corrosion of metals in biodiesel is one of the concerns related to biodiesel compatibility issues (Haseeb et al., 2010a). Studies have been able to prove that, despite having numerous social, economic and environmental advantages over diesel, biodiesel is less stable and more susceptible to oxidation reactions. Thus, biodiesel would be corrosive and prone to degradation caused by moisture absorption and oxidation during storage (MCCORMICK et al., 2007; HASEEB et al., 2010b; FAZAL et al., 2011a), besides microorganisms action.

MATERIALS AND METHODS

The soybean biodiesel used in this work was produced and donated by GrandValle Bioenergy Company, Brazil, and is within the standards established by Resolution n.45, from 25.08.2014, specified by

ANP Technical Regulation n.3/2014. The diesel used in the research was the B5 S500 diesel commercialized by Shell Brazil. This fuel has addition of 5% biodiesel and maximum sulfur content of 500 ppm.

The test coupons were prepared in accordance with ASTM D130/12. All of them were made from the same steel plate and cut into shaped blades, having dimensions of 12.5 x 75 x 3mm. Before immersion, the test coupons were treated as follow: polished with silicon carbide abrasive papers (grade 240), then washed and degreased with alcohol 98% and acetone 100%. These were then dried with hot air, identified and submitted to ultrasonic bath with acetone 100% for 180 seconds. After ultrasound bath, the samples were dried with hot air until any residual acetone was evaporated. Later, they were weighed on analytical balance of four decimal places. After cleaning, the corrosion tests were performed.

All corrosion tests were conducted meeting the requirements of ASTM D130/12. The corrosion tests were performed at room temperature (25°C) and 100°C. All baths corrosion, both at 25°C and 100°C, were performed in triplicate for 240 consecutive hours. In the test at room temperature (25°C), the samples were submerged in 30 ml of B5 S500 diesel and B100 soybean biodiesel.

After immersion, the samples were sealed and protected from solar radiation and the outdoor humidity, and maintained under these conditions for 240 hours (10 consecutive days) and then analyzed. In the test at temperature of 100°C, the test coupons were submerged in test tubes of 25mm diameter and 150 mm long, containing 30 ml of fuel (B100 soybean biodiesel or B5 S500 diesel) and placed in low stainless steel pressure pump with a removable neoprene gasket on the cover, and resistant to pressure. Low-pressure pumps containing test tubes with fuel in question and the samples were inserted into the corrosion bath stabilized at 100°C.

After completion of the consecutive 240 hours of testing, the samples were removed, dried and weighed to check training and deposits and possible mass gain. Subsequently, the samples surface was cleaned, deeply cleaned (ultrasound bath), dried and weighed again to check the possible loss of mass for the calculation of the uniform corrosion rate. The obtained data from weight loss was converted into corrosion rate (mpy) using the equation (FONTANA, 1987).

It has: $mpy = (W \times 534)/(\rho \times t \times A)$, where: mpy stands for mils (0.0254 mm) penetration per year; W is the weight loss (mg); ρ is the density (g/cm^3); A is the exposed surface area (in^2) and t is the exposure time (h). The mils penetration per year is a corrosion rate widely used. The rate of penetration can be used to predict the life of a given component (FONTANA, 1987).

RESULTS AND DISCUSSION

The characteristics of B100 soybean biodiesel used in the tests are presented in table 4. Table 5 shows the mean values of the corrosion deposits formed after 10 days in the corrosion test, according to the fuel used and the test temperature. It was observed that the test coupons submitted to corrosion tests with B100 soybean biodiesel had higher deposit formation and that this increase also was proportional to the increase of test temperature.

Table 4: Characteristics of B100 soybean biodiesel used in the tests.

Properties	Units	Methods	Brazilian Limits	Results
Density, 20°C	Kg/m³	ASTM D4052	850-900	881.9
Kinematic Viscosity, 40°C	mm²/s	ASTM D445	3.0-6.0	4.37
Flash Point	°C	ASTM D93	Min.: 100°C	172
Ester content	%m/m	EN 14103	Min.: 96.5	99.8
Carbon Residue	%m/m	ASTM D4530	0.050	0.040
Sulfated Ash	%m/m	ASTM D874	Max.: 0.02	<0.02
Sulfur	mg/Kg	NBR 15867	Max.: 10	<0.01
Sodium + Potassium	mg/Kg	NBR 15553	Max.: 5	<0.01
Calcium + Magnesium	mg/Kg	NBR 15553	Max.: 5	<0.01
Phosphorus content	mg/Kg	NBR 15553	Max.: 10	<0.01
Copper Strip Corrosion	-	ASTM D130	Max.: 1	1
Cold Filter Plugging Point	°C	ASTM D6371	Max.: 19	-15
Acid Number	mgKOH/g	ASTM D664	Max.: 0.50	0.5
Free Glycerol	%m/m	ASTM D6584	Max.: 0.02	0.0015
Total Glycerol	%m/m	ASTM D6584	Max.: 0.25	0.1547
Monoglycerides	%m/m	ASTM D6584	Max.: 0.70	0.5500
Diglycerides	%m/m	ASTM D6584	Max.: 0.20	0.0609
Triglycerides	%m/m	ASTM D6584	Max.: 0.20	0.0152
Ethanol or Methanol Content	%m/m	EN 14110	Max.: 0.20	0.006
Iodine value	g/100g	EN 14111	Report	133.3

Table 5: Mean values of the corrosion deposits formed after 10 days in the corrosion test.

Test Coupon Number	Fuel	Temperature (°C)	Deposit (g)	Mean Deposit (g)
25	B5 S500 diesel	25	0.0004	0.00043
26	B5 S500 diesel	25	0.0004	
27	B5 S500 diesel	25	0.0005	
10	B5 S500 diesel	100	0.0007	0.00070
11	B5 S500 diesel	100	0.0006	
12	B5 S500 diesel	100	0.0008	
22	B100 soybean biodiesel	25	0.0009	0.00110
23	B100 soybean biodiesel	25	0.0011	
24	B100 soybean biodiesel	25	0.0013	
19	B100 soybean biodiesel	100	0.0020	0.00190
20	B100 soybean biodiesel	100	0.0018	
21	B100 soybean biodiesel	100	0.0019	

After the corrosion test at 100°C, the soybean biodiesel (B100) samples changed the color and appearance while in diesel samples no visual change was observed. Table 6 shows weight loss values (W) of the test coupons submitted to corrosion tests at different temperatures for 10 consecutive days. It was observed that the higher testing temperature and the higher concentration of biodiesel cause the higher values of W.

Table 6: Weight loss values (W) of the test coupons submitted to corrosion tests at different temperatures for 10 consecutive days.

Test Coupon Number	Fuel	Temperature (°C)	W (mg)
25	B5 S500 diesel	25	0.2
26	B5 S500 diesel	25	0.2
27	B5 S500 diesel	25	0.4
10	B5 S500 diesel	100	0.4
11	B5 S500 diesel	100	0.3
12	B5 S500 diesel	100	0.4
22	B100 soybean biodiesel	25	0.4
23	B100 soybean biodiesel	25	0.5
24	B100 soybean biodiesel	25	0.7
19	B100 soybean biodiesel	100	1.0
20	B100 soybean biodiesel	100	0.9
21	B100 soybean biodiesel	100	0.9

It was noted in this study that the corrosion rates of SAE 1020 carbon steel test coupons submitted to 10 consecutive days corrosion tests in the presence of B100 soybean biodiesel at room temperature (25°C) and 100°C were higher than the corrosion rates of the test coupons submitted to corrosion tests in the presence of B5 S500 diesel. It was also observed that in the case of biodiesel and diesel, the corrosion rates increase with the increase of temperature (table 7 and figure 1). This behavior is in accordance with other works found in the literature that used different materials and biodiesel (HASEEB et al., 2010a; FAZAL et al., 2011a; HU et al., 2012; SINGH et al., 2012).

Table 7: Corrosion rates of SAE 1020 carbon steel coupons after 10 consecutive days corrosion test.

Test Coupon Number	Temperature (°C)	Fuel	Corrosion Rate (mpy)
25	25	B5 S500 diesel	0.01499
26	25	B5 S500 diesel	0.01496
27	25	B5 S500 diesel	0.02976
22	25	B100 soybean biodiesel	0.02997
23	25	B100 soybean biodiesel	0.03698
24	25	B100 soybean biodiesel	0.05206
10	100	B5 S500 diesel	0.02999
11	100	B5 S500 diesel	0.02241
12	100	B5 S500 diesel	0.03032
19	100	B100 soybean biodiesel	0.07598
20	100	B100 soybean biodiesel	0.06725
21	100	B100 soybean biodiesel	0.06822

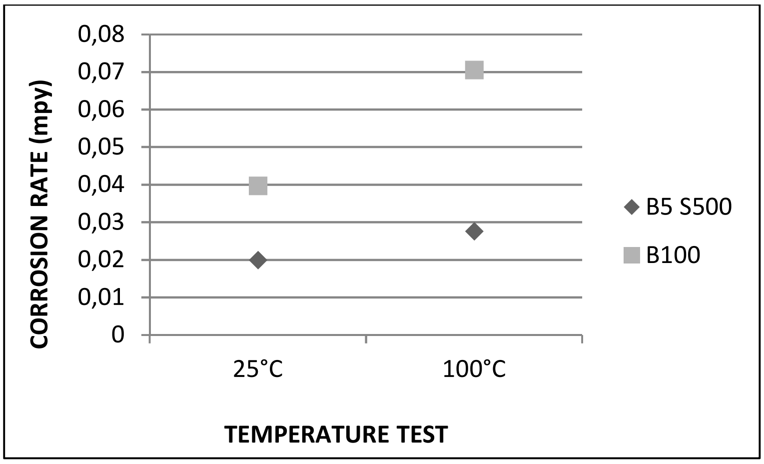

Figure 1: Average corrosion rates of SAE 1020 carbon steel coupons after 10 consecutive days corrosion test.

Table 8 summarizes results from different researches concerning the corrosion rates for different materials exposed to diesel and biodiesel (static immersion tests). In general it can be concluded that: the average corrosion rate in the case of biodiesel is greater than the diesel one; the average corrosion rate increases with the increase of temperature; materials such as: copper; magnesium; aluminum; brass; leaded bronze exhibit greater values of the average corrosion rate than steel carbon and cast iron.

Table 8: Average corrosion rates for different material exposed to diesel and biodiesel (static immersion tests).

Fuel	Material	Temperature ºC	Test Hours	Average Corrosion Rate (mpy)	Reference
B5 S500 Diesel	SAE 1020 Carbon Steel	25	240	0.01990	Present work
B100 Soybean Biodiesel	SAE 1020 Carbon Steel	25	240	0.03967	Present work
B5 S500 Diesel	SAE 1020 Carbon Steel	100	240	0.02757	Present work
B100 Soybean Biodiesel	SAE 1020 Carbon Steel	100	240	0.07048	Present work
B0 Diesel	Mild Steel	27	1200	0.046	Fazal et al., 2011a
B100 Palm Biodiesel	Mild Steel	27	1200	0.052	Fazal et al., 2011a
B0 Diesel	Mild Steel	80	1200	0.05	Fazal et al., 2011a

B100 Palm Biodiesel	Mild Steel	80	1200	0.059	Fazal et al., 2011a
B0 Diesel	Piston Metal	Ambient temperature (15-40 ºC)	7200	0.0058	Kaul et al., 2007
B100 *Jatropha Curcas* Biodiesel	Piston Metal	Ambient temperature (15-40 ºC)	7200	0.0117	Kaul et al., 2007
B100 Karanja Diessel	Piston Metal	Ambient temperature (15-40 ºC)	7200	0.0058	Kaul et al., 2007
B100 Mahua Biodiessel	Piston Metal	Ambient temperature (15-40 ºC)	7200	0.0058	Kaul et al., 2007
B100 Salvadora Biodiessel	Piston Metal	Ambient temperature (15-40 ºC)	7200	0.1236	Kaul et al., 2007
B0 Diesel	Copper	60	840	0.036	Haseeb et al., 2010a
B100 Palm Biodiesel	Copper	60	840	0.053	Haseeb et al., 2010a
B0 Diesel	Leaded Bronze	60	840	0.017	Haseeb et al., 2010a
B100 Palm Biodiesel	Leaded Bronze	60	840	0.0248	Haseeb et al., 2010a
B100 Palm Biodiesel	Aluminum	Room temperature (25-27 ºC)	720	0,1230	Chew et al., 2013
B100 Palm Biodiesel	Aluminum	Room temperature (25-27 ºC)	1440	0.0527	Chew et al., 2013
B100 Palm Biodiesel	Magnesium	Room temperature (25-27 ºC)	720	3.0910	Chew et al., 2013
B100 Palm Biodiesel	Magnesium	Room temperature (25-27 ºC)	1440	2.6563	Chew et al., 2013
B100 Palm Biodiesel	Cast Iron	Room temperature	1200	0.0771	Fazal et al., 2011b
B0 Diesel	Cast Iron	Room temperature (25-27 ºC)	2880	0.0774	Fazal et al., 2012
B100 Palm Biodiesel	Cast Iron	Room temperature (25-27 ºC)	2880	0.1122	Fazal et al., 2012
B0 Diesel	Copper	Room temperature (25-27 ºC)	2880	0.1583	Fazal et al., 2012
B100 Palm Biodiesel	Copper	Room temperature (25-27 ºC)	2880	0.3928	Fazal et al., 2012
B0 Diesel	Aluminum	Room temperature (25-27 ºC)	2880	0.0840	Fazal et al., 2012
B100 Palm Biodiesel	Aluminum	Room temperature (25-27 ºC)	2880	0.1730	Fazal et al., 2012
B0 Diesel	Brass	Room temperature (25-27 ºC)	2880	0.1201	Fazal et al., 2012
B100 Palm Biodiesel	Brass	Room temperature (25-27 ºC)	2880	0.2099	Fazal et al., 2012
B0 Diesel	Aluminum	80	600	0.1000	Norouzi et al., 2012
B100 Rapeseed Biodiesel	Aluminum	80	600	0.3529	Norouzi et al., 2012
B0 Diesel	Copper	80	600	0.3235	Norouzi et al., 2012
B100 Rapeseed Biodiesel	Copper	80	600	0.9198	Norouzi et al., 2012
B100 Commercial Biodiesel	Brass	Room temperature	120	0.8661	Aquino et al., 2012
B100 Commercial Biodiesel	Copper	Room temperature	120	0.2283	Aquino et al., 2012
B100 Palm Biodiesel	Copper	Room temperature (25-27 ºC)	200	0.3513	Fazal et al., 2013
B100 Palm Biodiesel	Copper	Room temperature (25-27 ºC)	300	0.4119	Fazal et al., 2013
B100 Palm Biodiesel	Copper	Room temperature (25-27 ºC)	600	0.6057	Fazal et al., 2013
B100 Palm Biodiesel	Copper	Room temperature (25-27 ºC)	1200	0.6541	Fazal et al., 2013
B100 Palm Biodiesel	Copper	Room temperature (25-27 ºC)	2880	0.5330	Fazal et al., 2013

Table 9 shows the average corrosion rates (the mean values of the corrosion rates shown in table 7) and the average thickness loss values (mm) calculated for the lifespan (20 years) of SAE 1020 carbon steel samples submitted to corrosion tests with B5 S500 diesel samples and B100 soybean biodiesel at temperatures of 25°C and 100°C. These values represent an outstanding relative corrosion resistance (< 1mpy) using as reference the values shown by Fontana (1987) based on typical ferrous and nickel-based alloys.

Table 9: Average thickness loss values (mm) calculated for the lifespan (20 years) of SAE 1020 carbon steel samples.

Temperature °C	Fuel	Average corrosion rate (mpy)	Average thickness loss in 20 years (mm)
25	B5 S500 diesel	0.01990	0.0101
25	B100 soybean biodiesel	0.03967	0.0201

100	B5 S500 diesel	0.02757	0.0140
100	B100 soybean biodiesel	0.07048	0.0358

CONCLUSIONS

The effect of temperature on the corrosion of SAE 1020 carbon steel in B100 soybean biodiesel and B5 S500 diesel was investigated. The corrosive attack on the surfaces of the test coupons submitted to B100 soybean biodiesel are more evident than in test coupons submitted to B5 S500 diesel. The specimens submitted to corrosion tests in the presence of B100 soybean biodiesel had a higher formation of corrosion deposits on their surfaces than the specimens submitted to corrosion tests in the presence of B5 S500 diesel. This increase in the formation of corrosion deposits also was evident with increasing test temperature. The SAE 1020 carbon steel corrosion rate, submitted to both fuels, increased with temperature.

This increase was more pronounced in test coupons submitted to B100 soybean biodiesel. After literature search, it was observed the lack of published studies on the corrosive potential of soybean biodiesel on SAE 1020 carbon steel, limiting the comparison of this study with other results, thus highlighting the need for further research in the area.

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