

The Study on Harmless Treatment for Urban Domestic Waste with Microecology Engineering Technology

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Abstract

It is an ecology engineering harmless treatment technology to treat solid waste with biological germ. A kind of microecological lotion produced in Japan was introduced to make an experiment in Beijing Haidian District Solid Waste Treatment Plant. Base on the experiment, it is proved that this method has good property in clearing off stench, reducing mosquitoes and flies and clearing solid waste leachate.

Key words

Microecology engineering technology Domestic waste Harmless treatment

It's well known that the harmless treatment of domestic waste has puzzled the world for long. Statistics show that the urban domestic waste in China has amounted to 440kg per person in 1992, yearly increased by 10% and the waste has accumulated during the years to over 600 million t, covering land of 500 million m². This waste and the solid waste leachate seriously contaminated soil, water, and air as well as people's health. Even worse, the waste decompose emits methane which will easily result in fire or explosion.

The traditional methods of waste disposal include landfill, incineration, compost, and pile, but the first two methods can not be popularized for the disadvantage of taking up too much space and their high cost in management and investment. For example, an incinerator of daily treatment capacity 100t will cost 13million yuan, while the investment for a landfill, which can be used for 15-20 years, capable of disposing waste 1500t daily will be 150million yuan. The defect of compost method is power-expenditure and inefficient. So far all these methods can not solve the problem of clearing off stench, or reducing mosquitoes and flies. What makes things worse is that they cause a severe environmental pollution.

However, this long-standing puzzle was settled in 1997 after the introduction of a kind of microecological lotion produced in Japan. China Agricultural University, along with the Institute of Environment and Hygiene, Haidian District, conducted research on harmless treatment of domestic waste with miroecology engineering technology.

1. The Design and Method of The Experiment

1.1 Location: Beijing Haidian Distract Solid Waste Treatment Plants A and B

Plant A: waste coverage 13.34hm², pile bulk 160m*140m*9m, total weight 300000t, no treatment before

Plant B: waste coverage 6.6hm², pile bulk 80m*50m*12m, total weight 250000t.

1.2 Experiment Design

Successful pre-experiment in Plant A in 1997, and extended to Both Plant A and B in 1998. Waste treatment with EM lotion, a kind of microecological lotion in hot June to September.

1.3 Air Sample

Air samples were taken in both Plant A and Plant B in June 29th, July 27th, August 6th, and August 21st. Three experiment sites were put respectively on the dustheaps and 50m from the lee of the dustheaps in the two plants. After sample analysis the average statistics were maintained.

1.4 Handling

NH₃: sodium hypochlorite-salicylic spectrophotometric method
 SO₂: formaldehyde buffer liquid sorbent-muriatic acid aniline spectrophotometric method
 H₂S: methano spectrophotometric method
 Flies: fly-cage trap

1.5 Pilot study on the clearing of solid waste leachate

Treat waste leachate with EM lotion of different concentration under anaerobic condition and aerobic condition and study the water quality fluctuation.
 COD_{Cr}: potassium dichromate method
 BOD₅: biochemistry cultivating method
 PH: PH indicating
 SS: weighting

2. Results and Effects

2.1 Stench Clearing Effect

See the following table 1, diagram 1, 2 and 3

the Measure of the Stench of the Waste Plant

date	gas	on Plant A (mg/m ³)	wipe off (%)	in Plant A (mg/m ³)	wipe off (%)	on Plant B (mg/m ³)	wipe off (%)	in Plant B (mg/m ³)	wipe off (%)
Jun 29	NH ₃	2.0950		0.9010		11.9500		5.5500	
	H ₂ S	0.0400		0.0350		0.0390		0.0300	
	SO ₂	0.1930		0.1860		0.2000		0.1790	
Jul.27	NH ₃	1.0890	48.02	0.4950	45.06				
	H ₂ S	0.0072	82.00	0.0038	89.14				
	SO ₂	0.0207	89.27	0.0091	95.11				
Aug. 6th	NH ₃	0.7252	33.41	0.4035	18.48	1.1200	90.63	0.9227	83.27
	H ₂ S	0.0036	50.00	0.0023	39.47	0.0056	85.64	0.0054	82.00
	SO ₂	0.0174	15.94	0.0039	57.14	0.0574	71.30	0.0420	76.54
Aug. 21	NH ₃	0.5840	19.47	0.3285	18.59	1.0716	4.30	0.3907	57.66
	H ₂ S	0.0023	36.11	0.0015	34.78	0.0025	55.36	0.0029	46.30
	SO ₂	0.0098	43.68	0.0032	17.95	0.0210	63.41	0.0300	28.57
total wipe off (%)			72.12		63.54		91.03		92.96
				94.25		95.71		99.17	90.33
				94.92		98.28		89.50	83.24

Diagram One: the Effect of EM Lotion on NH₃

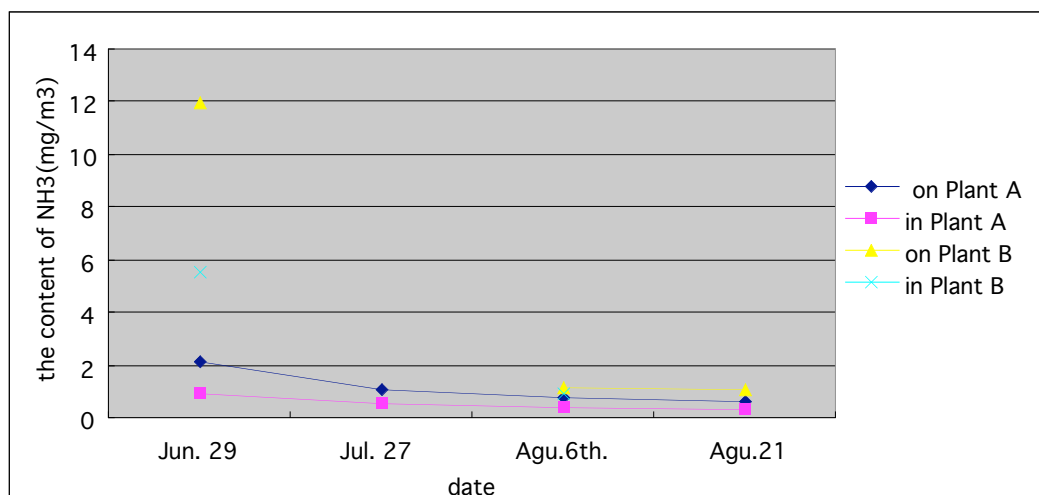


Diagram Two: the Effect of EM Lotion on H₂S

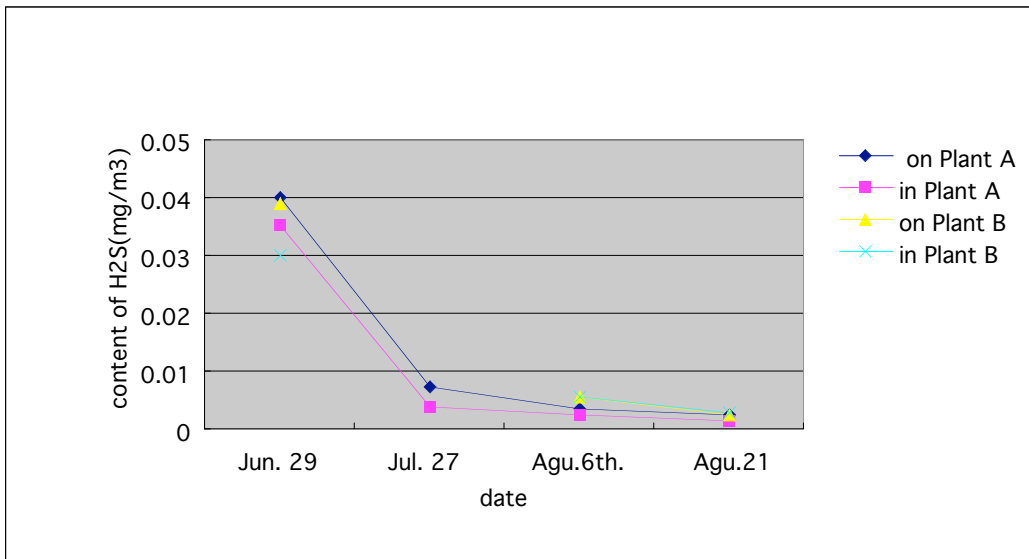
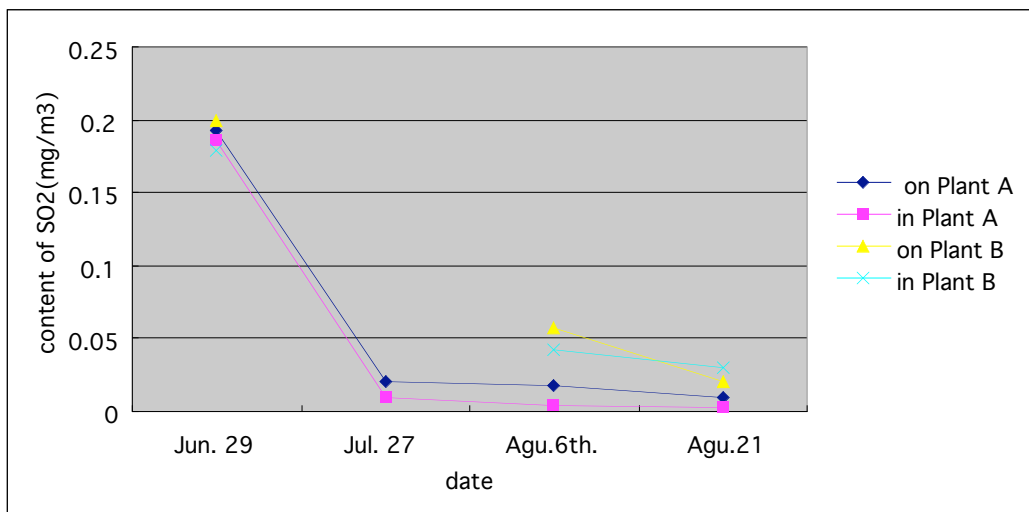


Diagram Three: the Effect of EM Lotion on SO₂



2.1.1 The waste coverage and reserve of Plant A are larger than those of Plant B, and has a better air background quality since its stench clearing has been carried out in 1997. The ammonia concn of Plant A from either the laystall or lee 50m away is 17.5% of that of Plant B. This shows that the EM lotion has a great effect on clearing off stench.

2.1.2 After the waste in both Plant A and Plant B being treated with the same microbiological technology, the content of harmful gases in both Plants decrease sharply, but that of Plant B boasts a faster decrease and higher clearing effect, and later on they tend to become identical. This result shows that EM lotion has a distinct effect on clearing off stench and keeping air fresh.

2.1.3 The experiment has proved that the proper use of EM technology will resultfully restrain the formation of harmful gases like methane. After the EM technology has been applied, spontaneous combustion never occurred.

2.2 Fly-reducing Effect

After the adoption of EM technology the fly-density has changed as the following table2 shows:

Table 2 Statistics of the Fly-density amount/H-Hutch

term	before EM using	after EM using	
	Jul. 2nd~3rd	Agu. 20~21	Sep. 4~5
on the Plant A	95	2.0	2.0
in the Plant A	90	2.0	2.0
on the Plant B	129	19.0	
in the Plant B	52	32.0	
Total Wipe A		97.3	97.3
off (%) B		71.8	

The statistics in this table shows that the fly-density has decreased a great deal after the experiment. In Plant A: density: 2/h.cage (much lower than the requirement of a hygienic city); reducing effect: 97.3%. In Plant B: density: 25.5/h. Cage; reducing effect: 71.8%

2.3 Clearing Effect of Solid waste Leachate

The regular treatment of waste leachate with EM technology didn't achieve much due to its complex contents. Especially in hot and rainy summer when melons, fruits and vegetables rot and drained by rain, the large amount of pollutants which remained in the garbage or produced after the garbage degradation dissolve in the leachate, thus making its contents complex than ever. Specific figures are showed in the following table3:

Table 3 the Statistics of Monitoring the Solid Waste Leachate

Plant	date	pH	color	degree	CODcr	BOD ₅	SS
A	Jun.29	8.01	yello green	2	675.50	230.20	1,645
A	Jul.29	7.01	brown yello	2	1,323.70	829.20	3,330
A	Aug.6	7.21	dark brown	2	2,170.20	812.10	6,450
A	Aug.21	7.15	yellow green	2	1,393.40	987.28	6,450
B	Jun.29	8.15	brown yello	2	1,767.10	463.70	18,344
B	Jul.29	7.03	brown yello	2	1,786.70	900.90	19,002
B	Aug.6	7.04	blue green	2	9,570.40	4,821.70	21,203
B	Aug.21	7.04	blue green	2	11,700.00	4,971.20	21,650

After conducting many experiments by applying microbiological and engineering technologies along with physical and chemical approaches, we finally made two satisfying technological proposals and achieved resultful effect in clearing waste leachate. See table 4,5,6,and 7:

Table 4 COD_{Cr} Result (mg/L)

Plant	date	treatment 1	wipe off(%)	treatment 2	wipe off(%)	before treatment
A	Oct.5	157.95	88.73	34.63	95.31	1401.98
A	Oct.8	140.88	89.99	30.52	97.82	
B	Oct.5	339.22	94.69	67.85	98.84	6380.20
B	Oct.8	381.02	94.03	78.43	98.77	

Table 5 BOD₅ Result (mg/L)

Plant	date	treatment 1	wipe off(%)	treatment 2	wipe off(%)	before treatment
A	Oct.5	25.76	94.02	9.36	98.83	430.91
A	Oct.8	27.12	93.71	10.01	97.68	
B	Oct.5	43.64	98.15	27.19	98.84	2334.51
B	Oct.8	58.69	97.49	30.82	98.68	

Table 6 SS Result (mg/L)

Plant	date	treatment 1	wipe off(%)	treatment 2	wipe off(%)	before treatment
A	Oct.5	1,633	74.68	1,440	77.67	6,150
A	Oct.8	1,985	69.22	1,595	75.27	
B	Oct.5	3,665	81.81	1,960	90.27	20,150
B	Oct.8	2,300	88.59	1,890	90.62	

Table7 pH Monitor Result

Plant	date	treatment 1	wipe off(%)	treatment 2	wipe off(%)	before treatment
A	Oct.5	9.01	1.86	7.11	-1.90	7.15
A	Oct.8	9.89	2.74	7.44	-2.45	
B	Oct.5	9.42	1.70	7.50	-1.92	7.72
B	Oct.8	9.08	1.36	7.04	-2.04	

From table 4 and 5 we can see that the lowest clearing effect of COD_{Cr} is 88.73%, and highest 98.84%; as to BOD₅, the lowest 93.71%, highest 98.84%. The results of COD_{Cr} and BOD₅ are much lower than the nation's discharge standard. We can also see from the table that the beginning effect of the leachate clearing is not so pleasing yet it proves to be successful after several technological improvements.

3. Result and evaluation

3.1 Based on these experiments it is proved that the microecological technology, characterized with EM technology, has a good effect in clearing off stench and reducing mosquitoes and flies both in livestock barns such as sty or henhouse and in waste plant. This technology also makes the concn of harmful gases and the density of flies reach to or lower than the nation requirement. Meanwhile the adoption of microecology engineering technology (mainly the adoption of EM virus) along with physical and chemical approaches can effectively clear the solid waste leachate and reach the nation discharge standard. All these prove that EM

microbiology engineering technology is a scientific innovation for harmless treatment of urban domestic waste, and it lays a firm basis for waste deduction and recycle.

3.2 The EM microbiological lotion is a kind of compound virus lotion composed of a number of microbiology. Its effect in clearing off stench and reducing flies and mosquitoes is confined to methods applied, environment and the waste components. Its function mechanism in the above mentioned scope is not clearly defined yet. Therefore the actual application of this technology should be based on the real circumstances and needs improving.

3.3 The harmless treatment of waste is the first step, a fundamental step in garbage disposal. At present It remained difficult to make full use of the urban domestic waste due to its complex components and non-classification. The use of the technology our institute provided with the premise of waste classification will make it possible to produce high-quality waste fertilizer, reduce and recycle the waste.