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PERFORMANCE STUDY OF BIOWISH TREATMENT TECHNOLOGY FOR REDUCTION OF EMISSION OF ODOURS IN SOLID WASTE

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Abstract: **During processing and disposal of solid waste, there is production of odorous gases which is one of the major issue faced in Solid Waste Management. There are threat to not only living animals but also the landmass facility as well as natural flora and fauna. Major gases responsible for causing odour from a solid waste are hydrogen sulphide and ammonia. A study has been performed on municipal, commercial and institutional solid waste for the decreasing rate of production of odorous gases when they are microbially treated using Biowish technology. Two gases are chosen for analysis which is ammonia (NH_3) and hydrogen sulphide (H_2S). Emission concentrations of these gases were measured initially at different temperatures ranging from 28 ± 2^0C to 36 ± 2^0C without applying Biowish chemical. Later, Biowish chemical was sprinkled on those solid wastes by dissolving in water at different concentrations and concentration of ammonia and hydrogen sulphide measured. Analysis shows that there was considerable reduction in strength of ammonia and hydrogen sulphide when Biowish chemical was applied in higher doses and at higher temperature. In some cases it was reduced to even zero also.**

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I INTRODUCTION

Solid Waste can be defined as any material which constitutes scrap material, effluent and other unwanted excess substances produced due to the application of a process or which requires to be disposed as they can be broken, contaminated or spoiled. There composition varies with locality, standard of living and time. As per recent study, the per capita waste generation is increasing at the rate of 1.3% per year. With an urban growth rate of 3-3.5% per annum the annual increase in waste quantities may be considered at 5 % per annum. Municipal solid waste density in India is typically around 450-500 kg/m^3. Chemically they consists a number of constituents in which primary components are lipids, protein, carbohydrates and natural fibers. Solid waste is one of the major issues in various developed and developing countries. They are imposing threat to hygienic safety in various ways like there accumulation at random locality, aesthetic problem, leaching to groundwater, fly nuisance and odour etc. At their processing sites, they cause odour problem severely which makes it difficult for any person to work with it. Odour can be defined as a sensation caused due to the reception of the expression by olfactory system. Bacterial decomposition, volatilization and chemical reactions are the factors responsible for the production of municipal solid waste gases. Among all these factors, bacterial decomposition is mostly responsible for gaseous production when organic waste solids, food (i.e. meats, vegetables), garden waste (i.e. leaf and yard waste) are broken down by bacteria naturally present in the waste and in soils. Volatilization is an also important reason which generates gas when certain wastes change from a liquid or solid into a vapor. When different waste materials are mixed together then, chemical reactions occur during disposal operations. Moisture has an important role to play in the speed of decomposition.

Generally the more is the quantity of moisture the more gas is generated either process is aerobic or anaerobic. Gases released from different sites are the main factor in polluting the environment and leading hazardous effects on health as volatile organic compound various types of Cancer and birth problems etc. Main odour causing compounds are ammonia and hydrogen sulphide. These odours are irritant to mucosa membrane and deposited in the nose and upper respiratory tract which causes cough, chest tightness.

Gases may migrate from the landfill either above or below ground. Gases can move from landfill area to the atmosphere and through the soil underground and may enter homes or utility corridors in nearby area of landfill.

II MATERIAL AND METHODOLOGY

The study area is two municipal solid waste transfer stations at Nada Khada and Kali Bawadi in Udaipur city with average 100-150 tons /day waste. In this study Enzymematic treatment is done by spraying Biowish powder and measurement is done by Multi Gas Detector which measure ammonia and hydrogen sulphide gas. About two transfer stations has been selected for monitoring of odour pollutant in residential with commercial area of Udaipur city for the analysis of various gases generated from municipal solid waste. In this study odour pollutant parameters such as NH_3 and H_2S are monitored and the results are presented.

Biowish is a strong mixture of biocatalysts which breaks down complex organic molecules which helps in eliminating waste, reducing odours, improving soil fertility and enhanced water quality, among other uses. By virtue of all these properties, it helps to solve problems of environmental management which includes wastewater, solid waste, soil and water remediation and industrial emissions, as well as agriculture also. Its working mechanism involves eliminating odors at their molecular source by bio chemically changing the pattern of decomposition and accelerating the natural degradation process. Biowish Odor uses a dual action process on odor causing molecules. First, it degrades the substrates at the source and then, causing decomposition in their gaseous state. When enzymes come into contact with the volatile organic compounds they start reacting biochemically and subsequently break the volatile organic compounds into odorless compounds. Rapid process of decomposition and degradation take place due to Biowish Odor's special properties to operate within an acidic environment and digest odor molecules in their dissolved, gaseous state.

Other native bacteria generally lose effectiveness at pH levels below 4.5 whereas Biowish Odor can operate in acidic conditions. Dose of Biowish Odor is 1g to 5gm in a 1 liter to 5 liter of water. Various advantages of Biowish technology includes removing odors at source, reducing emission of ammonia, hydrogen sulphide and volatile compounds, breaking down organic waste, reducing waste volume and 100% non-toxic and natural. Composition of ingredients of Biowish is given in table 1.

Materials used at the site were Biowish odour, municipal solid waste, water and multi- gas analyser. The study was conducted on the fresh solid waste at the Transfer Station. Dosage was 1g/ ton of waste. It was mixed in raw water and sprayed on solid waste. Raw water was utilized for activation and then application of Biowish Odor solution. After spraying, it was left for 45 minutes for activation. Finally, Multi Gas Analyser was run on Fresh solid waste material before and after application of Biowish Odor for recording H_2S and NH_3 on fresh solid waste material at Transfer station.

Table 1: Composition of Ingredients

S. No.	Ingredient	Percent (%w/w)
1	Rice bran oil	38.0- 42.0
2	Water (filtered)	23.0 – 27.0
3	Soybean meal	8.0 – 12.0
4	Dolomite (Ca Mg(CO3)2)	6.0 – 9.0
5	Dextrose anhydrous	6.0 – 9.0
6	Active Microbial Cultures	0.1-1.0
7	Sodium Chloride	0.1 - 0.5
8	PS Dry	3.0 - 5.0
9	Trace nutrients	0.1 - 0.5

III OBSERVATION AND ANALYSIS

Characteristics of municipal solid waste of both locations, varying concentration of Biowish odour solution at different temperature is given in subsequent tables and figures.

Table 2: Average Characterization of Municipal Solid Waste

S. No.	Constituents	Nada Khada Transfer Station		Kali Bawadi Transfer Station	
		Quantity(kg)	%(by weight at disposal site)	Quantity(kg)	%(by weight at disposal site)
1	Biodegradable	2.5	50%	2.3	46 %
2	Polythenes	0.32	6.4%	0.42	8.4 %
3	Paper	0.36	7.2%	0.44	8.8%
4	Inert	1.2	24%	0.14	2.8 %
5	Glass	0.24	4.8%	1.3	26 %
6	Clothes	0.125	2.4%	0.22	4.4%
7	Dry leaves	0.25	5%	0.18	3.6%
	Total	**5 kg**		**5 kg**	

1. At Nada Kheda Monitoring station:

Table 3: Pollutant Concentration Observation of NH_3 at different Temperature and dosing rate

Dosing	7.00 AM (28^0C)	11.00 AM (33^0C)	2.00 PM (36^0C)	5.00 PM (34^0C)	8.00 PM (30^0C)
0 gm	7.40	8.00	8.20	6.40	6.00
1 gm	5.80	6.00	6.20	5.20	4.80
2 gm	4.60	5.20	5.20	3.60	3.80
3 gm	2.80	2.20	3.00	1.80	1.60
4 gm	1.00	2.40	1.60	0.00	0.20
5 gm	0.20	0.20	0.20	0.00	0.00

Table 4: Pollutant Concentration Observation of H_2S at different Temperature and dosing rate

Dosing	7.00 AM (28^0C)	11.00 AM (33^0C)	2.00 PM (36^0C)	5.00 PM (34^0C)	8.00 PM (30^0C)
0 gm	2.60	2.80	2.80	2.40	2.00
1 gm	2.00	1.60	1.60	1.40	1.20
2 gm	1.60	1.20	1.40	1.20	1.00
3 gm	0.60	0.40	0.40	0.20	0.20
4 gm	0.20	0.20	0.40	0.20	0.00
5 gm	0.00	0.00	0.00	0.00	0.00

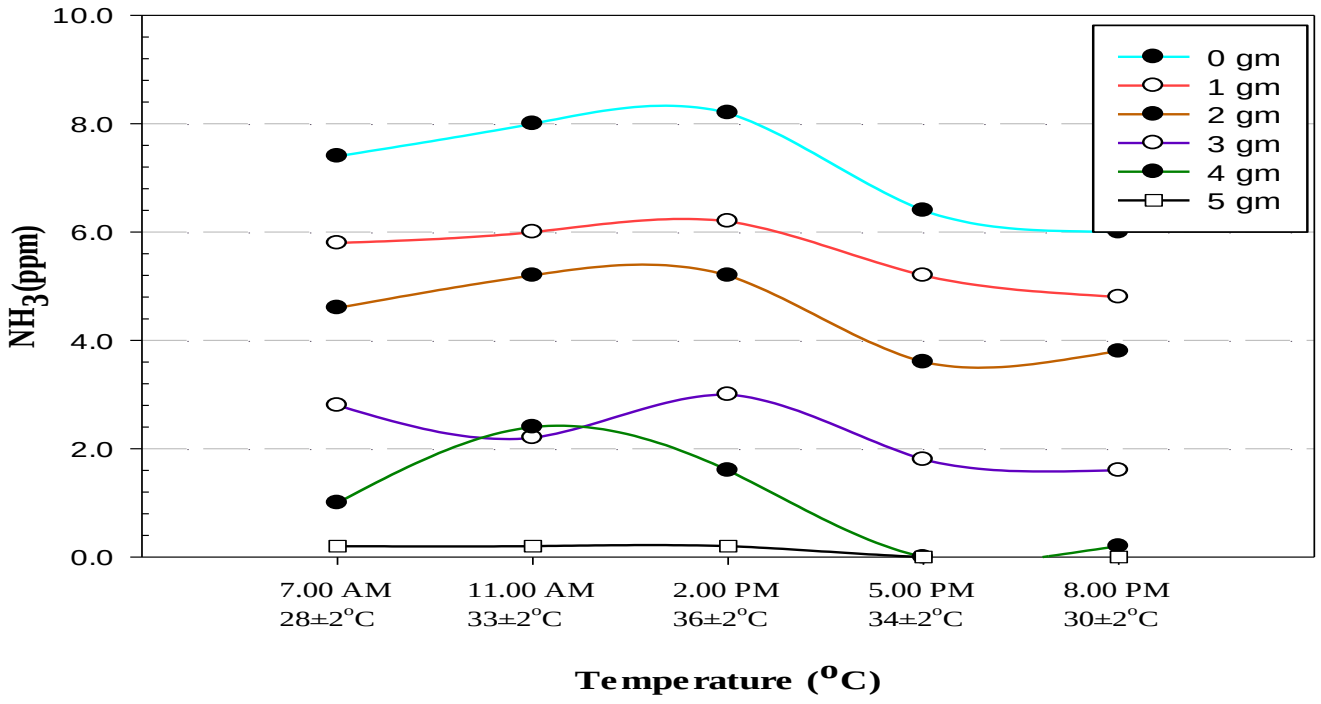

Figure 1: Graph showing Combination of NH_3 at Different Temperature and dosing rate in Nada Khada Transfer station

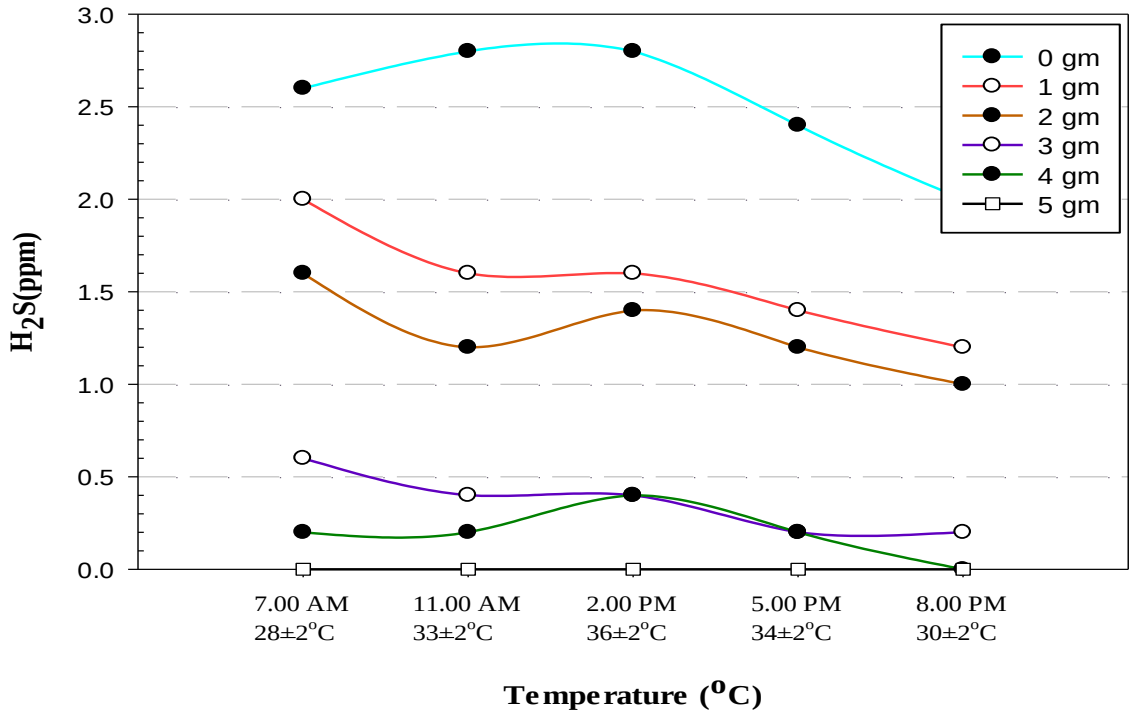

Figure 2: Graph showing Combination of H_2S at Different Temperature and dosing rate in Nada Khada Transfer station

2. At Kali Bawadi monitoring station:

Table 5: Pollutant Concentration Observation of NH_3 at different Temperature and dosing rate

Dosing	7.00 AM (28^{0}C)	11.00 AM (33^{0}C)	2.00 PM (36^{0}C)	5.00 PM (34^{0}C)	8.00 PM (30^{0}C)
0 gm	8.00	8.40	8.60	7.40	6.00
1 gm	6.60	6.20	6.40	6.60	5.40
2 gm	5.20	5.40	6.40	5.40	4.00
3 gm	4.00	4.00	4.20	2.40	2.00
4 gm	1.60	1.00	1.20	0.40	0.60
5 gm	0.40	0.20	0.20	0.00	0.00

Table 6: Pollutant Concentration Observation of H_2S at different Temperature and dosing rate

Dosing	7.00 AM (28^{0}C)	11.00 AM (33^{0}C)	2.00 PM (36^{0}C)	5.00 PM (34^{0}C)	8.00 PM (30^{0}C)
0 gm	3.00	2.80	3.20	2.00	2.00
1 gm	2.20	1.80	2.00	1.40	1.20
2 gm	1.80	1.40	1.20	1.20	1.00
3 gm	0.60	0.40	0.20	0.20	0.20
4 gm	0.20	0.00	0.20	0.00	0.00
5 gm	0.00	0.00	0.00	0.00	0.00

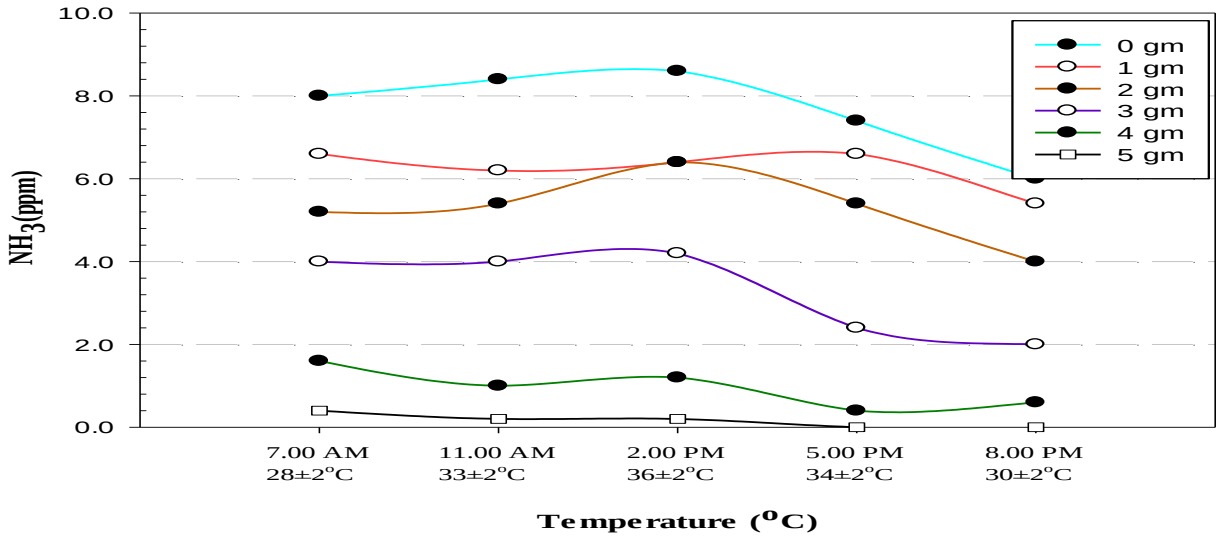

Figure 3: Graph showing Combination of NH_3 at Different Temperature and dosing rate in Kali Bawadi Transfer station

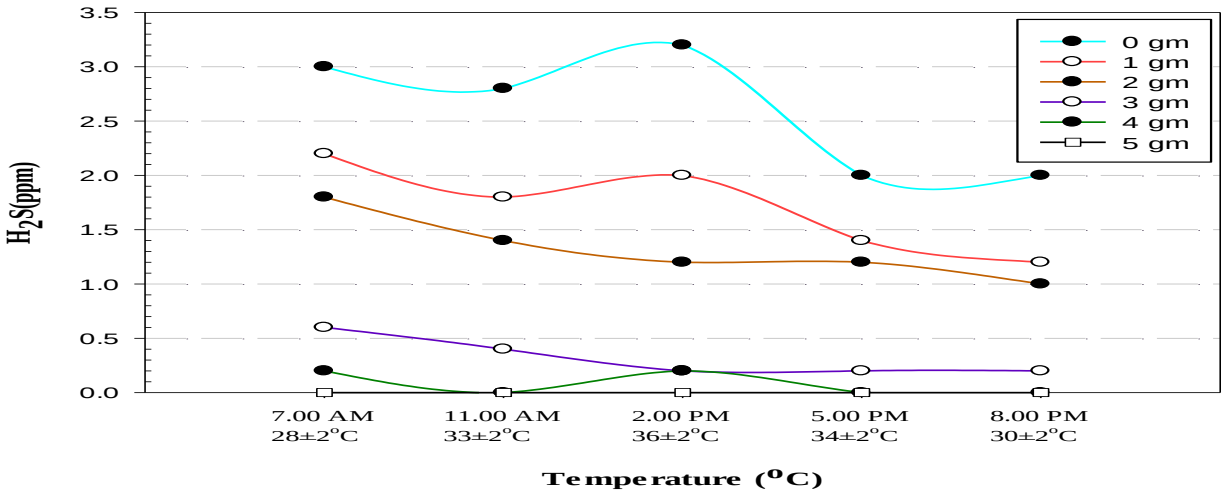

Figure 4: Graph showing Combination of H_2S at Different Temperature and dosing rate in Kali Bawadi Transfer station

IV CONCLUSIONS

An attempt has been made to find out the odor pollution level for transfer station of Udaipur city by using Biowish treatment on solid waste. Major aim of the study was to analyze the impact of gases generated from the solid waste on environment. In this study, only two parameters NH_3, H_2S have been considered. Biowish treatment have done at two transfer station of Udaipur and NH_3, H_2S were measured. NH_3, H_2S are mostly responsible for odor problem in the solid waste collection site. Result of these areas reveals that NH_3 and H_2S concentration were reduced at different dosing rate. Reason for reduction of these above two gases is due to the suppression of anaerobic decomposition. Hence, reductions in production of these gases were tried by using Biowish technology. Ammonia and Hydrogen sulphide levels fluctuated at different temperature. During this work the levels of ammonia and hydrogen sulphide gases increases in afternoon and reduce in the evening. As seen from the above discussion the main odor pollution problem around the solid waste transfer station site is the increasing level of Ammonia and Hydrogen sulfide gas concentration in air. Ammonia and hydrogen sulfide gas released from the solid waste when inhaled in large quantities leads to various health problems. Biowish Odor application on Fresh solid waste material at transfer station area of Udaipur showed significant reduction in odor. Several interviews were conducted with staff members on site agreed that Biowish odor has proven to be a safe and effective to manage noxious odors on municipal solid waste transfer station site. The Biowish treatment on solid waste conducted at Transfer station area of Udaipur at

Nada Khada, Kali Bawadi Transfer Station on Fresh Municipal solid waste material has shown a very drastic decrease in the odor levels as H_2S and NH_3gas reduced to almost zero. As anaerobic decomposition of organic matter produce NH_3 and H_2S.

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