Anticipation Of Vocs And Haps Compounds By Using Of Appropriate Technology

M.Shabari,R.Thiraviyaraj, A.Suresh Kumar, R.Vignesh, S.Renuga Devi

ABSTRACT- Most of the manufacturing industries, like paints, chemicals, pharmaceuticals, Textiles, petrochemicals are produce volatile organic compounds (VOCs), hazardous air pollutants (HAPs) and odors as part of their manufacturing process. It should be affect for the nature of environment and human health. So it can be consider that these kinds of pollutant problems are reduce by using of bio (or) chemical oxidation process. From this method dealing with these industrial air emissions include masking agents or activated-charcoal filters, or thermal- or catalytic-oxidization systems that use natural gas to burn off the pollutants. However, as the world struggles to increase energy efficiency to cut both costs and carbon emissions, industry is investigating lower-impact, and more efficient methods of controlling the release of harmful pollutants into the atmosphere. Bio (or) chemical oxidation is an air pollution control technology that uses naturally-occurring to biologically absorb and digest industrial emissions, converting them to carbon dioxide, water and mineral salts. The process typically involves drawing a contaminated air stream through some type of medium that hosts a community of microbes including either bacteria or fungi, or a combination of the two. The process is referred to as bio-oxidation, although it can occur in "bio-trickling filter," and "bio-filter" units, either alone or in combination, all of which operate at a different media "wetness" based on the requirements of the appropriate microbe's and the targeted pollutant.

Key words: Bio (or) Chemical oxidation, volatile organic compounds, hazardous air pollutants, Bio filtration, Oxidation, CO_2 Emission, and H_2O Formed

INTRODUCTION

A number of industries, including those that manufacture paints, chemicals, pharmaceuticals and wood panels, produce volatile organic compounds (VOCs), hazardous air pollutants (HAPs) and odors as part of their manufacturing process. Traditional methods of dealing with these industrial air emissions include scrubbers, or activated-charcoal filters, or catalytic-oxidization systems that use natural gas to burn off the pollutants. However, as the world struggles to increase energy efficiency to cut both costs and carbon emissions, industry is investigating lower-impact, and more efficient methods of controlling the release of harmful pollutants into the atmosphere. Bio-oxidation is an air pollution control technology that uses naturally-occurring microbes to biologically absorb and digest industrial emissions, converting them to carbon dioxide, water and mineral salts. The process typically involves drawing a contaminated air stream through some type of medium that hosts a community of microbes including either bacteria or fungi, or a combination of the two.

- *M.Shabari is currently pursuing B.E. (Final)Civil Engineering in Erode Sengunthar Engineering College, IndiaPH-9578218284. E-mail: saishabari46@gmail.com*
- *R.Thiraviyarajis currently pursuing B.Tech. (Pre-Final)Chemical Engineering in Erode Sengunthar Engineering College, IndiaPH-9578218284. E-mail: r.thiravi@gmail.com*
- *A.Suresh Kumaris currently pursuing B.Tech. (Pre-Final)Chemical Engineering in Erode Sengunthar Engineering College, India*
- *R.Vigneshis currently pursuing B.Tech. (Pre-Final)Chemical Engineering in Erode Sengunthar Engineering College, India*
- *S.Renuga Deviis currently pursuing B.E.. (Pre-Final)Civil Engineering in Erode Builders Educational Trust, India*

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MAGNITUDE OF THE PROBLEM

India is an agriculture country, it contain total forest &agriculture land of 1004540 km^2. In that 1750.25 lakh ha amount of sai land become polluted (in the year of 1984).but only 247.84 lakh ha of land treated. Still 1502.41 lakh ha of area are remaining. Owing increases industries & population the product of paper, leather, metals, rubber and plastics etc… thus are steep increases over the last few decades. Ex: the annual urban refuse of USA is estimated to be over 400 mega tons. The national average waste generated in North America is 1 ton for capita per year about 2.7 Kg per person per day. In India 300-400 gram of waste produced by person per day.

Table 1.1 the following table shows the polluted land detail in India.

STATE OR UNION TERRITORY	*PROBLEM AREA (lakhs, ha)*	*AREA TREATED (lakhs, ha)*	*AREA TILL TO BE TEATED(lakhs, ha)*
Andhra Pradesh	**117.32**	**7.29**	**110..03**
Assam	**25.10**	**0.62**	**24.48**
Gujarat	**137.29**	**22.30**	**114.99**
Bihar	**67.28**	**6.56**	**60.72**
Haryana	**45.25**	**2.00**	**43.25**
Himachal Pradesh	**18.78**	**1.47**	**17.31**
Jammu & Kashmir	**8.33**	**0.49**	**7.84**
Karnataka	**106.16**	**31.48**	**102.68**
Kerala	**19.78**	**1.29**	**18.49**
Madhya Pradesh	**214.24**	**32.92**	**181.32**

Manipur	**199.38**	**84.28**	**115.1**
Meghalaya	**4.74**	**0.16**	**4.58**
Nagaland	**12.60**	**0.17**	**12.43**
Orissa	**10.27**	**0.15**	**10.12**
Punjab	**46.70**	**3.70**	**43.00**
Rajasthan	**71.49**	**2.91**	**68.58**
Sikkim	**379.73**	**15.87**	**363.86**
Tamil Nadu	**0.45**	**0.03**	**0.42**
Tripura	**58.00**	**4.22**	**53.78**
Uttar Pradesh	**3.86**	**0.16**	**3.7**
West Bengal	**135.75**	**24.45**	**111.3**
Union territories	**46.77**	**2.17**	**44.6**

THE REACTION OCCURED IN REACTOR

C_6H_5OH + OXIDASING AGENT (bacteria) → CO_2 + H_2O
(OR) (OR)
ACTIVATED CHARCOAL MINIMISED C_6H_5OH

The above equation is under 1st order reaction. Because the rate of the reaction only depends up on the concentration of the VOCs in the fluid (ex-phenol).

THE MATHEMATICAL EXPRESSION

The rate of the reaction is given by,

$$r = \frac{K1\,[C6H5OH]}{[CO2][H2O]} = -\frac{d[C6H5OH]}{dt}$$

For simplifying the above equation,
Bio oxidation demand reaction can be expressed as 1st order,

$$\frac{-dL_t}{dt} = k'C$$

Lt – pollutant
C – Living organism

$$\frac{-dL_t}{dx} = t'L_t$$

$$\frac{L_t}{L_o} = e^{-k't} = 10^{-kt}$$

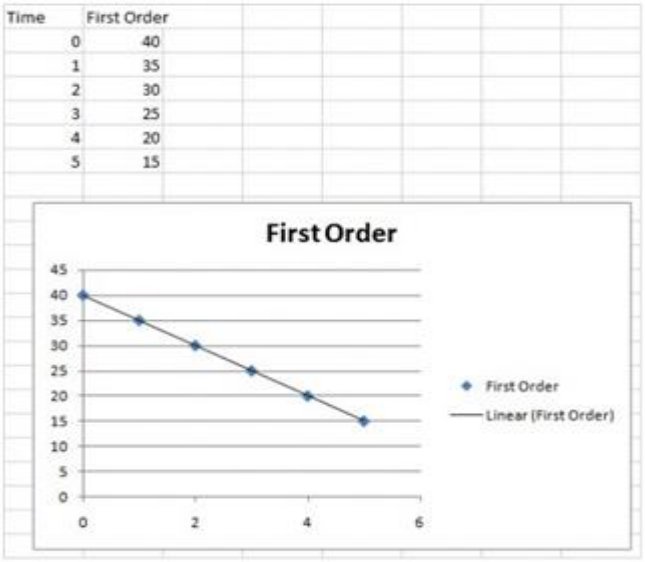
$$Y = (L_o - L_t)$$

$$Y = L_o(1 - e^{-k't})$$

$$Y = L_o(1 - 10^{-k't})$$

GRAPHING FIRST ORDER REACTION

The following graph represents



Concentration vs. Time

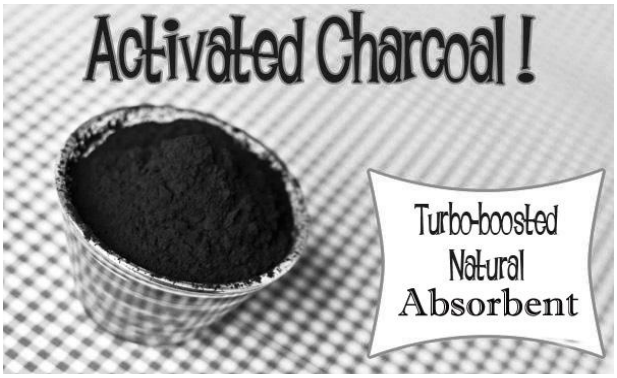
MEANING FOR BIO-OXIDATION

Bio-oxidation is a biological air pollution control technology that utilizes bacteria & fungi to biologically absorb and digest vapor phase VOCs and odorous compounds commonly found in industrial and municipal applications.

THE ROLE IN THE ACTIVATED CHARCOAL

Activatedcharcoal is charcoal that has been treated with oxygen to open up millions of tiny pores between the carbon atoms. The use of special manufacturing techniques results in highly porous charcoals that have surface areas

of 300-2,000 square meters per gram. These so-called active, or activated, charcoals are widely used to adsorb odorous or colored substances from gases or liquids.



The word adsorb is important here. When a material adsorbs something, it attaches to it by chemical attraction. The huge surface area of activated charcoal gives it countless bonding sites. When certain chemicals pass next to the carbon surface, they attach to the surface and are trapped. Activated charcoal is good at trapping other carbon-based impurities ("organic" chemicals), as well as things like phenol, ethanol, etc. . . . . So they pass right through. This means that an activated charcoal filter will remove certain impurities while ignoring others. It also means that, once all of the bonding sites are filled, an activated charcoal filter stops working. At that point you must replace the filter.

DISADVANTAGES OF USING CHARCOAL

If we are using charcoal in long time means the adsorption will be terminated and desorption process takes place inside the reactor.

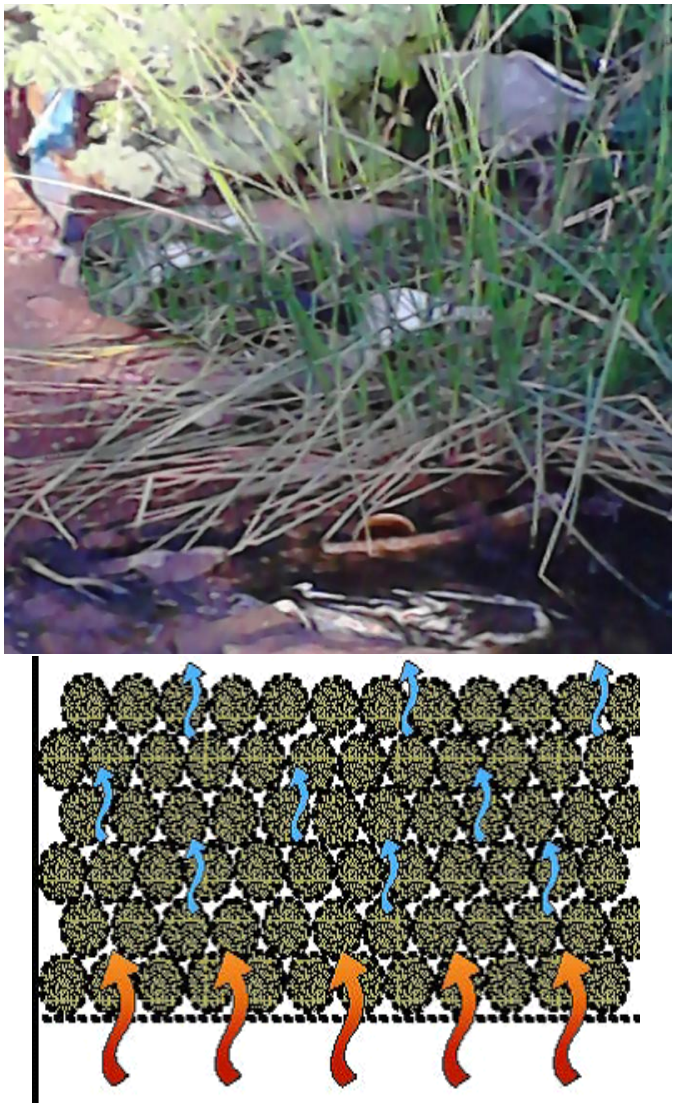
MODIFY FROM PAST

Historically, it was used to treat odors. The earliest "systems" were essentially open pits of soil. Most modern bio-oxidation systems, while based on the same biological principles as earlier systems, are completely enclosed and highly engineered, and the technology has developed to the point where bio-oxidation can degrade emissions produced by a number of industrial processes. It has been shown to control: methyl ethyl ketone (MEK); methyl isobutyl ketone (MIBK); toluene; xylene; acetone and various alcohols from the manufacture of paints; methanol and formaldehyde from the manufacture of particleboard; and solvents used in silk-screen printing, as well as other pollutants.

PROCESS OF POACEAE FAMILY PLANT

Poaceae family plant used in bio-oxidation digest the pollutants in a multi-step process. After the chemicals pass through the plant's cell wall, enzymes transform the molecules by pulling them apart until they change into a different compound. For example, in the digestion of a phenol molecule (C_6H_5OH), the molecule changes to carbon dioxide (CO_2) when carbon and oxygen join one another, and then to water (H_2O) when hydrogen and oxygen molecules join. This process of "oxidation," the joining of molecules with oxygen, not only makes CO_2 and H_2O, but also provides some of the energy needed by the cell for metabolic processes. Limited Upper VOC Concentration Capability (<2,000 ppm).

Image for the poaceae family plant



SAMPLE DUAL VESSEL SYSTEM:

SYSTEM INTERNAL COMPONENTS:

- Sprinkler Heads and Cross Flow Media
- Activated charcoal bed.

ADVANTAGES:

- Effective treatment.
- No expensive chemicals.
- No maintenance costs.
- Certified technology.
- Compact, does not occupy space.

VENT GAS ANALYSIS SUMMARY:

94.3% average removal of Non-BTEX VOCs

- Methane Ethane Propane
- i-Butane n-Butane i-Pentanes
- n-Pentane i-Hexane n-Hexane
- HeptaneIso-Octane

99% average removal of BTEX compounds

- Benzene, Toluene, Ethyl benzene, Xylenes

TOTAL VOC removal average = 95.1%

ALTERNATIVE TECHNOLIES:

- Fungi (or) bacteria
- RTO's
- Agents
- Thermal & Catalytic Oxidation
- Scrubbers

TOTAL SUMMARY OF THE PAPER:

- To prevent the environment from the industrial emissions like volatile organic compounds (VOCs), hazardous air pollutants (HAPs).
- Lower capital costs.
- Significantly lower energy requirement.
- Treats combined air streams.
- No combustions of by-products.
- Odor reduction obtainable in <24 hours.
- Significant lower CO_2 generated.
- Less maintenance, fewer moving parts.

RESULT AND DISCUSSION

From this project concluded for bio (or) chemical oxidation system will reduce greenhouse gas emissions by CO_2 reduction with save thousands of cubic feet of natural gas annually to heat and businesses, and reduce NOX emissions. Most of the manufacturing industries, like paints, chemicals, pharmaceuticals, Textiles, petrochemicals are produce volatile organic compounds (VOCs), hazardous air pollutants (HAPs) and odors as part of their manufacturing process. From this method dealing with these industrial air emissions include masking agents or activated-charcoal filters, or thermal- or catalytic-oxidization systems that use natural gas to burn off the pollutants. These kinds of industrial effluents can be suitable for oxidation process. By using the oxidation method we can reduce the **95.1%** of the chemical pollutant present in the effluent.

CONCLUSION

From this project we can able to anticipate the land and the air pollution by the application of the ACTIVATED CHOACOAL and POACEAE FAMILY PLANT. It may able to anticipate the VOCs and HAPs. From that project we recover the water also and it's also a CO-GREEN project.

REFERENCE:

[1] Jim Boswell, senior scientist at Bio-Reaction Industries (BRI).

[2] Sastry.C.A. and Mohan.G.j. (1963), Anaerobic digestion of industrial wastes.Indian J.Environ. Health.

[3] Gomec, Y.C., speese,R.E.,(2003). The role pH in the organic material in the solubilisation of domestic sludge in anaerobic digestion. Water science technology.