Effect Of Carbon Black Emitted From Gasoline Automobile On The Environment

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Abstract: The research on effect of carbon black (CB) from gasoline automobile on the environment was carried out to determine the absorption rate of radiations by carbon black. In the experiment conducted in which two aluminum foils of same dimension (100cm x 100cm) were placed under sun with one foil covered with one gram (1g) of carbon black and the other foil uncovered with carbon black (kept uncovered). The specimens were allowed under the sun for total time of two hundred minutes (12000 seconds). Temperature changes of both foils were recorded in the interval of twenty minutes (1200 seconds) for some repeated readings. At the end of the experiment, results showed that the temperature change of foil covered with CB was higher (29.0 °C) than the temperature change of foil not covered with CB (28.0 °C). The difference in the temperature changes of both foils is in average of 1.0 °C. This is to say that carbon black emitted from gasoline automobile can be applied in the activities and practices that require radiation absorption.

Keywords: Carbon Black, Effect, Environment, Radiations.

1. Introduction
Carbon containing substances are the substances (compounds) that contain an atom (or atoms) of carbon such as CO₂, CO, carbon black, etc. These compounds have effects on the environment in various ways. The most common of these effects is climate change [1]. Within the discussions of global climate change, the international community recognized the importance of establishing inventories for sources and sinks of particulate light absorbing carbon [5]. Environmental protection has now become a major concern, especially following the significant negative consequences resulting from the economic development promoted since the industrial revolution. People are progressively made to understand their activities and the implications on the environment, and are increasingly interested in reducing and correcting the adverse effects [10]. Some of the sources of energy are oil, natural gas, coal, municipal waste (thermal), enriched uranium (nuclear), gradients of water (hydroelectric), heat of the earth (geothermal), wind, Sun (photovoltaic, solar thermal), biomass, etc. One fraction of the carbonaceous aerosol, commonly called carbon black (CB), is characterized by its strong absorption of visible light and by its resistance to chemical transformation[3] [7]. Carbon black (CB) is formally defined as an ideally light-absorbing substance composed of carbon. The formation process is excluded from this definition because of the varieties of potential processes and is mostly formed in incomplete combustion of carbonaceous matter. The burning of fuels for energy generates greenhouse gas (GHG) emissions expressed as CO₂e (carbon footprint equivalent) and the carbon black (soot) during the various activities: for electricity, for heat, for construction machineries and equipment, for transport of construction materials and generated waste. The green house gases (GHGs) and other carbonaceous by-products emitted absorb and hold radiations in the atmosphere and the environment [6]. Carbon black is a commercial form of solid carbon that is manufactured in highly controlled processes to produce specifically engineered aggregates of carbon particles that vary in particle size, aggregate size, shape, porosity and surface chemistry. Carbon black typically contains more than 95% pure carbon with minimal quantities of oxygen, hydrogen and nitrogen [2] [4]. Carbon black disposition also affect the health of human being by increasing the lung risk as regards to making the human lungs susceptible to cancer. The excess inhalation of aerosol carbon black is another contributor to health changes and other environmental problems [8].

2. Materials and Method
A spatula was used to collect some quantities of carbon black (CB) from the tailpipe (exhaust pipe) of a gasoline vehicle, particularly a L300 bus, into a crucible. The bus commuted beyond a thousand mile daily. After the sample (CB) collection, two aluminum foils were placed on two stools (stand) of 100cm high each. Then one of the aluminum foils was covered with one gram (1g) of the CB and the other aluminum foil was left uncovered with any substance. The two stools containing the samples were put under the sun and left for several hours. Temperature changes of the two samples were read and recorded in every twenty minutes (1200 seconds) using thermometer. A stop watch was used to determine the time for the temperature changes. The average ambient temperature of the environment was recorded to be 25.5 °C in the period of the experiment.


2.1 Sample Preparation
The CB was collected direct from the vehicle tailpipe in order to free the sample from contaminations such as grease and other oils, etc. Also the aluminum foils were cut in dimensions of 100cm by 100cm so as to have an equal surface area. For non disturbance of the samples, two stools of equal height 100cm high were produced.

3. Results and Discussion
The values of temperature changes from the two samples were tabulated as $\theta_1$ and $\theta_2$. Temperature changes of empty foil and the foil containing CB were denoted as $\theta_1$ and $\theta_2$ respectively. The values recorded were used to plot a graph of temperature versus time.

![Fig. 1: Absorption rate of radiation for the aluminum foil without carbon black.](image1)

![Fig. 2: Absorption rate of aluminum foil covered with gasoline carbon black.](image2)

The results presented in Fig. 1 and 2 represent the graph of temperature against time. Fig.1 showed that for aluminum foil without CB covering, the temperature at twenty minutes (1200 seconds) which was the first reading (time) was 25.7 $^\circ$C and at the maximum or last reading at 12000 seconds was 28.0 $^\circ$C. Fig.2 revealed that for aluminum foil covered with carbon black (CB), temperature change at the initial reading (at 1200 seconds) was 26.4 $^\circ$C and final reading (at 12000 seconds) was 29.0 $^\circ$C.

Result in Fig. 3 is the representation of comparison between the aluminum foil whose surface area was uncovered with CB and the aluminum foil whose surface area was covered with CB. This comparison has shown the aluminum foil with CB on the surface absorbed more radiations than aluminum foil without CB. The absorption of many radiations by the CB led to the increase in temperature (temperature change) of the aluminum foil with CB.

4. Conclusion
Two aluminum foils of equal dimensions (100cm x 100cm) were exposed to sunlight at same time. One of the foils surface areas that was covered with 1g of carbon black of gasoline was observed to absorb more radiations than the foil without any carbon black covering. The aluminum foils were allowed under the sun for 12000 seconds. The first reading and the other readings were subsequently taken in interval of 1200 seconds. The results of the experiment showed that carbon black absorbed radiations which increased the temperatures of the foil containing it than the foil uncovered with any carbon black. The difference in temperature changes of the two foils is averagely 1.0 $^\circ$C. This effect has shown that carbon black from gasoline can be applied in activities requiring light absorption (good absorber of radiations). However any environment covered with carbon black has the tendency of absorbing radiations, thereby increasing the temperature of the environment.

5. Recommendations
Carbon black should be completely involved in work requiring radiations absorption because of its unburned carbon which is black in colour since dark (black) materials enhance the absorption of radiations. Also carbon black should be properly disposed. It should be disposed in areas where high temperature is needed and never in areas where high temperature is not required.
References


