Example of research paper on car engines

Environment, Animals

Abstract

Cars have always played an important role in the course of human development. In the past, man had a vision to introduce an invention to transport people along long distances. To turn the vision of a self-propelling automobile into reality, it took the development of a reliable combustion engine that operated on liquid fuel. In 1672, the first steam-powered vehicle as a toy for the Chinese emperor was built by Ferdinand Verbiest, a member of a Jesuit mission in China. As the automobile industry grew, so did the rate of environmental pollution. Car engines are considered to be the prime source of air pollution. The toxic pollutants emitted from car engines have a significant impact on the atmosphere. Air pollution has direct impacts on humans, plants, and animals. It is important that we take an initiative to reduce vehicular emissions. Reduction in vehicular emissions will not only give us a safer and healthier environment but would also help us live a healthier life.

Introduction

In the course of human development, mobility has always played an important role. Man has almost attempted to invest in every era to find means to allow him to transport people along long distances. To turn the vision of a self-propelling automobile into reality, it took the development of a reliable combustion engine that operated on liquid fuel. The word automobile is a combination of the Greek word: Autos (self) and Latin word: Mobilis (mobile). Based on the prevalent means of propulsion, the early history of the auto-mobile can be divided into a number of eras. It would be

hard to imagine life in our modern day without the motor car. Its emergence required the existence of many conditions without which an undertaking of this kind would not have been possible. At this point, some development landmarks may be worthy of note. They represent an essential contribution to the development of automobile. (Reif K.). The true definition of an automobile or car is a wheeled vehicle that can transport passengers with the help of its own motor. The motor is often called the ‘ car engine’. The automobile and car engine was not invented by a single person. Moreover, the invention of the automobile did not happen on single day. (Marshall, J. D., E. Behrentz. 2005) Most theorists suggest that automobiles were invented through an evolutionary phase that resulted into the development of modern day cars such as hybrids and electric cars. The electric cars became famous because of their zero-emission concept. However, many criticized the electric car’s zero-emission concept since the electricity used to power the cars were generated from electrical pants that were associated with emissions. (Eberhard M, and Tarpenning M. 2006). An estimated 100, 000 patents have been created throughput the world in the automobile industry. There are many inventors of the automobile and its credit cannot be given to a single human being. This paper explores the development of the car engine, its use in modern-day life, effects on the environment, and the solutions to reduce or control the environmental problems associated with car engines.

History of car engines

Based on the prevalent means of propulsion, the early history of the auto-mobile can be divided into a number of eras. Later periods were defined by

trends in size, utility preferences, and exterior styling. In 1672, the first steam-powered vehicle as a toy for the Chinese emperor was built by Ferdinand Verbiest, a member of a Jesuit mission in China. The car was not a real-size replica but small that it could not carry a driver. However, it can be considered as the first (auto-mobile) or the first working steam-powered vehicle. Nicolas-Joseph Cugnot built the first steam powered auto-mobile capable of human transportation in 1769. The first car powered by an internal combustion engine fuelled by hydrogen was designed by François Isaac de Rivaz in 1807. Karl Benz invented the first petrol or gasoline powered auto-mobile the Benz Patent-Motorwagen in 1886. (Reif K.)

The first self-propelled steam road vehicles to transport groups of passengers was built by French Amédée Bollée in 1873. It was also known as the first ‘ real automobile’. Nikolaus Otto is the man behind the four-stroke internal combustion engine that constitutes most of the modern automotive propulsion. Rudolf diesel built a similar four-stroke diesel engine. In 1838, Christian Friedrich Schönbein discovered the principle of hydrogen fuel cell. It was the only technology back then that could replace gasoline as an energy source for cars. Ányos Jedli is the inventor behind the battery electric car. In 1859, Gaston Planté invented the lead-acid battery. The end of World War I (1918), through the Wall Street Crash at the end of 1929 was known as the vintage era. During this era, closed bodies, and front-engined cars with standardized controls became the norm. 90% of cars sold in 1919 were open, while 90% of all cars were closed in 1929. Multi-valve and overhead camshaft engines produced at the high end, and V8, V12, and even V16 were the base for internal combustion engines. Most of the high-end internal

combustion engines were a preferred choice of the ultra-rich. Until the turn of the 21st century, electrically powered auto-mobiles appeared but only occupied a niche market at the turn of the 20th century. For the first time in history, the global car population exceeded 400 million in 1988, increasing the flexibility and mobility for millions of people. Currently, the growth is the highest in the areas of Asia where industrialization is at its peak. In highly developed areas such as Western Europe, there has been a spurred increase in car sales. For the last few years, car sales have hit records in the South. More than half billion vehicles are on the world's roads now (10 times more than as recorded in 1950). The count includes heavy vehicles such as trucks, trailers, and road rollers. However, the rapid growth of trucks and cars have now become the largest source of worldwide air pollution. The purpose of this paper is to review the role of motor vehicles and its worldwide air pollution problems. The paper would summarize the status in controlling emission from cars and other such sources around the world and to assess the prospects for the future. (Reif K.)

Environmental impacts of car engines

Car engines are considered to be the prime source of air pollution. The toxic pollutants emitted from car engines have a significant impact on the atmosphere. Air pollution has direct impacts on humans, plants, and animals. (Lloyd AC, & Cackette TA. 2001)

Car engines affect the environment by creating noise. Vehicles are the prime source of noise pollution in urban areas. Community noise is most often associated with road traffic in urban environment. The size and speed of a vehicle is directly associated with the size of the motor engine. (Holzman DC.

2011) The larger the size of the vehicle, larger is the engine size, and greater the noise pollution. Vehicle maintenance also plays an important role in the reduction of noise pollution. (Lloyd AC, & Cackette TA. 2001; Walsh M. 1990)

Car engines are also a primary source of water pollution. The oil and other particles from car engines enter into rivers and creeks. The oil and other pollutants enter storm-water drains from roads in most urban settings. The pollutants that enter the storm-water drains eventually meet the sea and affect aquatic life. Oil is considered as a harmful water pollutant that can contaminate large water reservoirs. Small plants and animals that survive in different aquatic ecosystems maybe affected by oil and other pollutants released from car engines. (Lloyd AC, & Cackette TA. 2001; Walsh M. 1990)

Car engines have an overall effect on the environment. Right from its manufacturing, operation, and maintenance. Firstly, car engines utilize non-renewable sources such as petroleum, metals, and other fossil fuels. Most of these sources are used for making plastic, and fuel for car engines. The manufacturing and operation of car engines have the following effect on the environment: Utilization of non-renewable sources, damage caused by extraction of these sources, and the disposition of the sources that affect the ecosystem.

(Lloyd AC, & Cackette TA. 2001; Walsh M. 1990)

Ecosystems affected by air pollution

Air pollution affects air, land, and water ecosystems. The environmental effects of air pollution due to car engines are hazardous and affect human health to a significant extent. Air pollution is the main cause of acid rain. Acid rain is precipitation containing harmful amounts of sulfuric and nitric

acids. When fossil fuels are burned, sulfur and nitrogen oxides are released into the atmosphere that eventually form sulfuric and nitric acids. (Lloyd AC, & Cackette TA. 2001). These acids fall to the earth as dry precipitation (gas and particulates) or wet precipitation (rain, snow, or fog). Some of the toxic pollutants are carried by the win (sometimes hundreds of miles). Acid rain is known to cause significant damage to the environment. For example, acid rain causes soils and water bodies to acidify, damage trees, and make the water unsuitable for fish and other wildlife. Acid rain also damages national heritage such as statues, buildings, and sculptures. The most classic example of acid rain damage that affected wildlife and forests located near the Massachusetts lakes, ponds, rivers, and soils. (Burr, M. L., et al, 2004)
Acid rain has significant damage to water bodies. Eutrophication is one such condition where high concentrations of nutrients (such as nitrogen) that stimulate algae blooms. This is turn causes loss in plant and animal diversity. (Burr, M. L., et al, 2004)Algae blooms are also responsible in large scale fish death. Eutrophication is a natural process associated with the some estuaries and aging lakes. However, human activities may accelerate the process of eutrophication by increasing the rate at which nutrients enter the water (aquatic ecosystem). Vehicular emissions from cars and trucks are common sources that would contribute to the amount of nitrogen entering the aquatic system. It is important to control vehicular emission in order to protect our environment and safeguard our biodiversity. (Burr, M. L., et al, 2004)
As mentioned earlier, vehicular emission has significant impacts on the atmosphere. Haze is one such condition that is associated with air pollutants emitted from vehicles. When tiny air pollutant particles in the air encounter

with sunlight, haze is formed. Haze obscured the texture, clarity, color, and form of what we see. Apart from vehicular emissions, industrial facilities, construction activities, and power plants cause haze. Most haze-causing pollutants are directly emitted to the atmosphere. (Burr, M. L., et al, 2004) However, some pollutants such as nitrogen oxides and sulfur dioxide that form tiny particles in the air that are carried downwind can also be considered sources of haze. Haze is the leading cause of vehicular accidents due to low visibility on the roads. It is often mistaken for smog. The pollutants in the air can have adverse effects on humans and animals. (Burr, M. L., et al, 2004)

Air pollution is the only source for ozone depletion. Ozone depletion is said to be hazardous since its affects both, ground-level and the earth’s upper atmosphere (also known as the stratosphere). At ground-level, ozone is considered as a pollutant that has harmful effects on human health. The scenario is different in the stratosphere. In this case, the ozone forms a layer that protects life on earth from the harmful ultraviolet (UV) rays of the sun. The ozone layer in the stratosphere is also termed as the ‘ good ozone’. Many pollutants such as halons, hydrochlorofluorocarbons, and chlorofluorocarbons. These substances were used in solvents, pesticides, and coolants. The depletion of the ozone would increase the amounts of UV radiation to reach the earth. UV radiation is the leading cause of different types of cancer. UV radiation also affects crops such as soybeans. It can also reduce crop yields and cause significant damage to forests. Thus, vehicular (car engines) emission has significant damage to aquatic, terrestrial, and urban ecosystem. (Sullivan K R Jr. & Kimmell K.)

Organisms susceptible to vehicular emission

Vehicular has significant effect on the environment. Like humans, animals may suffer from health problems if exposed to harmful toxics or pollutants in the air. The health effects vary from species, exposure time and quantity. Many studies have provided evidence that air pollutants contribute to reproductive failure, birth defects, and disease in animals. Air pollutants that break down in the environment and enter the aquatic ecosystem are a great threat to its organisms, namely fish. (D N Alstad, G F Edmunds, Jr, and L H Weinstein. 1982) Most of the air pollutants have an indirect effect on different organisms. Some of the pollutants accumulate and bio-magnify (in tissues) of animals. The effects of these toxic pollutants are observed in animals at the top of the food chain. The concentrations of these toxics are much higher than in the air or water. Air pollution is said to have serious consequences on birds and insects. Vehicular emissions have resulted in toxicology and decline of insect numbers. (D N Alstad, G F Edmunds, Jr, and L H Weinstein. 1982)Many observational studies have proved the hazardous effects of air pollutants on economically important insects such as bees and silkworms. (D N Alstad, G F Edmunds, Jr, and L H Weinstein. 1982)

A research study by a few PhD students evaluated the effects of air pollutants on birds. The study confirmed the toxic effects of air pollutants and the decrease in the number of Pied Flycatcher (Ficedula hypoleuca) and the Great Tit (Parus major). (Eeva, T et al 1991). The researchers observed that pied flycatcher suffered from growth abnormalities of nestlings and poor quality egg shells. In the case of the great tit, growth of nestling was retarded (mostly in late nestling stage) and increased mortality. (Eeva, T et

al 1991). In summary, the great tit suffered from the reduced amount of suitable food for nestlings and the pied flycatcher suffered from the direct toxic effects of air pollutants. There have been many studies that have reported the toxic effects of vehicular emission on kites, eagles, small mammals, insects, and a few terrestrial animals. Many more studies need to be conducted to evaluate organisms susceptible to vehicular emissions. (Eeva, T et al 1991).

Chronic and acute effects of vehicular emission

Vehicular emissions can have acute or chronic effects to the environment or humans directly. Acute effects of vehicular emission include reduced crop growth, increased plant susceptibility to disease, ecosystem change, and forest damage. Chronic effects include health hazards in humans and animals owing to toxic pollutants that are emitted from automobiles. It is important to understand the effects of bad quality air in humans. (Lloyd AC, & Cackette TA. 2001). Further, the current US air quality standard tends to understate the health effects. For example, as noted in testimony before the Congress in 1987 by the Environmental Protection Agency (EPA), new studies indicate:

“ That elevated ozone concentrations occurring on some days during the hot summers in many of our urban areas may reduce lung function, not only for people with preexisting respiratory problems, but even for people in good health. This reduction in lung function may be accompanied by symptomatic effects such as chest pain and shortness of breath. Observed effects from exposures of 1 to 2 hours with heavy exercise include measurable reductions in normal lung function in a portion (15-30 percent) of the healthy population

that is particularly sensitive to ozone.”

Direct consequences of car engines (emissions) in humansIn this section of the paper we would focus on the direct consequences of vehicular emission on the human body. The chances of air pollutant exposure is would be high in a person working on the roads. A person working on the roads may inhale more toxic particles in his lifetime compared to an individual who works in an air conditioned office. However, it is not necessary that only workers on near roads have high risk of breathing toxic pollutants. A scientific study reviewed the toxic air pollutant exposure levels in drivers of buses, cars, and other heavy equipment vehicles. (Ulfvarson U, et al. 1987). The chances of a car or truck driver is equal to that of a worker near the roads in inhaling toxic gases released from vehicular emission. The researchers observed that is hard to avoid particles that enter the air inlet of an automobile, Most of the air pollutants would consist of toxic gases emitted from other vehicles. (Ulfvarson U, et al. 1987). The particles that enter the automobile not only affect the driver but the passengers inside. In public transportation such as school buses, the passengers are as harmed as the bus driver. (Soll-Johanning, 1998.) Moreover, the buses and heavy vehicles are a major source of inhaled diesel particulate matter among children and the elderly. (Marshall & Behrentz, 2005).

In other cases, for children who do not travel by school buses, the location of their daycare centers and homes may contribute to the levels of inhaled particulate matter. In their study, Burr et al. 2004 showed a positive association between respiratory disorders in the children and air pollution from heavy traffic on the street. Housten et al., 2006 stated that children

may be more susceptible to the effects of vehicular emission (due to their developing immune system and higher breathing rates). However, it does not mean that adults should ignore the warnings and health hazards of vehicular emission. There is no statistical difference between the rate of acquiring a respiratory disorder between children and adults in areas where vehicular emission is the highest. The direct consequences of vehicular emission are observed in humans, plants, and animals. However, we would consider the direct consequences of vehicular emission in humans. (Zuurbier, M., et al. 2010)

Although the symptoms of vehicular emission exposure seem to be benign and mild, long-term exposure to high levels of vehicular emissions can cause chronic diseases. (Burr et al., 2004). More than 100 million people in the world are exposed to vehicular emission on a daily basis. Most of the vehicular emissions move in the air. In Philadelphia, the concentrations of airborne particles are so high that daily deaths associated with vehicular emission are reported. (Schwartz, 2000)

Indirect consequences of car engines (emissions) on the environment

As we discussed the direct consequences of vehicular emissions on humans in the previous section, we would focus on the indirect consequences of vehicular emission on animals. Since, we know that vehicular emissions affect individual animals or population directly, it may also happen that air pollutants affect wildlife indirectly. (Schwartz, 2000). The indirect effect may change the ecosystem to a significant extent. Vegetation can be considered as the most important aspect of any ecosystem. It serves as a food source,

provides breeding and nesting habitat, and affords cover for protection from weather and predators. Therefore, any change in vegetation could indirectly affect animal populations. (Schwartz, 2000)

There are a few species that can survive in an air-pollution-injured vegetation. Many researchers have found that invertebrates are able to establish or have a preference in an air pollution-injured vegetation. (Schwartz, 2000). Many soil invertebrates may not survive due to the toxicity of air contaminants present in the soil. Heavy metals and fluorides may have a direct consequence on soil invertebrates. (Schwartz, 2000)

In such cases, species more metal-tolerant are replaced by species that are sensitive to metals. For example, soft-bodied species such as nematodes and earthworms seem to be more readily affected by elevated metal concentrations. In the forest floor litter decomposition, invertebrates play an important role. The availability of nutrients to plants is reduced due to the delayed mineral release owing to forest floor litter build-up. (Zuurbier, M., et al. 2010)

The quantity and quality of food supply when decreased has a direct consequence on the mortality rate of herbivores. Birds and mammals are indirectly affected by changes in the quantity and quality of food resources due to water acidification. Fewer fish in acidic lakes has an indirect consequence on birds such as osprey. The mortality rate of the osprey increases in more acidic lake conditions. On the other hand, birds such as the diver would prefer an acidic lake owing to its clarity compared to a normal lake. (Zuurbier, M., et al. 2010). Example: In Scotland, as the main food supply, fish, are reduced in acidic streams and lakes, Otters are rarely

observed. Calcium is an essential element for both birds and mammals. During reproduction, an adequate dietary supply is highly important. Mammals need calcium for skeletal development of fetuses while birds need birds need calcium for the proper formation of eggshells and for skeletal growth of hatchlings. (Zuurbier, M., et al. 2010). Many invertebrate species that contain high concentrations of calcium, such as crustaceans and molluscs, are very sensitive to pH levels. During the acidification of wetlands, most invertebrates would not survive in extreme conditions and thus, changing the overall ecosystem. (Zuurbier, M., et al. 2010)

Environmental solutions

Car emissions account for 70% of the air pollution. As discussed earlier, the effects of air pollutants on humans and the environment are hazardous and need to be controlled or reduced at the earliest. Reducing vehicular emissions would have significant impacts on the environment and human health. There are five steps that could be followed in order to reduce vehicular emissions. (Maizlish N, Woodcock J, Co S, et al. 2013)

- Drive slow and relax: City driving is often associated with brake and accelerator motion. Continuous acceleration and brake would increase the fuel consumption of the vehicle that would eventually increase vehicular emission. 20% of the vehicles carbon footprint can be reduced by slowing down and driving moderately.
- Switch to four day work week: 20% of vehicular emissions can be reduced by incorporating a four day work week. Work for 4 days a week for 10 hours per day and take an off for 3 days or use public transport on the fifth day of work. This pattern is said to reduce vehicular emission to a significant extent.

- Turn your air conditioner 10 minutes before you reach your destination: Turning off your air conditioner before you reach your destination would reduce vehicular emissions. The amount of CO2 emitted would reduce to a significant extent.
- Shut your engine down (when not needed): Turning down your engine off in a traffic jam or at times where there isn't any movement required would reduce the amount of carbon emissions into the environment.
- Use parallel parking: The amount of time wasted in searching a place to park your vehicle adds to the amount of vehicular emissions in the environment. Parallel parking space saves times, adds to the driver's convenience, and reduces vehicular emissions to some extent. (Maizlish N, Woodcock J, Co S, et al. 2013)

Conclusion

Reducing vehicular emissions will not only help us protect the environment but increase our overall health. There has been a substantial increase in the production of car engines over the last decade. The number of car engines is said to increase ten-fold in the next ten years. The increasing demand of automobiles will have an adverse effect on the environment indirectly or directly. Thus, it is important to control vehicular emission in order to prevent and control air pollution. Here are some of the alternatives to avoid or reduce vehicular emission: (a) Consider alternatives to travelling, such as telecommuting and video-conferencing. (b) Consider using public transportation, walking, or biking rather than private automobile. (c) Most forms of public transportation have lower pollutant emissions per passenger

than private vehicles. (d) Consider carpooling if you must drive. (e) Keeping your vehicle well-maintained will minimize emissions to a significant extent. (f) Avoid rapid acceleration and drive at a steady speed, which decreases fuel consumption and pollutant emissions. (g) Avoid idling for long periods. It is important that we take an initiative to reduce vehicular emissions. Reduction in vehicular emissions will not only give us a safer and healthier environment but would also help us live a healthier life.

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