The Effect of an Engine Cleaning Fuel Additive on the Fuel Efficiency of an Engine

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ABSTRACT

In this experiment, the effects of an engine cleaning fuel additive, Lucas Oil® Upper Cylinder Lubricant and Injector Cleaner, on the fuel efficiency of an engine were examined. It was hypothesized that if an engine cleaning fuel additive was added to the fuel supply of an engine, the fuel efficiency (how long the engine stays running on a constant amount of fuel) would improve. The null hypothesis was that when an engine cleaning fuel additive was added to the fuel supply of an engine, there would be no difference in fuel efficiency. A total of 24 tests were run: eight using two-cycle gasoline without an additive (untreated) and eight tests using two-cycle gasoline treated with an additive (treated). Eight tests were run using non-treated two-cycle gasoline after the treated gasoline had been run through the engine in order to test the residual effect of the cleaner (untreated after). Using three ounces of gasoline, the average run time for the non-treated tests was 11.69 minutes. With the same amount of fuel, the average run time for the treated tests was 14.47 minutes. With the same amount of fuel, the average run time for the untreated (after) group was 14.18 minutes. Overall, the treated group showed a 23.8 percent improvement in time over the non-treated group, and the non-treated (after) group showed a 21.3 percent improvement in time over the non-treated (before) group. Based on a one-way ANOVA, there was a significant statistical difference between the times of the treated fuel and the untreated fuel, as well as a significant difference between the times of the untreated before and the untreated after. From these results, the hypothesis that the engine cleaning fuel additive would improve the fuel efficiency of the engine was supported, and the null hypothesis was rejected.

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INTRODUCTION

Fuel efficiency is an important aspect of new engines in today's market from both an economic and an environmental prospective. As gas prices skyrocket, fuel efficiency is more important than ever, especially in an economic downturn. If an engine can run longer on a smaller amount of fuel, then this will save the consumer money. It also is important that the maximum amount of energy be utilized from every gallon of gasoline. One way to achieve better efficiency and power is through the use of engine-cleaning fuel additives in a vehicle's fuel.

There are many different types of fuel treatments on the market, each with different purposes. The cleaner used in this experiment was Lucas Oil® Upper Cylinder Lubricant and Injector Cleaner. This product is a fuel additive that claims to improve fuel economy as well as increase power and reduce exhaust emissions. The product claims to remove carbon buildup in fuel injectors and to lubricate vital engine components. This additive is comprised of more than 90% hydrotreated heavy paraffinic distillate, which is a highly-refined form of mineral oil (Lucas). Mineral oil is a byproduct of the petroleum refining process. It is similar to petroleum jelly, only in liquid form.

The additive is designed to improve fuel efficiency by removing carbon and other buildup from the combustion chamber and from the fuel injectors. Unwanted carbon and deposits in the combustion chamber can lead to burned valves, broken piston rings, pre-ignition (pinging), and loss of power (Lucas). Buildup in the fuel injectors can cause loss of fuel economy, loss of power, burned pistons, increased emissions, and injector failure

(Sentry). These effects can be detrimental to engines, and if the problem is not corrected, they can lead to expensive repairs.

New federal requirements set for 2016 will require carmakers to achieve a fleetwide average of 35 miles per gallon in their automobiles. According to NPR, the new technology which will bring about higher fuel efficiency will make the average cost of a new car an estimated 926 dollars more expensive; however, car owners could save as much as $3000 over the life of the car through better gas mileage. However, even without government input, automakers are motivated to make automobiles more efficient.

The purpose of this experiment is to test the effect of an engine cleaning fuel additive on the fuel efficiency of an engine. The engine used in this experiment was a five-year old Homelite Vac-Attack two-stroke yard blower. The hypothesis for this experiment is that if a fuel system cleaner is added to the gasoline that is being run through an engine, then the fuel efficiency of the engine will improve. The null hypothesis is that if a fuel system cleaner is added to the gasoline that is being run through an engine, then there will be no change. The independent variable in this project is the fuel that is used (treated or non-treated), and the dependent variable is the time in minutes that the engine stays running.

MATERIALS

• Homelite VacAttack Yard Blower

• 1 Gallon 93 Octane Unleaded Gasoline

• Echo® 2-Cycle Fuel Mix (2.6 Ounce Bottle)

• Lucas Oil® Upper Cylinder Lubricant and Injector Cleaner

•Stopwatch

•3 Oz Measuring Device

• 1 Teaspoon Measuring Scoop

EXPERIMENTAL DESIGN

The following chart was used to record the time (in minutes) that the blower engine stayed running during the trials.

	Untreated Before	Treated	Untreated After
8 Trials			

Dependent Variable: The time (in minutes) the engine stays running.
Independent Variable: The fuel running through the engine (untreated, treated, untreated after).
Constants: Blower, engine speed, outside temperature, amount of fuel used.

The hypothesis for this experiment is that if a fuel system cleaner is added to the gasoline that is being run through an engine, then the fuel efficiency (time engine stays running) of the engine will improve. The null hypothesis is that if a fuel system cleaner is added to the gasoline that is being run through an engine, then there will be no change in fuel efficiency.

METHODS

Before the experiment, the 2.6 ounce container of two-cycle engine oil was mixed with the one gallon of gasoline to be used with the blower. All gasoline in the blower's fuel tank was siphoned, so the tank was empty. Three ounces of non-treated fuel were measured and poured into the fuel tank on the blower. The blower was then run at full throttle until the engine shut off. The time was recorded, and this procedure was repeated for a total of eight trials. For the next set of trials, one teaspoon of the Lucas Oil upper cylinder lubricant and injector cleaner was measured into the 3 ounce cup and then fuel was added for a total of 3 ounces. This mix was poured into the tank, and the blower was run at full throttle until the engine shut off. The times were recorded, and the procedure was repeated for a total of eight trials. The third set was conducted in the same manner as the first set. Three ounces of untreated fuel were measured and poured into the fuel tank on the blower. The blower was run at full throttle until the engine shut off. The time in minutes was recorded, and the procedure was repeated for a total of 8 trials. Means were calculated for each set, and the data gathered was analyzed using a one-way ANOVA.

RESULTS

For this experiment, the chart below was used to record the times that the blower stayed running during the trials.

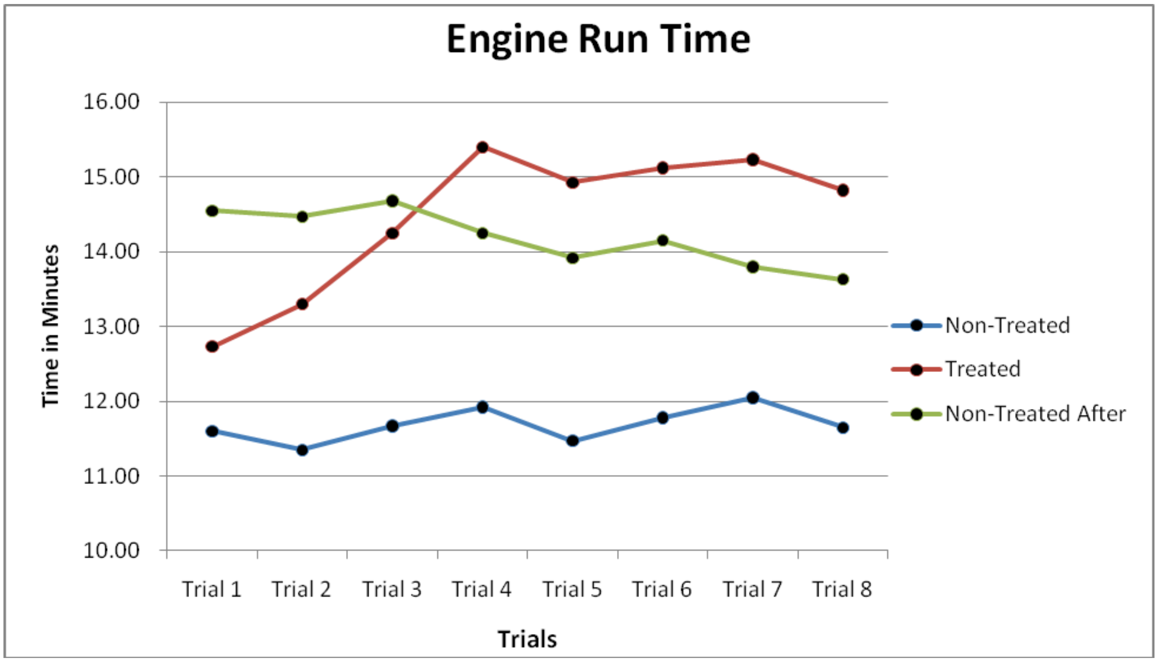
Table 1: Data Collection for Engine Run Time in Minutes

	Non-Treated	Treated	Non-Treated After
Trial 1	11.60 min	12.73 min	14.55 min
Trial 2	11.35 min	13.30 min	14.47 min
Trial 3	11.67 min	14.25 min	14.68 min
Trial 4	11.92 min	15.40 min	14.25 min
Trial 5	11.47 min	14.93 min	13.92 min
Trial 6	11.78 min	15.12 min	14.15 min
Trial 7	12.05 min	15.23 min	13.80 min
Trial 8	11.65 min	14.82 min	13.63 min

Table 2: Averages for the Sets of Trials

	Non-Treated	Treated	Non-Treated After
Mean	11.69	14.47	14.18
Range	.70	2.67	1.05

Table 3: Graph for Times of Trials



As the data above shows, the treated fuel rises significantly over the untreated fuel during the first four trials. The treated fuel rises steadily from the 11.65 minute mark set in the last trial of the untreated, to peak at 15.40 minutes in the fourth trial. This was a 3.75 minute increase in run time from the last trial of the untreated set. However, in trials five through eight, the times leveled off, with run times of approximately fifteen minutes.

The average engine run time for the non-treated tests was 11.69 minutes. The average run time for the treated trials was 14.47 minutes. The average time for the untreated after tests was 14.18 minutes. The treated trials showed a 23.8 percent increase in run time over the untreated group, and the untreated (after) group showed a 21.3 percent increase in run time over the untreated before group.

DISCUSSION

The purpose of this research was to examine the effects of an engine cleaning fuel additive on the fuel efficiency of an engine. The results from this study indicated a statistically significant increase in fuel efficiency between the untreated and treated trials, as well as a significant increase between the untreated before and the untreated after trials.

The surprising results were the times for the untreated after trials, which tested the residual effect of using the additive. Although the times gradually decreased, they all remained above 13.63 minutes, a significant increase over the untreated before trials. There are several explanations for this. First, it shows that the cleaner has done its job, by removing carbon buildup from inside the engine, causing the engine to run smoother and more efficiently. Second, the effect of the additive was not fully shown, as the engine tested was a carbureted engine. The additive is designed to remove buildup not only from inside the engine cylinders, but also from inside the fuel injectors. Since the tested engine did not have fuel injectors, there could be no improvement from cleaning dirty injectors. Therefore, it is most likely that the significant improvement in fuel efficiency came directly from cleaning carbon buildup in the engine chamber.

In a single factor ANOVA test between the untreated and the treated tests, there was a statistically significant difference in fuel efficiency. With a .05 alpha-value, the p-value was .00000164, and the F-value at 62.03 was higher than the f-critical, which was 4.60. In another ANOVA test between the untreated before and the untreated after, there was also a statistically significant difference between the two. The p-value was .00000000021, far less than the alpha value. The F-value was 257.10, much higher than the f-critical, which was 4.60. This analysis supported the hypothesis, which stated that an engine-cleaning fuel additive, when added to the fuel supply of an engine, will cause an increase in fuel efficiency. In addition to the hypothesis being supported, the null hypothesis was rejected.

The additive, however, does come at a cost. A 32 ounce bottle of the additive costs ten dollars and will treat 100 gallons of fuel. Thus, there is a ten cent cost to treat each gallon of fuel. For example, if a car got 16 miles per gallon, and gasoline was $3.00 per gallon, it would cost $3.00 to go 16 miles. However, if this additive was used, it would cost $3.10 per gallon, but the car could travel 19.68 miles on the same amount of fuel. This takes the cost of driving the car from 18.75 cents per mile down to 15.75 cents per mile, even though 10 cents were added to the per gallon cost of the fuel. The average car is driven 12,000 miles per year, and if it cost three cents less per mile to drive the car, then this would create a savings of $360 per year.

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BIBLIOGRAPHY

"Fuel Injector Cleaner." *Sentry Fuel Treatments*. Web. 18 Aug. 2010. http://www.sentrytreatments.com/shtml/injectorcleaner.shtml.

"Lucas Fuel Treatment." *Lucas Oil*. Web. 18 Aug. 2010. http://www.lucasoil.com/products/display_products.sd?catid=2&iid=26.

Lucas Fuel Treatment MSDS. Lucas Oil. Web. 29 Sept. 2010. http://www.lucasoil.com/images/medialibrary/B9411875450A033C9D5A934AACA7BE09.pdf.

Lucas Fuel Treatment TDS. Lucas Oil. Web. 29 Sept. 2010. http://www.lucasoil.com/images/medialibrary/44D56CE8B244DE6C40C6C668131E1823.pdf.

"White House Issues New Gasoline Mileage Standards : NPR." *NPR : National Public Radio : News & Analysis, World, US, Music & Arts : NPR*. 1 Apr. 2010. Web. 29 Sept. 2010. http://www.npr.org/templates/story/story.php?storyId=125458204.