Platinum Fuel Saver

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Abstract

With the increasing prices of oil and the increasing concern about the environment, there have been numerous products that claim to improve fuel efficiency. However, these products often have countless claims that argue that they work and do not work. One such product is the Platinum Fuel Saver. In this paper we investigate the claims and evidence supporting both sides and evaluate the Platinum Fuel Saver's ability to improve gas efficiency.

Gasoline:

Gasoline has been around for over 150 years. In 1859, Edwin Drake dug the first oil well. He used the petroleum and distilled it into kerosene and discarded the gasoline and other products because there was not use for it (History of Gasoline). Gasoline did not come into play until 1892, when the invention of the automobile arose. During the late 1800's, the word gasoline was used as a "brand name" for a petroleum-like distillate, almost in the way Vaseline is today. It was far from being any type of motor fuel by any means. It was first used as a medicine to remove head lice of affected victims.

Gasoline is one type of fuel that many countries rely on, on a daily basis. Though it is not the main form of fuel used across the world, it still plays a vital role throughout many countries. In the growing years since the invention and discovery of gasoline, the demand has increased. With demand comes the need for vast supplies and quantities. The United States alone in 2011 consumed a total of 134 million gallons of gasoline (How much gasoline does the United States consume?). That number is enormous.

Those who own, manufacture and sell gasoline across the globe understand the immense amount of profit to be made on a daily basis. It is almost a game to see who can make the most money by selling off gasoline. Gasoline prices are greatly affected and tend to increase past the daily budget of most hard working people across the globe.

The need for a cheaper alternative to gasoline or a way to procure better gas mileage is a must. During the early 1980's a company started by Mr. Joel Robinson introduced a product called "The Platinum Fuel Saver". Under the easy installation section on this product's website (http://www.1800lessgas.com/index.php/easy-installation/), he claimed that with a mere simple connection to a vehicle's vacuum line, microscopic quantities of the platinum 22 compound would be added into the air-fuel mixture that would be entering the engine. On the front page of this products website, there are numerous claims that this product increases a 22% increase of overall gas mileage (Platinum 22). Is it too good to be true?

There are many devices available today that boast about saving gasoline and harnessing more miles per gallon by using their product. The Platinum Fuel Saver is one of these products. Looking into the history, definition and overall properties of gasoline will give a strong background on proving or disproving The Platinum Fuel Saver's claims.

There are a few different properties of gasoline that need to be understood before properly gaining a solid grasp on what gasoline is and what it does. A few properties of gasoline is its volatility, octane rating, stability, energy content, its density, chemical analysis additives, and detergents. All these properties make up what gasoline is today.

Internal Combustion engines using gasoline

Ideal combustion is when controlled combustion occurs in the piston when the flame waves from the sparkplug uniformly combusts the fuel air mixture with a smooth pressure change. A complete combustion process requires the burning of all the carbon to produce carbon dioxide and all the hydrogen to produce hydrogen dioxide (Stoichiometric Combustion). Engine knocking in high compression engines is caused by non-uniform explosion waves of fuel in the piston by high heat in the cylinder walls. Abnormal combustion, also engine knocking, occurs in the piston when pockets of the fuel air mixture downstream of the flame wave from the sparkplug combusts unwantedly, by heat and pressure. This creates local shockwaves that result in a higher pressure within the piston that may have not been designed for. Commonly, problems with an engine's air-fuel mixture cause engine knocking sounds to occur (What is Engine Knocking?). There is an optimal mixture of air and fuel that is efficient for an engine. Where an insufficient amount of air is added, an engine can produce unburned fuel, soot smoke, and carbon monoxide (Stoichiometric Combustion). Too much air results in a lean mixture, which can cause engine knocking and damage (What is Engine Knocking?).

Volatility

Volatility defines a liquid's evaporation characteristics. The more volatile a substance is the more readily it will evaporate. The Reid Vapor Pressure (RVP) of gasoline is measured using the Reid vapor pressure test. Using this test method the vapor pressure of gasoline is determined at 37.8°C (100°**F)** (D323-08 Standard Test Method for Vapor Pressure of Petroleum Products). Vapor pressure is critical in knowing how readily a substance is to evaporate or how volatile it is. The volatility of gasoline is important because different volatility levels are desired for different temperatures and atmospheric conditions. Proper volatility levels of gasoline are useful to

prevent vapor lock in fuel lines and failed engine warm ups, as well as reducing the amount of unburned hydrocarbons that have diminishing effects on the ozone.

Engines operating in high temperatures can cause the fuel to increase in volatility levels more than required and can create excess vapor. This gasoline vapor can clog up the fuel lines suffocating the engine from fuel. Engines that are attempted to be started in cold temperatures, where gasoline is less volatile, can sometimes cause a failed start. Vapor from gasoline can escape during the production and sale of gasoline polluting the environment. This can be reduced by having a less volatile fuel. Overall, with gasoline being very readily to change state compared to other fuels it is necessary to determine and maintain certain desired volatility levels.

Engines operating in cold temperatures or in the winter are allowed to burn gasoline with a higher RVP, which is regulated by the EPA (Gasoline). In the winter there is an increase with the allowed RVP, therefore allowing for more volatile compounds to be blended in with gasoline (Gasoline). Butane, a cheaper compound than gasoline yet a more volatile compound, can be blended in with gasoline to save money and increase the gasoline supply with the allowed increase in RVP (A Primer on Gasoline Blending). Lower volatility levels are needed in the summer to lower the RVP while higher volatility levels are desired in low temperatures to increase the vapor pressure to the allowed RVP.

Octane ratings

Octane actually has two different definitions. The first definition refers to a flammable hydrocarbon which is refined from crude oil and makes up the blend of chemical mixture that we call gasoline. The second definition is that octane is a measure of a fuel's likeliness of creating a knock or a ping when mixed with mixtures of air and fuel while being burned inside the cylinder

walls of an engine. There are various forms of gasoline present today all ranging from 87 octane to racecar gasoline that has an octane number of 115 or higher.

When determining octane numbers and ratings, two methods are used. The two differing procedures are in international use for determining the octane rating; these are the Motor method and Research method (Octane Rating). Running gasoline through a motor under load is considered the motor method. The research method takes a free running motor and runs gasoline through it. This method gives slightly higher octane ratings. The octane rating of gasoline that a person would receive at a pump is the average of the above two tests. This ensures a proper and even octane distribution at the pump.

High compression ratios used with fuel that has a lower than required octane can cause a disturbing "pinging" ("knocking") noise as the fuel charge "explodes" rather than being initiated by the controlled spark plug, resulting in extreme cylinder pressures.

Anti-knocking additives are used in fuels to prevent annoying, fuel wasting, and potentially damaging engine knocking (Dolhyj, Guttmann and Velenyi). High compression ratios used with lower than required fuel octane can cause a disturbing "pinging" ("knocking") noise as the fuel explodes rather than being initiated by the controlled spark plug, resulting in extreme cylinder pressures (Tetra Ethyl Lead). Anti-knocking additives would increase the combustion temperature, resulting in a higher Octane rating. A higher Octane rating is desired when engine compression is high. Higher octane fuels can lead to higher compression ratios which in turn can lead to more efficient gasoline engines and reduced fuel consumption (US EPA proposing allowing high-octane, higher ethanol content fuels as part of Tier 3 regs; E30 as example). The Octane rating or number of a certain fuel is a measure of the amount of compression the fuel can

handle before detonation. The higher the Octane rating the more compression the fuel can withstand before detonating. Higher Octane rating fuels are used for high compression engines to minimize or prevent engine knocking by having higher combustion temperatures, where temperature is strongly linked with pressure therefore having a higher combustion pressure. An increase of the combustion temperature (higher octane) of a fuel allows for it to withstand higher temperatures and pressures. This can prevent knocking by stopping the unwanted detonation of pockets of fuel air mixture downstream of the flame wave.

Stability

In order for gasoline to perform as designed it needs to be in stable form. Gasoline if properly stored can be stable almost indefinitely. For storing gasoline, a proper stabilizer is needed. Within a couple months, gasoline can create varnish and shellac if you do not add stabilizer to it, and if it does you can cause serious damage to an internal combustion engine if gasoline with shellac is used (Storing Gasoline). Storing gasoline in airtight containers prevents water vapors from entering the gasoline container and possibly ruining the mixture. An airtight container also guarantees that the components within the gasoline do not escape. Another proper storage technique is making sure the container is stored in a cool place, not somewhere where the temperature can cause the mixture to expand and possibly leak out or evaporate.

Improper storage of gasoline leads to gums, and solids forming in the gasoline mixture. The term used to describe the formation of gums and solids is stale. Stale gas makes it harder to start an engine because of the presence of these gums with the fuel tank, lines and injectors. If a fresh tank of gasoline is passed through an engine, it should effectively clean out any build up that was left over from the previous tank of bad gasoline.

Energy content

From a barrel of oil almost 40% is used to produce gasoline, with the rest used to produce a host of products including jet fuel and plastics and many industrial chemicals (The How's and Why's of Replacing the Whole Barrel).

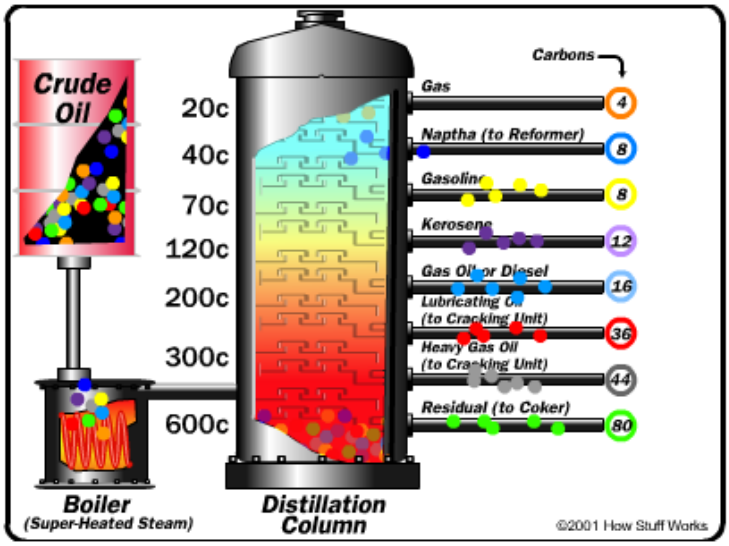

Figure 1 Oil refining breakdown (How Oil Refining Works).

The combustions process of gasoline releases the energy desired. The combustion of the hydrocarbons making up gasoline ideally produces only carbon dioxide, water, and energy in the following reaction:

$$2C_8H_{18} + 25O_2 \rightarrow 16C0_2 + 18H_2O$$

Equation 1

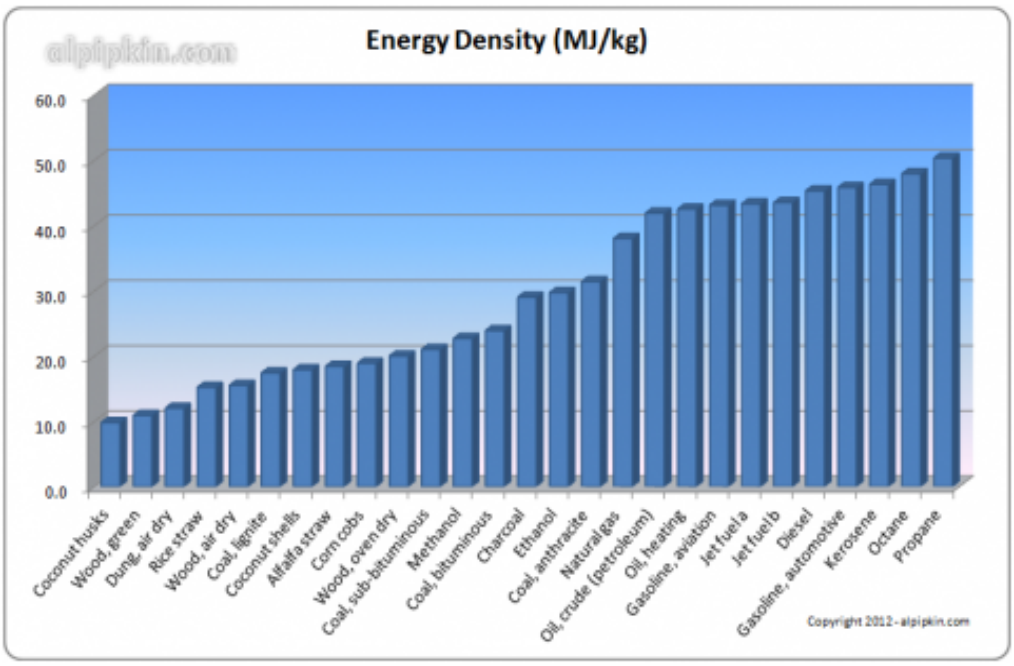

Figure 2 (Energy Density)

Gasoline offers almost 45 MJ/kg. Crude oil has an energy density of 41.9 MJ/kg which is 2.7 times that of dried wood. It can be refined into products with an even greater energy density such as diesel fuel, gasoline, and kerosene for instance, which burn much cleaner than coal or crude oil (Energy Density). With different blends and additives along with the ambient temperature and season, the energy content can differ about 5%.

Additives

Gasoline is used in many ways and with that there are different preferred results that can be obtained by using additives. Dyes are used in gasoline to prohibit the use of gasoline without a road tax intended for off road usage in on road vehicles. Untaxed Gasoline is dyed, while taxed gasoline is clear or white. Another use for dye is in diesel fuel. Highway diesel fuel is not dyed, while not EPA approved highway diesel is dyed red (Fuel and Fuel Additives). Detergents are added to clean engines from carbon build up which will help the startup process and engine efficiency. Fuel stabilizers and antioxidants are used to preserve gasoline and can inhibit gum

build up in the engine if the vehicle is not used frequently. An important focus in gasoline additives is to find out what additives enhance gasoline combustion by increasing the pressure at which it will combust and to make the gasoline combustion complete and uniform.

During WWI, it was found that an inexpensive chemical called Tetra-ethyl lead can be added to gasoline to significantly improve its octane rating (EPA). With this additive, cheaper grades of octane can be made usable with this chemical. Tetra-ethyl lead, by increasing the octane, allowed engine compression to be substantially raised. This leads to an increased vehicle performance and fuel economy. This lead additive used to increase octane rating enabled development of modern high-compression gasoline engines. Yet in the 1970s lead began to be phased out and banned in the US because of the environmental hazards it posed. Emissions from leaded gasoline were producing lead aerosols that covered the earth in a thin layer, which is highly toxic to living things such as humans. With modern refining technology of gasoline, lead additives are no longer needed to meet desired octane ratings. Other additives were found to achieve the octane ratings needed without causing harm to vehicles or people.

Oxygenates are fuel additives that are an oxygen-bearing compounds that can enhance gasoline combustion and sometimes achieve higher octane ratings. The use of non-oxygenated gasoline in cold conditions tends to increase carbon monoxide emissions from vehicles. The clean air act requires use of oxygenated gasoline, in areas where winter time carbon monoxide levels exceed federal air quality standards (EPA).

Ethanol is an oxygen-bearing compound that is highly effective in enhancing gasoline combustion. Ethanol is soluble in gasoline and extends life of our oil reserve. Ethanol is also 115 octanes and can boost lower grades of octane to higher desired grades. E15, a 15% blend of

ethanol in gasoline, works to increase fuel efficiency by improving fuel combustion by adding oxygen to the reaction ethanol burns, thereby reducing exhaust emissions. “With EPA’s June 15, 2012 approval of a number of companies’ misfueling mitigation plans, EPA has acted on each of the Clean Air Act steps required to bring E15 to market. Some companies have now met all of the Clean Air Act requirements related to E15 and may lawfully introduce E15 into the marketplace.” (EPA)

Methyl Tertiary Butyl ether (MTBE) is another common additive and a fairly simple molecule that is created from methanol. MTBE does not harm catalytic converters. MTBE is useful because like ethanol it boosts octane. Unlike ethanol, MTBE is thought to be a carcinogenic compound and mixes easily with water (MTBE). If gasoline containing MTBE leaks underground, it can easily contaminate our water wells. However, along with MTBE being released into the environment so are other additives along with the gasoline.

Platinum Fuel Saver Framework

The Platinum Fuel Saver is a device that uses a mixture of Platinum, Rhodium and Rhenium (Robinson, Method for reduction of pollution from combustion chambers) to allegedly improve a car’s miles per gallon by 22% (Platinum 22). The inventor, Barnett Joel Robinson, explains the system in his two patents.

The Platinum Fuel Saver was originally produced by the National Fuel Saver Corporation. However, at the time of this writing, the Platinum Fuel Saver is produced and distributed by 1800lessgass.com. In 1991, the Environmental Protection Agency released a report on the claims about the Platinum Fuel Saver. (EPA) The report states that Robinson’s claim of improved mileage was not seen during the tests. “EPA completed the evaluation based

on the information available and our technical assessment of the technology. EPA judged that there was no technical basis or appropriate test data to support the claims for a fuel economy improvement or emission reduction due to the device. Therefore, EPA issued a report concluding that the device would not have an emission or fuel economy benefit. (EPA)" While this does not necessarily mean that the Platinum fuel saver did not work as advertised, it does raise some questions since their website has "has now demonstrated on the EPA Federal Test Procedure a 48% increase in miles per gallon" (Platinum 22) but the only known test stated otherwise.

Platinum Fuel Saver Operation:

Delivery System

Robinson's first patent described a delivery system, which is used by the Platinum Fuel Saver. The delivery system consists of a closed container for water with the platinum solution in it that is covered by a thin film of oil (#10 in Figure 2). The thin film of oil acts as a means of coating the water molecules in the solution to provide proper distribution of the solution to the vacuum tubing (#18 in Figure 2).

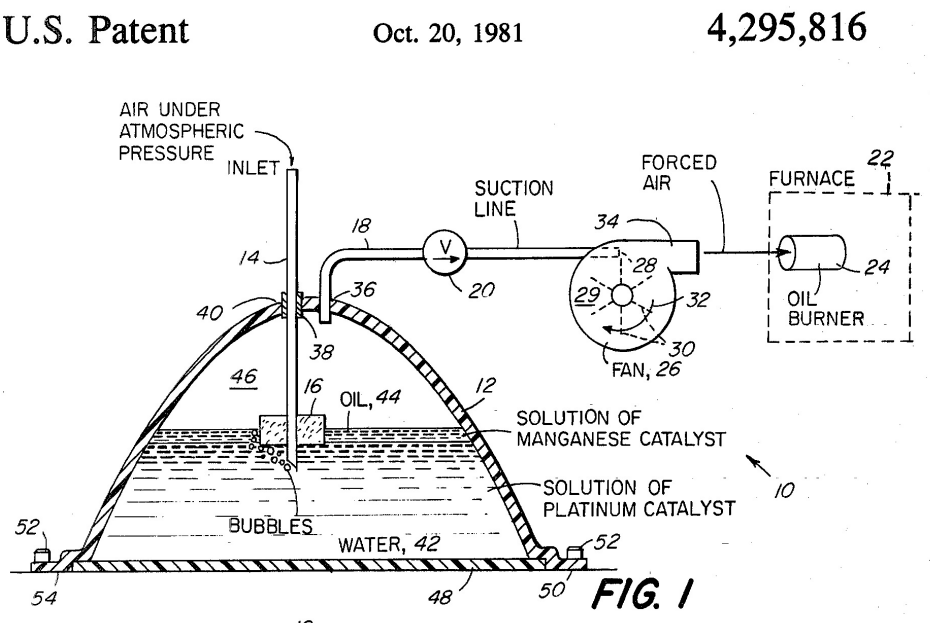

Figure 2 Diagram of the delivery system. Taken from the patent (Robinson, Catalyst delivery system).

In the event of a road that is anything less than smooth, the jolting and jerkiness would aid in mixing of the solution. The container also has two tubes that pass air in (#14 in Figure 2) and out (#18 in Figure 2) of the container. The outlet tube (#18) is used to connect to the volume of air (#46) above the water (#42) and oil (#44) to a vacuum that sucks the air into the combustion chamber. The inlet tube (#10) is designed such that one end of the tube is open to the outside atmosphere while the other end floats such that it is at a fixed depth below the surface of the water and oil.

The vacuum causes the pressure of the air above the water to drop, which in turn, lowers the level of the water in the tube connected to the outside atmosphere (#14). When the air pressure in the chamber gets low enough, the vacuum draws air from the outside through the tube (#14) and through the solution as bubbles and into the chamber (#46). As the air is pulled

through the water and oil, the air bubbles pick up some of the fine dispersion of the catalysts. By controlling the depth of the tube in the water, it is possible to control the internal air pressure relative to the outside air pressure. By varying the bubble rate and the concentration of the catalysts in the solution it is possible to control the catalyst-to-fuel ratio.

In the case of the Platinum Fuel Saver, the vacuum is provided by one of the engine's vacuum lines. The vacuum in these lines is generated by the engine cylinders sucking air into the combustion chamber. This in turn means that the air along with the aerosolized catalysts would be pulled right into the combustion chamber.

At this point is should be noted that the platinum fuel saver web site states that the device can be installed by anyone in 5-10 minutes, however, this delivery system has a major design flaw that eliminates a good number of vehicles. The problem lies in that some cars have turbocharges or superchargers, which boost the pressure or the air going into the engine to levels above that of the outside air. If the delivery system is connected to such a vehicle, the result would be that the platinum solution would be forced out of the container and into the engine compartment.

Platinum Fuel Saver Catalysts

Robinson's second patent covers the catalysts used in the platinum fuel saver. The patent states that the platinum fuel saver uses Platinum, Rhodium, and Rhenium. It goes on to say that the fuel saver solution is made by mixing 400 grams of $H_2PtCl_66H_2O$ (CPA), 120 grams of "$RhCl_2$" and 50 grams of rhenium in perrhenic acid in 114 liters of liquid. (Robinson, Method for reduction of pollution from combustion chambers)

Platinum Catalyst $H_2PtCl_66H_2O$ (CPA)

The basis of the selections of the catalysts is that the Platinum "serves for oxidizing the carbon and CO into CO_2." (Robinson, Method for reduction of pollution from combustion chambers)

Rhodium Catalyst $RhCl_2$

The Rhodium would serve to reduce the NO_x into N_2 and O_2. (Robinson, Method for reduction of pollution from combustion chambers)

Rhenium (Perrhenic Acid) $Re_2O_7(OH_2)_2$

The rhenium would serve to promote the catalytic reactions of the platinum and rhodium. (Robinson, Method for reduction of pollution from combustion chambers)

Published Evaluations:

Environmental Protection Agency

Since the creation of the platinum fuel saver, the EPA has done two evaluations of the device. The first test in 1981 was performed upon the request of Joel Robinson. While details of the test data were not published, the second report states that the first test concluded that "there was no technical basis or appropriate test data to support the claims." (EPA) The second evaluation was published in 1991.

The second evaluation used three different cars. A 1988 Chevrolet Celebrity, a 1988 Ford Taurus, and a 1987 Dodge Van. Before each test of the car in the different configuration, the vehicle was serviced and tuned to manufacturer specifications. All testing used commercial unleaded summer-grade gasoline. The following is the testing procedure as specified in the EPA report.

1. Check tire pressure
2. Drain and pressure check the fuel system. Then refuel.
3. 2000 miles of mileage accumulation on an established road route using commercial unleaded summer-grade gasoline from the EPA storage facilities.
4. Drain and refuel
5. Sun analyzer vehicle specification check (analyzes the exhaust composition.)
6. Set tire pressure for dyno
7. Drain and refuel to 40% fill for prep
8. LA-4 prep. (Prep for the dynamometer test to simulate urban driving.)
9. Overnight soak
10. Drain and 40% fill with chilled fuel. Heat build with no evaps. Then Federal Test Procedures (FTP) and Highway Fuel Economy Test (HFET) tests with commercial unleaded summer-grade gasoline.
11. Repeat steps 7 to 10
12. Remove test tires from vehicle and store
13. Install Platinum Gasaver per manufacturer's written instruction
14. Mileage accumulation to 2000 miles with Platinum Gasaver using commercial unleaded summer-grade gasoline from EPA supplies. For each vehicle, the mileage accumulation route with the device will be the same as that used for the baseline testing
15. Install test tires.
16. Drain and refuel
17. Sun analyzer vehicle specification check

18. Duplicate FTP and HFET test with the Platinum Gasaver installed (steps 7 to 10 completed twice)

In the end the test showed that there was no statistically valid improvement in the emissions. The results can be seen in Appendix A Table 1 EPA test data. As seen in the data, the largest change in gas mileage is 3% for the FTP test of the 1988 Ford Taurus. Such a small change can easily be accounted for by minor changes in the acceleration and breaking rates or stopping times while driving the vehicle.

Joel Robinson: Platinum 22,

During the testing of platinum 22 products, performed by Mr. Joel Robinson and his team, one vehicle was used. The vehicle was a Chevrolet 350 V8 engine. It was tested with the product, and without the product as a control. The test runs were done on a dynamometer, which is a machine with rollers in the floor. A vehicle is then strapped onto the rollers and can be driven yet remain in a stationary position. The test conditions of the vehicle ranged from 2600rpms with a total of fifty eight pounds of torque at a constant speed of fifty five miles an hour. The chamber in which the tests were being done, were maintained at constant temperature and pressure to simulate driving conditions. Each test run was carried out for a total of six hours of constant driving for seven days a week. Fuel consumption on the first test without Platinum 22 rendered an average of 13.18 miles per gallon (About Platinum 22). The second week of testing with Platinum 22 gave an average of 15.66 miles per gallon, which is an improvement of 18% (About Platinum 22).

In the tests done by Mr. Joel Robinson and his company, it showed the effectiveness of Platinum 22 to boost the gas mileage of the car tested. This goes to show that any vehicle with

this device should show similar results as the vehicle tested. This backs up the claims made by Mr. Joel Robinson about his product, contrary to the previous EPA test results.

Channel 5

In 2007, local News Station 5 did an investigation into the Platinum Fuel Saver. The lead investigator was Jennifer Kraus (NewsChannel 5 Tests Platinum Gas Saver). Jim Furbush from the Better Business Bureau helped test the product for News Channel 5. The vehicle used was a 2004 Ford Taurus, a very common car used in the United States. The Ford Taurus before the test achieved an average of 24 miles per gallon. Real world on-road conditions were used for these tests instead of running the vehicle on a dynamometer as done in previous tests by Mr. Robinson and the EPA tests.

According to the Platinum Fuel Saver claims, the Ford Taurus should be achieving 30 miles per gallon. Mr. Furbush was very skeptical at the claims. During the installation of the device, a problem arose with one of the supplied vacuum t-fittings not fitting. A quick trip to the auto-parts store rendered the proper size fitting. Mr. Furbush drove several hundred miles after the device was installed and he saw no apparent difference in gas mileage. He referenced back to the previous EPA test in 1991 which also concluded no increase of gas mileage.

Two months went by of using the Platinum Fuel Saver and the test vehicle saw no increase in gas mileage. Kraus asked him what he would call this. His response was, “I would call it a waste of $250” (NewsChannel 5 Tests Platinum Gas Saver). Once the tests were completed they contacted Mr. Joel Robinson to gather his input on the situation. Robinson stated that not every vehicle that uses the devices sees an improvement and that he offered a four month money-back guarantee. Mr. Furbush tried on two separate occasions to get his money back and

the company has been unresponsive (NewsChannel 5 Tests Platinum Gas Saver). They told him to reset his vehicles sensors to see if the mileage improves then.

Another interesting fact stated within the News Channel 5 article was that of the "Federal Consumer Protection Agency" which had confirmed that the claims of the Gasaver were in fact true (NewsChannel 5 Tests Platinum Gas Saver). News Channel 5 Jennifer Kraus stated that no such agency exists. It cannot be found or located anywhere. A quick search on the internet shows that the Federal Consumer Protection Agency is a subdivision under the Federal Trade Commission which has been around since 1914. This adds to the mystery of the Platinum Fuel Saver.

Mr. Joel Robinson

The best way to obtain information on the Platinum Fuel Saver is from where it originated, Mr. Joel Robinson. The phone number supplied was 1-800-LESS-GAS. Making phone calls to that number rendered no one answering, but a voicemail stating who they were and a little about the product. Numerous attempts rendered the same outcome. Trying to contact Mr. Joel Robinson did not help in obtaining information the internet could not supply.

WCRN

It was brought to the attention of the IQP team that a local radio station in the town of Worcester, WCRN was broadcasting on weekly basis advertisements for the Platinum Fuel Saver. We sought after the radio station to try and obtain a copy of the radio ad and possibly gain more knowledge on why the ad was still running. Phone calls and emails to the sales manager rendered another dead end with no contact.

EPA

The EPA did a thorough in-depth test of the Platinum Fuel Saver back in 1991. The head Director of that test was Margo Oge. Her office was contacted for more information on the test done in 1991. An email was received with the copy of the report and confirming exactly what was known. More information was sought from the EPA but a reply never came back.

Is the Platinum Fuel Saver Plausible?

Metal Solubility desire:

Metals in their base form are non-water-soluble. In the past decade there has been a great increase in the usage and research of different forms of water-soluble transition metals for their catalysis effects. Aqueous catalysis is favored by Green Chemistry, or environmentally friendly chemistry, due to the positive implications for the use of water as a reaction media (Velazquez and Verpoort). “Water is certainly the most environmentally benign solvent in chemical synthesis. Catalytic application of transition-metal complexes is, however, usually restricted to organic solvents due to low solubility and stability of the metal complexes in aqueous systems” (Jantke, Cokoja and Pöthig). The use of water-soluble-transition metals has great advantages in many applications. Nuclear medicine and radio pharmacy desire the water solubility of metals for their better in vivo characteristics by having the water soluble metals be flushed and cleared out of the body faster (Water Soluble Complexes). Switching from volatile organic compounds to water gives cheaper, healthier, and more abundant solvent. Use of water-soluble homogeneous catalysts in aqueous media, where most substrates show only low solubility in water, can overcome this limitation and exploit new and efficient ways of chemical operations (Schaper, Hock and Herrmann).

How forms of metal are soluble:

Water solubility of metals is usually attained by utilizing hydrophilic ligands. These hydrophilic ligands bind to a central metal atom to form a coordination complex. This coordination complex of hydrophilic ligands efficiently blocks the hydrophobic transition metal making it hydrophilic, water soluble (Hydrogenation and transfer hydrogenation in water).

Platinum (NHC Ligands):

Platinum, a transition metal, has many forms of water soluble complexes. New water-soluble platinum(0) complexes bearing sulfonated N-heterocyclic carbene (NHC) and divinyltetramethylsiloxane (dvtms) ligands are available. Research on this form shows great results in aqueous solutions from their active and recyclable catalysts for the hydrosilyation of phenylacetylene and other alkynes at room temperature in water (Organometallics). Hydrosilylation has been called the most important application of platinum in homogenous catalysis (Renner, Schlamp and Kleinwächter). Also, recent reports show water-soluble (NHC) complexes can be applied in metathesis and hydrogenation reactions and turn out to be among the best performing catalysts known (Schaper, Hock and Herrmann).

Platinum Catalyst

A good catalyst for a reaction would be the activity level or speed of which it makes the reaction occur. Platinum has a very good activity level and is especially good for reactions where selectivity is not so important such as catalytic combustion of gasoline. (Bond) ‘’Platinum particles act as a catalyst by having hydrocarbon and oxygen molecules collide and dismantle on the platinum’s surface. Then they are rearranged into water and carbon dioxide.’’ (Infanger)

Rhodium Catalyst

As with platinum and hydrocarbons, the nitrogen oxide collides with the rhodium particles and dissociates them into its composite elements in the following reaction: (Infanger)

$$2NO_x \rightarrow x\ O_2 + N_2$$

Rhodium catalyst gives extremely high activity in hydrogenation of an aromatic compound. It hydrogenates many compounds at room temperature and atmospheric pressure. (Rhodium Catalysts)

Rhenium Catalyst

"Approximately 30% of the catalysts used worldwide to convert petroleum refinery napthas with low octane ratings into high-octane, liquid products contain Re. Platinum-Rhenium(Pt-Re) catalysts tolerate greater amounts of carbon formation and make it possible to operate at lower pressures and higher temperatures leading to higher yields and octane ratings." (Naor, Eliaz and Gileadi)

Chemistry Professor Consulted

In order to gain more knowledge on the potential chemical properties, Professor Drew R Brodeur was consulted. He has a BS in chemical engineering and a PhD in chemistry. Prof. Brodeur explained if the Rhodium catalyst in the Platinum fuel saver converts a product from the combusted gasoline, NO_x into N2 and 02, then it could be theoretically true using Le Chatelier's Principle. Le Chatelier's Principle states "that if a dynamic equilibrium is disturbed by changing the conditions, the position of equilibrium moves to counteract the change." (LE CHATELIER'S PRINCIPLE) Prof. Brodeur went on to say that this extra oxygen in the cylinders of an engine

would produce a reaction favoring a more responsive reactant, thus a more complete burning of the gasoline. Prof. Brodeur told us his assumptions are non-relevant to the amount of time for the catalyst to help and he is not sure if it would work at the milli-second level in the combustion chamber of an engine.

Conclusions

After evaluation of the product The Platinum Fuel Saver, information shows us that all assumptions are possible for a supposedly 22% increase of fuel efficiency, but this was not found true in any of the cases covered. During the research of the water soluble metals for the Platinum Fuel Saver solution, it came to our attention that the solution Mr. Joel Robinson created had the potential to actually work and provided a more efficient burn of gasoline. This in turn would allow for better gas mileage. Though the chance of the solution working is present, no hard evidence other than that of Mr. Joel Robinson surfaced.

Firstly the EPA, being a highly trusted agency of the U. S. Federal government, findings showed that the Platinum Fuel Saver did not show improvements in an increase of gasoline efficiency. “The overall conclusion from these tests is that The Platinum Gasaver did not significantly change vehicle emissions for fuel economy of either the Federal Test Procedures (FTP) or the Highway Fuel Economy test (HFET). The device clearly did not produce the large – greater than 20 percent – fuel economy benefits claimed by the manufacturer. Therefore the device would not be expected to realize either an emission or fuel economy benefit. Vehicle operation and performance were unchanged by the device.’’ (EPA)

The EPA did the testing of the Platinum fuel saver the exact same way as it was conducted by Mr. Joel Robinson. A dynometer was used for the process with test vehicles picked

at random. All variables were controlled throughout the experiment and all data recorded. They were very thorough and made sure to follow the manufactures instructions for conducting the test. If the EPA did the test and got different results from Mr. Joel Robinson, there has to be some explanation. There was not one step that the EPA skipped or missed. This leads us to believe that data on Mr. Joel Robinsons end could have been jumbled or misinterpreted resulting in the 22% increase which he states on his website.

Second, the reports from the Channel 5 News in 2007 show no increase in mileage using the Platinum Fuel Saver product. After over 4,000 miles driving with the Platinum Fuel Saver installed, Jim Furbush, "says the results have just not panned out." He also says, "I would call it a waste of $250." This test showed that, "In the end, his gas mileage increased less than one percent, nowhere near what the company had promised." This is another instance where a thorough company, in this case News Channel 5, went about testing a product which could allegedly add a 22% increase to a vehicle's gasoline mileage. Mr. Furbush followed the instructions of the manufactures and his mileage never saw an increase of more than 1%. Does that 1% show that the Platinum Fuel Saver worked even if it was for the 1% increase only? Highly unlikely. Driving 4,000 miles or more, driving style of an individual can change. There is no way to guarantee exact same style of driving with the same driving condition throughout those 4,000 miles. Mr. Furbush has seen exactly what every other Platinum Fuel saver customer has seen, a two hundred and fifty dollar product that only increases the hole in your wallet by 250%.

Also, looking at the physical and chemical properties and principles, results show the ability to have highly water soluble, active, and stable metal complexes are attainable. It is plausible for the three transition metals; Platinum Catalyst $H_2PtCl_66H_2O$, Rhodium Catalyst $Rhcl_2$ and

Rhenium (Perrhenic Acid) $Re_2O_7(OH_2)_2$ in the Platinum Fuel Saver to be able to be sucked into an engine cylinder in an aqueous solution, however a turbocharged or supercharged engine would result in product failure due to the vast amount of pressure, instead of vacuum being forced through the vacuum lines.

Theoretically, it is possible that these metals can have an effect on the combustion of gasoline. The Platinum Catalyst $H_2PtCl_66H_2O$ (CPA) could facilitate the oxidation of carbon to make carbon monoxide into carbon dioxide. The Rhodium Catalyst $RhCl_2$ could serve to reduce the NO_x into N_2 and O_2. Professor Brodeur backed this up by saying, that the extra oxygen in the cylinders of an engine produced by the Rhodium Catalyst from the products of the combustion could produce a reaction favoring a more responsive reactant, thus a more complete burning of the gasoline. However, in internal combustion engines in automobiles, enough oxygen is fed into the combustion chamber with the gasoline to have a complete reaction. Therefore there is no need of addition oxygen from the products of the combustion reaction.

Furthermore, after evaluation of the tests and resources available researched on The Platinum Fuel Saver, it deemed itself a device which neither increases gas mileage nor decreases vehicular emissions. Even with the plausible understanding of the Platinum Fuel Saver System, the proposed 22% increase mileage is not possible with the nearly complete combustion of gasoline in internal combustion engines.

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Appendix A

Table 1 EPA test data (EPA)

1988 Chevrolet Celebrity, 2.5 liter, 4 cylinder

	FTP					HFET				
test no.	HC	CO	NO_x	MPG	test no.	HC	CO	NO_x	MPG
baseline					baseline				
1	0.14	2.28	0.45	26.1	1	0.04	0.61	0.27	40.9
2	0.11	2.43	0.52	25.8	2	0.05	0.74	0.28	41.2
mean	0.125	2.355	0.485	25.95	mean	0.045	0.675	0.275	41.05
Platinum Gasaver					Platinum Gasaver				
1	0.12	2.42	0.63	26.1	1	0.05	0.91	0.39	41.7
2	0.12	1.92	0.56	26.4	2	0.04	0.57	0.35	42
mean	0.12	2.17	0.595	26.25	mean	0.045	0.74	0.37	41.85
change	-4%	-8%	23%	1%	change	0%	10%	35%	2%

1988 Ford Taurus, 3.0 liter, 6 cylinder

	FTP					HFET				
test no.	HC	CO	NO_x	MPG	test no.	HC	CO	NO_x	MPG
baseline					baseline				
1	0.25	4.71	1.15	21.4	1	0.02	0.51	0.89	36.5
2	0.25	3.81	1.19	21.5	2	0.02	0.45	0.93	37.1
mean	0.25	4.26	1.17	21.45	mean	0.02	0.48	0.91	36.8
Platinum Gasaver					Platinum Gasaver				
1	0.27	5.78	1.09	22.1	1	0.02	0.43	0.92	37.6
2	0.34	5.68	1.04	21.9	2	0.03	0.87	0.92	37.3
mean	0.305	5.73	1.065	22	mean	0.025	0.65	0.92	37.45
change	22%	35%	-9%	3%	change	25%	35%	1%	2%

1987 Dodge Van, 5.2 liter, V-8

	FTP					HFET				
test no.	HC	CO	NO_x	MPG	test no.	HC	CO	NO_x	MPG
baseline					baseline				
1	0.4	5.89	1.93	14	1	0.12	0.22	3.12	19.9
2	0.47	6.17	1.7	13.9	2	0.12	0.34	2.94	20.3
mean	0.435	6.03	1.815	13.95	mean	0.12	0.28	3.03	20.1
Platinum Gasaver					Platinum Gasaver				
1	0.4	4.79	1.88	14.2	1	0.11	0.25	2.95	20
2	0.39	5.69	1.78	14.2	2	0.11	0.28	3.11	20.1
mean	0.395	5.24	1.83	14.2	mean	0.11	0.265	3.03	20.05
change	-9%	-13%	1%	2%	change	-8%	-5%	0%	0%
mean change	3%	5%	5%	2%		6%	13%	12%	1%