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# REMOVAL OF TOXIC GASES BY USING BIOFILTRATION

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**ABSTRACT**

Ammonia gas is emitted by many industries, poultry farms and composting plant. It is a colorless, toxic reactive and corrosion gas with a sharp odor. Its generation at source is seriously notable as it is irritating to the skin, eyes, nose, throat, and lungs. Though many technologies are available biofiltration is an advanced technology that is being used as a control technique. In many research articles, the biofilter medias used as amixture of manure fertilizer, sugarcane bagasse, cattle manure and rice husk ( kavyashree etal). In this project an innovative idea of mixing theses biofilter media has been tried to improve their efficiency. An experiment setup of biofilter column is proposed for the investigation of removal efficiency.

**Keywords:**Biofiltration,Cattlemanure,Ricehusk,Manurefertilizer,Sugarcane bagasse, Ammonia.

## I. INTRODUCTION

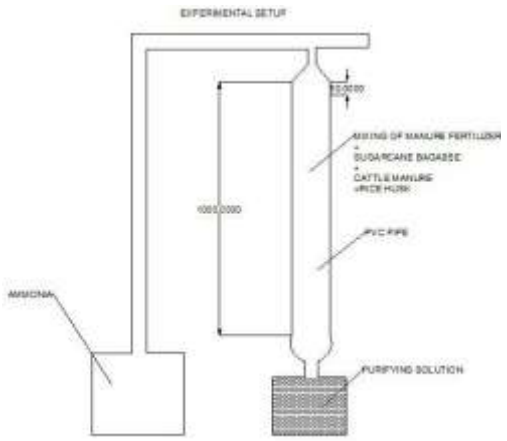
Ammonia gas is a colorless, odorous, corrosive and toxic gas. It is produced from several sources such as composting and fertilizer plant, wastewater treatment plants, livestock farming and the chemical and manufacturing industries. There are many technologies for ammonia removal such as the catalytic oxidation, liquid absorption , solid adsorption and biological filtration. The biological treatment is an emerging technology for treating odorous air pollution. The biofiltration is one of several biological treatment methods. The biofiltration is an ammonia gas pollution control method using living materials to capture and biodegrade pollutants. Biofiltration is the most attractive alternative method for ammonia gas treating because its high removal efficiency, low operation and maintenance cost and modest environmental impact. In the biofiltration process, an industry gases passes through a biofilter media layer such as manure fertilizer, sugarcane bagasses, cattle manure, rice husk are the materials. These layers will help adsorbed the ammonia gas in the industry. After that a biodegradation occurs due to the microorganisms activity in the biofiler followed by biodegradation of adsorbed pollutants. The biofilter media uses the microorganisms to remove the air pollution. Moreover the biofiltration is a proven technology as an odor and volatile organic compound reducing emission method from industrial and commercial emission sources. Thus, manure fertilizer has sufficient nutrient as required.

However, the dense and packed volume characteristics of manure fertilizer may not allow gas to pass through easily. Therefore, another media such as sugarcane bagasse that can increase void space in the manure fertilizer must be added. Sugarcane bagasse is an agro-industry waste from sugarcane industry. on how to mix both materials to get the highest efficiency must be conducted. In this study, the ammonia gas removal is evaluated by a laboratory-scale biofilter using a mixture of manure fertilizer sugarcane bagasses, cattle manure and rice husk as the biofilter media. The ammonia gas, before and after biofiltration were analyzed to determine the effect of the biofilter on the removal efficiency.

## II. CHOICE OF TECHNOLOGY

The biofilter medias used as a mixture of fertilizer, sugarcane bagasses, cattle manure and rice husk for the removal ammonia gas from industries.

**LINE DIAGRAM OF EXPERIMENTAL SETUP:**




**All dimensions are in mm**

## III. MATERIALS AND METHODS

### RAW MATERIALS:

**MANURE FERTILIZER:** The manure fertilizer are used as the agricultural residue biofilter media in these experiments. The manure fertilizer is a product from animal waste composting which has the advantage of adding a balanced set of nutrients to soil. It contains many nutrients for microorganisms such as nitrogen, phosphorus, potassium, trace nutrients and soil microorganism stimulants

**SUGARCANE BAGASSE:** The sugarcane bagasse are used as the agricultural residue biofilter media in these experiments.The typical sugarcane bagasse is a fibrous matter that remaining from the juice extraction from the sugarcane stalk. The moisture content is high in range 40-50%. The typical sugarcane bagasse contains 45- 55% of cellulose, 20-25% of hemicelluloses, 18-24% of lignin, 1-4% of ash and less than 1% of waxes.

**CATTLE MANURE:** Cattle manure was selected as a filter media as it contains nitrate oxidizing bacteria such as nitrosomonas and nitrobacter. Initial characteristics of cattle like pH, nitrates were determined.

**RICE HUSK:** Rice husk was grinded and size of 0.6mm retained in the sieve was selected. Rice husk was soaked in the water for 24 hr.

## IV.MATERIALS USED

**Column specifications:**

1. Material: Poly Vinyl Chloride
2. Diameter: 110mm
3. Height of biofilter: 1000mm
4. No of sampling ports: 2
5. Diameter of the port: 15mm

**Filter Media specifications**

1. Cattle manure
2. Rice husk - Grinded and size of 0.6mm retained in the sieve
3. sugarcane bagasse
4. manure fertilizer

## V. EXPERIMENTAL SETUP

The diagram of the biofiltration process used is shown in Fig In this study, biofilter reactors were used; the reactor consists of a cylindrical vessel. The biofilter was constructed from a Poly Vinyl Chloride pipe with a height of 1m and a diameter of 0.11m. The column of biofilter was packed with the mixture of cattle manure, sugarcane bagasse, manure fertilizer and rice husk as shown in fig. The packed biofilter material in each layer was supported by a metal sieve plate. Gas-sampling ports were provided at the inlet and outlet of each layer. The reactor has the biofilter media as manure fertilizer, rice husk, cattle manure combined with sugarcane bagasse respectively. The inlet ammonia gas flow rate was maintained at 50 cm3 sec-1. The moisture content of the biofilter media was maintained at 45-60% for optimum operation condition.

## VI. RESULTS

**Biofilter media characteristics:** The properties of biofilter media, manure fertilizer, cattle manure, rice husk and sugarcane bagasse, are shown in Table. The moisture content of manure fertilizer ,sugarcane bagasse rice husk and cattle manure were 2.7%, 9.1%, 6% and 10.2% respectively. The moisture content is a major parameter for the operation control of the biofiltration process. The optimum moisture content of a biofilter media should be 40-60%. Thus, water must be added to the biofilter media in order to maintain the moisture content within the optimal range. The pH is 8.6, 5.1, 8.5, and 6.8 for manure fertilizer and sugarcane bagasse, cattle manure, rice husk respectively

| sno | Properties | Unit | Manure Fertilizer | Sugarcane Bagasse | Rice husk | Cattle Manure |
|---|---|---|---|---|---|---|
| 1 | Moisture content | % | 2.70 | 9.10 | 6 | 10.2 |
| 2 | pH | - | 8.60 | 5.10 | 6.8 | 8.5 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 3 | C/N ratio | - | 5.50 | 120.00 | 72 | 98 |
| 4. | Organic carbon | % dry weight | 13.10 | 24.00 | 14.58 | 9.11 |
| 5 | Organic matter | % dry weight | 22.70 | 41.40 | 24.55 | 40.40 |

## VII. CONCLUSION:

The experimental results demonstrated that the ammonia gas was successfully eliminated in a laboratory scale biofiltration process using rice husk, cattle manure, manure fertilizer and sugarcane bagasse as biofilter media in this study. When we compare Rice husk and cattle manure has been proved as an efficient media for removal of Ammonia gas from air stream. Removal efficiency for bed depth of 20cm was found to be 61.5% and for bed depth of 40 cm was found to be 71.45%. The mixture of manure fertilizer and sugarcane bagasse is an effective biofilter media for ammonia gas removal applications.The maximum ammonia gas removal efficiency at 89.93%**.**The elimination capacity increases when the inlet ammonia gas concentration increases. In our project the biofilter as a media as a mixture of cattle manure, rice husk, sugarcane bagasse and manure fertilizer e maximum ammonia gas removal efficiency is 98.5% for biofiltration process. The experiments can concluded that the rice husk, cattle manure, manure fertilizer and sugarcane bagasse are suitable biofilter media for a biofiltration process. The mixture of rice husk, cattle manure, manure fertilizer and sugarcane bagasse has no significant effect on the ammonia gas removal efficiency

## BIBLIOGRAPHY

[1].“Ammonia gas removal using biofilter”, Kavyashree. B A, Ramya. N, Sanjay Urs .A M, Chandan. K B, Shilpa. B S, Rashmi. M B.-*July 2015*

[2].“Biofilter Treating Ammonia Gas Using Agricultural Residues Media”, Thaniya Kaosol and Nutthawut Pongpat. -2012

[3].“Biofiltration for ammonia removal from composting exhaust gases” Estel.la Pagans, Xavier Font, Antoni S´anchez.- 1 March 2005.

[4].“Biological Removal of Ammonia from Contaminated Air Streams Using Biofiltration System”,*MR .Shahmansouri, H. Taghipour, B .Bina, H .Movahedian*-13 September 2005

[5].“Removal of ammonia from landfill leachate from biofiltration process”-L.Mpenyana,M.A A.Coetzee and S.Schwarzer.-2008