

Research Article

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Using Biological Solutions to Reduce Odor from Waste Transfer Stations - A Case Study of Jodhpur and Udaipur City, India

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ABSTRACT

The waste transfer stations function as sites where waste is temporarily stored for approximately 12-24 hours before being transported to landfills. During this storage period, the waste transfer stations emit nasty odors that pose challenges for nearby communities. This research endeavors to employ a human-friendly and environmentally safe biological solution to mitigate the odor originating from municipal solid waste. To generate scientific data, the study monitored hydrogen sulfide gas (H₂S) and ammonia gas (NH₃) levels during the trial period, as these gases are known to be the major contributors of malodorous waste transfer stations. The trial, conducted at four transfer stations in India, demonstrated a substantial reduction in odor throughout the entire study duration. The recorded levels of H₂S and NH₃ gases remained remarkably low during the trial. This investigation concluded that biological solutions can serve as a secure safe and natural approach to diminish, rather than merely masking, odor-causing compounds in municipal solid waste at waste transfer stations.

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Introduction

Annually in India, a total of 62 million tons of waste is generated, encompassing 5.60 million tons of plastic waste, 0.17 million tons of biomedical waste, 7.90 million tons of hazardous waste, and 1.5 million tons of e-waste. According to the projections by the Central Pollution Control Board (CPCB), it is anticipated that by 2030, the annual waste generation will escalate to 165 million tons [1].

India produces around 133,760 tons of Municipal Solid Waste (MSW) daily, with about 91,152 tons being collected and approximately 25,884 tons undergoing treatment. The per capita MSW generation in India varies from approximately 0.17 kg per person per day in small towns to around 0.62 kg per person per day in cities [2]. The substantial amount of waste generated also brings along the issue of unpleasant odors.

Waste transfer stations are recognized as valuable solutions for facilitating the waste management process. Waste transfer stations are typically established in locations where there is a considerable distance between the waste collection point and the final disposal or treatment facility [3]. However, the

Unpleasant odors generated by the waste at these collection points cause discomfort nuisance for nearby communities, emphasizing the necessity for a reliable and economical solution.

In this study, four waste transfer stations were identified in the cities of Jodhpur and Udaipur.

The trial aimed to achieve the following objectives:

- Quantify levels of odor pollutant gases such as H₂S and NH₃ at different transfer stations in Jodhpur and Udaipur.
- Measure the reduction in the concentration of H₂S and NH₃ gases resulting from the application of BiOWiSH® Odor.
- Evaluate the decrease in the odor issue through personal sensory assessments.

Table 1: Identified Waste Transfer Stations

Waste Transfer Station #	Name of Waste Transfer Station	City
Transfer Station 1	Pratap Nagar	Jodhpur
Transfer Station 2	Central Jail	Jodhpur
Transfer Station 3	Nada Khada	Udaipur
Transfer Station 4	Kali Bawadi	Udaipur

Table 2: Average characterization of Municipal Solid Waste at Pratap Nagar - Jodhpur

Sr. No	Constituents	Jodhpur - Pratap Nagar	
		Quantity (kg)	% (by weight at disposal site)
1	Biodegradable	2.65	53.00%
2	Polythene	0.3	6.00%
3	Paper	0.32	6.40%
4	Inert	1.2	24.00%
5	Glass	0.22	4.40%
6	Clothes	0.11	2.20%
7	Dry leaves	0.2	4.00%
	Total	5kg	

Table 3: Average Characterization of Municipal Solid Waste at Central Jail – Jodhpur

Sr. No	Constituents	Jodhpur - Central Jail	
		Quantity (kg)	% (by weight at disposal site)
1	Biodegradable	2.45	49.00%
2	Polythene	0.34	6.80%
3	Paper	0.32	6.40%
4	Inert	1.22	24.40%
5	Glass	0.22	4.40%
6	Clothes	0.21	4.20%
7	Dry leaves	0.24	4.80%
	Total	5 kg	

Table 4: Average Characterization of Municipal Solid Waste at Nada Khada – Udaipur

Sr. No	Constituents	Udaipur - Nada Khada	
		Quantity (kg)	% (by weight at disposal site)
1	Biodegradable	2.5	50.00%
2	Polythene	0.32	6.40%
3	Paper	0.36	7.20%
4	Inert	1.2	24.00%
5	Glass	0.24	4.80%
6	Clothes	0.13	2.60%
7	Dry leaves	0.25	5.00%
	Total	5 kg	

Table 5: Average Characterization of Municipal Solid Waste at Kali Bawadi - Udaipur

Sr. No	Constituents	Udaipur - Kali Bawadi	
		Quantity (kg)	% (by weight at disposal site)
1	Biodegradable	2.3	46.00%
2	Polythene	0.42	8.40%
3	Paper	0.44	8.80%
4	Inert	0.14	2.80%
5	Glass	1.3	26.00%
6	Clothes	0.22	4.40%
7	Dry leaves	0.18	3.60%
	Total	5 kg	

Materials and Methods

The biological solution (BiOWiSH®) utilized in this study consists of a combination of beneficial microorganisms that initiates action within minutes. These microorganisms undergo a bio-chemical reaction with odor-causing molecules, efficiently breaking down volatile organic compounds upon contact into their ultimate inert forms, which are completely devoid of any smell. The technology exhibits the capability to rapidly mitigate odors in both landfill sites and composting facilities.

The application of the biological solution onto the waste was conducted using standard backpack sprayers. This dosing process was carried out daily for a week at each of the four specified waste transfer stations. The experiment involved testing different dosing rates to determine the most effective application rate for optimal results. The experiments were conducted at different temperatures also because intensity of odor increases at elevated temperature.

Results

NH₃ and H₂S were monitored on a daily basis for one week. These gases were chosen as they are reliable indicators for commonly odorous compounds at the municipal solid waste site, transfer stations, and disposal sites.

Table 6: NH₃ levels at Different Temperature and Dosing rate of BiOWiSH – Pratap Nagar, Jodhpur

Dosing	7.00 AM (29°C)	11.00 AM (32°C)	2.00 PM (42°C)	5.00 PM (38°C)	8.00 PM (34°C)
0 gm	7.75	8.50	14.00	11.00	15.50
1 gm	6.33	6.00	9.50	5.00	4.50
2 gm	6.00	5.00	4.00	2.00	3.00
3 gm	2.00	3.00	1.50	2.00	2.00
4 gm	1.00	2.00	1.00	1.00	1.00
5 gm	1.00	1.00	1.00	1.00	1.00
6 gm	0.00	1.00	1.00	0.00	0.00

Table 7: H₂S Levels at Different Temperature and Dosing rate of BiOWiSH – Pratap Nagar, Jodhpur

Dosing	7.00 AM (29°C)	11.00 AM (32°C)	2.00 PM (42°C)	5.00 PM (38°C)	8.00 PM (34°C)
0 gm	5.50	8.50	9.00	14.50	5.50
1 gm	2.50	3.50	3.00	4.00	3.50
2 gm	2.50	2.50	2.50	3.50	2.00
3 gm	2.40	2.50	2.00	3.00	2.00
4 gm	2.20	2.00	2.00	2.00	1.50
5 gm	2.00	1.00	1.00	2.00	1.00
6 gm	1.50	1.00	1.00	1.00	1.00

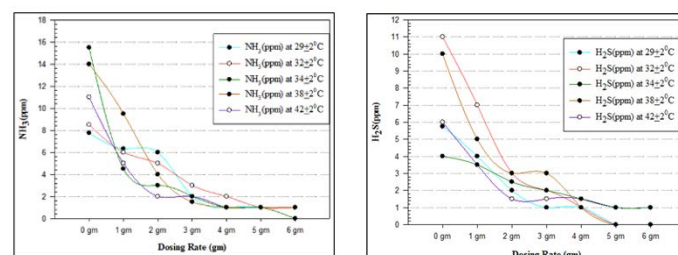


Figure 1: Reduction of NH₃ and H₂S at Different Temperature and BiOWiSH Dosing Rates at Pratap Nagar, Jodhpur

Table 8: NH₃ Levels at Different Temperature and Dosing Rate of BiOWiSH – Central Jail, Jodhpur

Dosing	7.00 AM (29°C)	11.00 AM (32°C)	2.00 PM (42°C)	5.00 PM (38°C)	8.00 PM (34°C)
0 gm	5.00	3.00	4.50	4.00	4.50
1 gm	4.50	2.50	3.00	2.50	3.00
2 gm	4.00	2.00	2.50	2.00	3.00
3 gm	2.50	1.50	2.00	2.00	2.50
4 gm	2.00	1.00	2.00	2.00	1.00
5 gm	2.00	1.00	1.50	1.50	1.00
6 gm	1.00	1.00	1.00	1.00	0.00

Table 9: H₂S Levels at Different Temperature and Dosing rate of BiOWiSH – Central Jail, Jodhpur

Dosing	7.00 AM (29°C)	11.00 AM (32°C)	2.00 PM (42°C)	5.00 PM (38°C)	8.00 PM (34°C)
0 gm	5.75	11.00	10.00	6.00	4.00
1 gm	4.00	7.00	5.00	3.50	3.50
2 gm	2.00	3.00	3.00	1.50	2.50
3 gm	1.00	2.00	3.00	1.50	2.00
4 gm	1.00	1.00	1.00	1.50	1.50
5 gm	0.00	0.00	0.00	1.00	1.00
6 gm	0.00	0.00	0.00	1.00	1.00

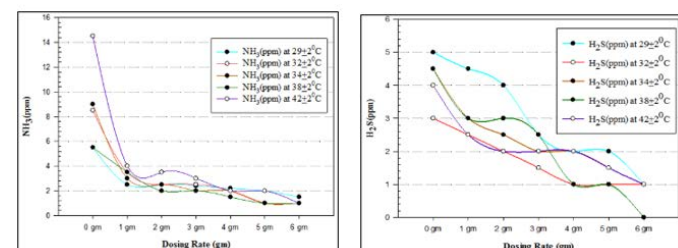


Figure 2: Reduction of NH₃ and H₂S at Different Temperature and BiOWiSH Dosing Rates at Central Jail, Jodhpur

Table 10: NH₃ Levels at Different Temperature and dosing rate of BiOWiSH – Nada Khada, Udaipur

Dosing	7.00 AM (29°C)	11.00 AM (32°C)	2.00 PM (42°C)	5.00 PM (38°C)	8.00 PM (34°C)
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 11: H₂S Levels at Different Temperature and Dosing rate of BiOWiSH – Nada Khada, Udaipur

Dosing	7.00 AM (29°C)	11.00 AM (32°C)	2.00 PM (42°C)	5.00 PM (38°C)	8.00 PM (34°C)
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

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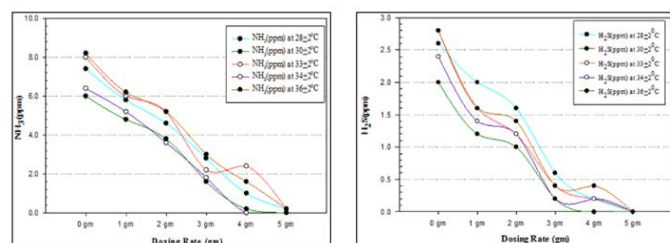


Figure 3: Reduction of NH₃ and H₂S at Different Temperature and BiOWiSH Dosing Rates at Nada Khada, Udaipur

Dosing	7.00 AM (29°C)	11.00 AM (32°C)	2.00 PM (42°C)	5.00 PM (38°C)	8.00 PM (34°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 12: NH₃ Levels at Different Temperature and Dosing Rate of BiOWiSH – Kali Bawadi, Udaipur

Dosing	7.00 AM (29°C)	11.00 AM (32°C)	2.00 PM (42°C)	5.00 PM (38°C)	8.00 PM (34°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 13: H₂S Levels at Different Temperature and Dosing Rate of BiOWiSH – Kali Bawadi, Udaipur

Dosing	7.00 AM (29°C)	11.00 AM (32°C)	2.00 PM (42°C)	5.00 PM (38°C)	8.00 PM (34°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

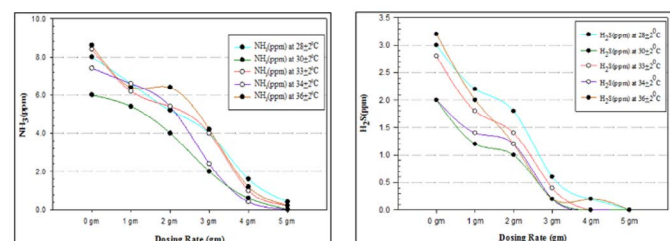


Figure 4: Reduction of NH₃ and H₂S at Different Temperature and BiOWiSH Dosing Rates at Kali Bawadi, Udaipur

Conclusion

The trial conducted at these four transfer stations in Rajasthan, India showed significant reduction in odor throughout the entire study. The H₂S and NH₃ gas levels were recorded at very low levels during the 7-day trial. The biological solution used here for this trial provided a safe and natural means to reduce (not mask) odor causing compounds in municipal solid waste.

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