

Vehicle Emission Control Using Algae

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Abstract: As we all know the number of vehicles are increasing at a very fast rate therefore causing great increase in environmental pollution which needs to be controlled.

Environmental pollution control using microbiology is thus an exciting area of science and technology which can be used for controlling pollution levels across the country, thus we have used green algae to reduce the amount of pollutants in the exhaust of a vehicle by evolution of oxygen in the presence of algae, water, sunlight or a light source and small amounts of vinegar. The purpose of this experiment was to figure out whether or not algae can photosynthesize in a tailpipe. If it can then it could be used to reduce auto emissions by taking in carbon dioxide and releasing oxygen. In a tailpipe there is sulfur dioxide and nitrogen oxide in exhaust, which would acidify the water. To simulate that, we used the algae with different concentrations of vinegar. But we found that algae was not able to survive with higher concentration of vinegar therefore concentration of vinegar was kept as low as possible in order to make algae grow further in the presence of light source thus absorbing carbon levels from the exhaust and releasing oxygen as a by-product.

1. INTRODUCTION

The basic process of photosynthesis is plants and other organisms to convert light energy, normally from the sun, into chemical energy that can be later released to fuel the organisms activities and thus release oxygen as a by product . Most plants, most algae, and cyanobacteria perform photosynthesis, and such organisms are called photoautotrophs.



Thus we have tried to use algae to control the emission levels of the automobiles i.e to decrease the levels of carbon contents in the exhaust of the automobiles that is transferred into the atmosphere .

2. APPLICATION

For this project we were interested in what's in car exhaust and how does it react with water, because the algae has to be in water. The chemicals in car exhaust include :

1. Carbon monoxide (CO)
2. Nitrogen dioxide (NO₂)
3. Sulfur dioxide (SO₂)
4. Soot
5. Benzene
6. Formaldehyde
7. Polycyclic hydrocarbons

But none of them are practical for a science project . Nitrogen dioxide and sulfur dioxide produce acids when mixed with water form acids which affect algae to carry out further photosynthesis. There are certain acids which are used to preserve algae in presence of acidic environment such as formalin (40% formaldehyde in water), as formaldehyde is considered carcinogenic, any contact with skin, eyes, and air passages should be avoided. Algae mixed with other chemicals such as glacial acetic acid and alcohol (FAA 1:1:8 by volume: 40% formaldehyde 1:glacial acetic acid 1:95% alcohol 8) gives better preservation results for some of the more fragile algae therefore we have used vinegar (acetic acid) or CH₃COOH, to stimulate the effect of sulphuric acid on algae . The purpose for this project is to find out whether algae can photosynthesize in acidified water. Our hypothesis is the higher the concentration of acid from vinegar (in % of volume) the less oxygen the algae will produce.

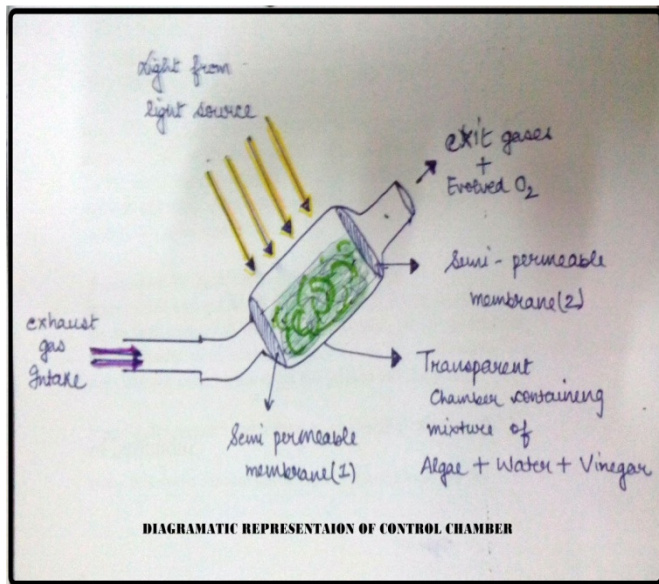
Algae is a photosynthetic bacteria that uses sunlight to obtain hydrogen from hydrogen sulphide and other reduced sulphur compounds for the reduction of carbon dioxide .



This whole reaction also involves reduction of water and releases oxygen as a byproduct thus depressing the amounts of carbon present in the exhaust .



3. METHOD



Above figure shows the diagrammatic representation of the emission control chamber in which exhaust gases from the muffler of the vehicle are made to pass through the control chamber, which consists of two semi-permeable membranes which do not allow to pass water through them but allow gases to pass through. Chamber contains a mixture of green algae, water and small amounts of vinegar or say acetic acid (CH_3COOH) to neutralize the effects of SO_2 in the exhaust which help to protect algae from harmful acids and grow further, when exhaust passes through this chamber the algae undergoes the process of photosynthesis in the presence of light source in order to decrease the carbon content of the exhaust and increase the amount of oxygen levels and finally releasing into the atmosphere thus enhancing the quality of exhaust which is released into the atmosphere.

VARIABLES USED

Controlled Variables

- amount of water
- amount of algae
- amount of plant food
- amount of light
- amount of air

Safety:

None of the chemicals (or the algae) are hazardous. Chlorella is edible, and 5% vinegar is not considered hazardous. I was very careful not to get the vinegar in my eyes.

4. MERITS

- This process is cheap i.e does not require large amount of money expenditure.
- Process is easy and fast.
- Appreciable amounts of carbon can be decreased.
- Quality of urban air can be enhanced easily .

5. DEMERITS

- Since oxygen is released as a by product so the control chamber should be kept as far as possible from the electricals, fuel tank or engine etc as it may catch fire.
- The efficiency of the process is not too high but appreciable .
- Takes proper attention for efficient working, because if the algae does not grow then photosynthesis will stop and the process will prove to be inefficient.

6. CONCLUSION

Observing present emission levels of the automobiles it is very necessary for controlling the pollutants, thus algae can be efficiently used to decrease the levels of carbon compounds presents in the exhaust using simple apparatus which is cost effective as well as easy to carry out, but the algae has to be protected with the help of acetic acid so that its grows further and photosynthesis goes on.

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