resumen

Tratamiento anaerobico y aerobico de lavazas de destilización

El artículo desciribe detalladamente un limbo de hojas en un esperimento de lavoratorio, en el cual un UASB-Reactor está acoplado con un tanque de ventilación. La cuota de COD de reducción yace en un 95 % para el UASB-Reactor y de un 99 % para el sistema total. En 1000 m^3 diarios de lavaza los costos del proceso alcanzan 0,2 yuan/m^3. La producción de Gas yace en 17 m^3/m^3 de lavaza o bien 20 m^3/m^3 Vd·d.

The Effect of Biogas Management on Improvement of Environment and Preventing Diseases

The manures are one kind of raw materials for anaerobic digestion as well as perfect organic fertilizers for agricultural production. Since ancient China, the manures have been using extensively as fertilizer for agriculture.

However, from view point of sanitation, the manures are also one of the sources of environmental pollution and diseases spread. To approach how manures are treated by adopting biogas production and its effect on environmental sanitation as well as human health, during 1984-1986 we surveyed the Cong Zhuang village. Bailou Townshop, Huaiyang County where the biogas were managed and utilized well. The result is reported in this paper.

I. Background

The Bailou village, Huaiyang County where biogas were managed and utilized well was selected as the survey village, while another village Jiazhuang where no biogas was used and no measures treating manures were taken as the control. For both villages, the soils are arenaceous clay, and their main crops cultured were wheat, corn and red taro as well as some cash crops such as cotton and greens. In the survey village, there were 222 households of farmers in all. The biogas were utilized in 1981. By 1985, 216 digesters had been built which account for 97.30 % of the total households in the village. All the digesters were built as "three in one". The ingredients of feed were as follows with a bit variance depending on different households: crop stalks 5 %, animal manures 10 %, human manure 5-10 % and water 70-80 %, whose C/N ratio was 28:1-35:1. The digestion were conducted at ambient temperature. 100 % of the biogas produced were utilized (Table 1). In the control village, no biogas digester was built. Their households toilets were pit-style. The distance between the two villages is 2.5 km, and their situation of geography, habits and customs were the same except biogas.

II. The management and utilization of biogas in the survey village

All of the digesters were operated and utilized by the farmers themselves. The biogas produced were used for household cook and light. The digested liquid were spread in the lands of greens as fertilizer. Most of the digesters were empty once a year, but some were twice a year. The digested solids were compost for one month before application in the fields.

Tab.1: The data of biogas extension and utilization in Congzhuang Village

Year	No. of households	Digesters number	Construction rate (%)	Running Digesters	Using rate (%)
1981	215	182	85.0	178	98.9
1982	217	186	85.7	185	99.5
1983	219	186	84.9	184	98.9
1984	222	186	83.8	186	100.0
1985	222	216	97.3	216	100.0
1986	222	216	97.3	216	100.1

III. The contents of survey and measuring methods

1. The measurements for indicators of sanitary harmlessness

(1) The number of coliform bacteria in manures: Fermentation Method (cultured at 43.5-44.5°C)

(2) Settling rate of the roundworm eggs: Adopt situ's Worm Eggs Diluted Counting Method and Improved Concentrating Method.

2. The measurements for environmental sanitation indicators

(1) Comparing the density of adult flies:

Trap the flies with the same kinds of trapping cage and baits, and same regulation to establish the trapping sites. The trapped flies were counted and classified in laboratory.

(2) Comparing the pollution degree of the drinking water:

The total number of the bacterial were counted after culture at 37°C for 24 hours, coliform bacteria were counted by means of Fermentation Methods, amino nitrogen by direct colorimetry analysis and chlorides by potassium chromate indicator capacity.

(3) Comparing the pollution degree of parasite eggs in soil:

The roundworm eggs were floated in saturated salt solution and then settled centrifugally to be concentrated; the young hookworm were isolated by separating method.

3. Monitoring diseases

(1) Evaluating the effect of preventing intestines parasitic diseases: In March and October every year during 1984-1986, the excreta of all the villagers in both villages were generally checked (in Saturated Salt Solution Method). Then all the villagers were treated with thipyrimidine 0.3 g/kg of body weight, the medicine was taken only once in all to treating roundworm. While once a day for 3 days to hookworm diseases. And the effect of preventing diseases were checked continually.

(2) Evaluating the effect of preventing intestines disease in the survey village:

The survey was conducted by looking back the past patients and looking up the current patients respectively. The former method for the patients whose fits were during 1980-1983 basing on the medical records of the country doctors or the country clinics, and the later for that during 1984-1986, by recording after diagnosing by the country doctors or the country clinics. The cases were collected, checked and statistically calculated by special persons at the end of every month.

IV. Results and analysis

1. Effect of anaerobically treating manures on sanitary harmlessness

During 1984-1986, 99 samples from inlets and outlets of biogas digesters were analyzed respectively. The coliform bacteria number at inlets were between 10^{-6} and 10^{-9}; that at outlets were 10^{-3} for 26 samples, 10^{-4} for 49 samples, 10^{-5} for 15 samples, 10^{-6} for 8 samples and 10^{-7} for one sample, in which 75

samples were up to the state criterion of sanitary harmlessness, accounting for 75.76 % of the whole samples. The number of roundworm eggs at inlets and outlets were 412-1973 and 42-71 respectively, and the percentage of settled roundworm eggs was 90-96 %. 86 samples were up to the state criterion of sanitation of harmlessness, accounting for 87 % of the whole samples.

2. The measurement results of the indicators concerning environmental sanitation

(1) The comparison of the adult flies density:

The flies trapped by the two villages during 1984-1986 were showed in Table 2 and Figure 1, indicating that the number in survey villages was smaller than that in the control village. It showed that it's effect in a certain degree to treat anaerobically the manures of animal and human to reduce the adult flies density.

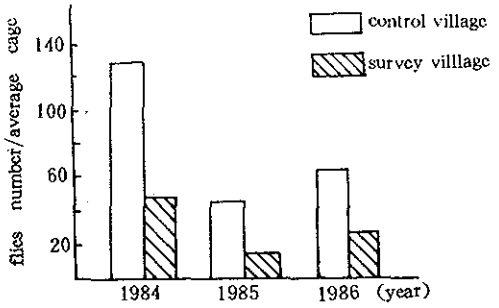

Fig. 1: The comparison of the flies density for the two villages during 1984-1986

Tab. 2: The comparison of flies trapped in the two villages during 1984-1986

		The number of flies trapped	
		Survey village	Control village
Trap-sites 1984	East	435	1549
	West	896	1603
	South	540	1384
	North	327	1131
	Center	442	972
	Sum	2640	6639
Cages trapped of the year		50	50
Flies/cage		52.8	132.8
Trap-sites 1985	East	115	584
	West	125	308
	South	94	614
	North	107	337
	Center	120	501
	Sum	561	2347
Cages trappedof the year		50	50
Flies/year		11.2	46.9
Trap-sites 1986	East	333	712
	West	269	343
	South	161	599
	North	226	793
	Center	225	677
	Sum	1214	3124
Cages trappedof the year		50	50
Flies/cage		24.3	62.5

(2) The comparison of pollution degree of the drinking water sources in the two villages:

The drinking water in manually pumping wells in both two villages were polluted. While the rate up to standard of the water sources in survey village was much higher than that of the control village. During 1984-1986, based on 132 samples per village of the two ones respectively, the rate up to standard of total bacteria number in the survey village was 56.06 %, while that in the control village was 32.58 % ($X^2 = 5.73$, $P<0.01$); the rate up to standard of coliform bacteria number in the survey village was 56.06 %, while that in the control village was 28.03 % ($X^2 = 8.77$, $P<0.01$); the rate up to standard of amino nitrogen in the survey village was 72.73 %, while that in the control village was 43.18 % ($X^2 = 6.35$, $P<0.05$); the rate up to standard of chlorides was 58.33 %, while that in the control village was 33.33 % ($X^2 = 6.22$, $P<0.05$). They showed that the indicator in the survey village were significantly better than in the control village.

(3) The comparison of pollution degree of parasite eggs in soil of the two villages (Table 3):

During 1984-1986, 120 samples per village were sampled respectively for the soil in greens lands or in courtyards. In survey village, there

were 33 samples with positive reaction in hookworm isolation, i.e., positive rate of 27.50 %; that of roundworm eggs were 20 samples and 16.71 % respectively. While in the control village, the corresponding values were 70 samples, 58.3 % for hookworm isolation; 55 samples and 45.87 % for roundworm eggs. They showed that the pollution degree of the control village was significantly much higher than that of the survey village.

24.53 %, 18.65 %, 13.37 % and 11.75 % ($u>2.58$, $p<0.01$). The results above showed that it's effect that managing the manures with "three in one" biogas digesters combining cure to control the epidemic of the intestines parasitic diseases.

By classifying the people of positive reaction basing on ages, it showed that the positive reaction rate, being higher for the children younger than 14, decreased with ages of people.

Tab. 3: The comparison of the soil polluted by round worm eggs and hookworm in two villages

Village	Survey				Control			
	1984	1985	1986	Sum	1984	1985	1986	Sum
Roundworm eggs								
No. of samples	40	40	40	120	40	40	40	120
Positive ones	7	6	7	20	16	25	14	55
Positive %	17.5	15.0	17.5	16.7	40.0	62.5	35.0	45.8
Hookworm								
No. of samples	40	40	40	120	40	40	40	120
Positive ones	13	11	9	33	23	29	18	70
Positive %	32.5	27.5	22.5	27.5	57.5	72.5	45.0	58.3

3. The effect on preventing diseases

(1) The effect of biogas management and utilization to treat the manures of animals and human on preventing intestines parasitic diseases:

Based on the results of the general stool examination (Table 4) for 958 persons in the survey village and 641 persons in the control village in March, 1984, the infectious rate of parasites of the survey village was significantly lower than that of the control village ($u>2.58$, $p<0.01$). By curing the patients infected by hookworm and roundworm, the rate turning to negative reaction were 94 % and 95.5 % respectively. After every one of 4 times of general stool examination from Oct., 1984 to March, 1986, antelmintics were taken in the same way for the two villages. In the survey village, decreasing tendency of hookworm infectious rate were 6.27 %, 4.76 %, 1.52 %, 1.47 % and 1.16 %; while that in the control village were 12.90 %, 10.47 %, 9.72 %, 5.12 %, 3.31 %, ($u>2.58$, $p<0.01$). And that of roundworm in the survey village were 20.04 %, 16.5 %, 6.17 %, 4.93 % and 3.91 %; while that in the control village were 33.92 %,

(2) The effect of biogas management and utilization to treat the manures of animals and human on preventing intestines infectious diseases:

In the survey village, since the "three in one" biogas digesters were extended to utilize and manage well, the fit rate of intestines infectious diseases reduced year by year in varying degrees (Fig. 2). In Jiazhuang Village where no biogas were used the intestines infectious diseases also reduced, but with significant smaller margin compared with that in the survey village. During 1984-1986, in the survey village, the fit rate of intestines infectious diseases were 5.13, 4.13 % and 2.73 % respectively; while that in the control village were 13.68 %, 13.85 % and 12.31 % respectively ($u>2.58$, $p<0.01$). There was a significant difference between the two villages. In the survey village, at the beginning of managing the maures by means of biogas utilization in 1981, there were 166 patients of intestines infectious diseases; and that during 1984-1986 reduced to 58, 51 and 31 patients respectively.

Tab. 4: The comparison of the change concerning the infectious rate of parasitic intestines diseases in the two village

Table 4 (1) March, 1984

Village	Survey	Control
No. of subjects Positive no. Infect rate (%) U=5.08, p<0.01	958 546 56.99	641 446 69.58
Classification of parasites		
Roundworm % U=3.44, p<0.01	408 42.59	329 51.33
Hookworm % U=2.33,p<0.05	252 26.30	203 31.67
Pinworm %	3 0.31	1 0.16
Whipworm %	20 2.09	27 4.21
Tapeworm %	2 0.31	5 0.78
Mix-infection %	139 14.51	119 18.56

Table 4 (2) October, 1984

Village	Survey	Control
No. of subjects Positive no. Infect rate (%) U=6.62, p<0.01	941 309 32.84	628 311 49.52
Classification of parasites		
Roundworm % U=5.68, p<0.01	198 21.04	213 33.92
Hookworm % U=4.51,p<0.05	59 6.27	81 12.90
Pinworm %	10 1.06	12 1.91
Whipworm %	4 0.43	3 0.48
Tapeworm %	3 0.32	2 0.32
Mix-infection %	35 3.72	42 6.69

Table 4 (3) March, 1985

Village	Survey	Control
No. of subjects Positive no. Infect rate (%) U=6.82, p<0.01	987 218 22.09	640 241 37.66
Classification of parasites		
Roundworm % U=3.97, p<0.01	163 16.51	157 24.53
Hookworm % U=12.14,p<0.01	47 4.76	47 10.47
Pinworm %	0 0	0 0
Whipworm %	4 0.41	1 0.16
Tapeworm %	2 0.20	0 0
Mix-infection %	12 1.22	16 2.50

Table 4 (4) October, 1985

Village	Survey	Control
No. of subjects Positive no. Infect rate (%) U=2.14, p<0.01	973 86 8.84	638 209 32.76
Classification of parasites		
Roundworm % U=7.80, p<0.01	60 6.17	119 18.65
Hookworm % U=7.52,p<0.01	15 1.52	62 9.72
Pinworm %	2 0.21	4 0.63
Whipworm %	1 0.10	3 0.47
Tapeworm %	1 0.10	2 0.31
Mix-infection %	7 0.72	19 2.98

Table 4 (5) March, 1986

Village	Survey	Control
No. of subjects	958	621
Positive no.	75	159
Infect rate (%)	7.86	25.60
U=9.67, p<0.01		
Classification of parasites		
Roundworm	47	83
%	4.93	13.37
U=5.95, p<0.01		
Hookworm	14	32
%	1.47	5.15
U=4.42,p<0.01		
Pinworm	14	6
%	1.47	0.97
Whipworm	5	14
%	0.52	2.25
Tapeworm	1	1
%	0.10	0.16
Mix-infection	6	5
%	0.63	0.81

Table 4 (6) October 1986

Village	Survey	Control
No. of subjects	946	604
Positive no.	60	100
Infect rate (%)	6.34	16.56
U=6.45, p<0.01		
Classification of parasites		
Roundworm	37	71
%	3.91	11.75
U=5.92, p<0.01		
Hookworm	11	20
%	1.16	3.31
U=2.95,p<0.01		
Pinworm	7	3
%	0.74	0.50
Whipworm	7	11
%	0.74	1.82
Tapeworm	0	0
%	0	0
Mix-infection	4	9
%	0.42	1.49

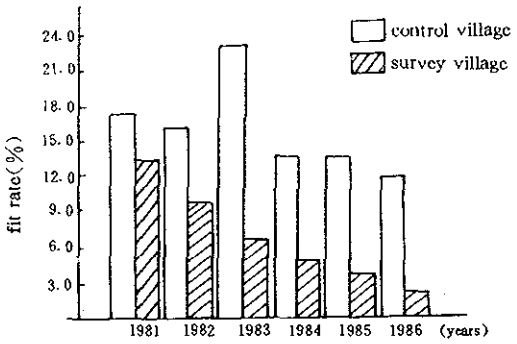

Fig. 2: The comparison of the fit rate of infectious intestines diseases

V. Discussion and conclusion

1. According to the description above, the biogas management had surely effected on improving the environmental sanitation in rural residential areas due to the flies density reduced and the better qualities of drinking water and soil sanitation.

2. This study showed that treating the manures of animals and human by biogas management had significant effect on reducing the infectious rate of parasitic and infectious diseases in intestines. So it is effective and feasible to take this measure in epidemic area of intestines infectious diseases.

3. The diseases derived from manures are mainly infectious and parasites diseases in intestines which are one of the common diseases in developing countries including China where the fit rate and infectious rate are rather high.

To reduce the intestines infectious diseases rapidly, it is necessary to popularize the sanitary treatment of manures and the corresponding measures of environmental sanitation. Management of biogas is really a good way to keep the manures harmless in rural area of our country, and it lay a good foundation to control and even wipe out the diseases derived from manures.

Yan Zhensheng and Xu Guoxiong, The Henan Provincial Sanitation and Antiepidemic Station, Zhengzhou, P.R. China

Guo Jlayue, Su Chuan hua and Liu Fang, The Sanitation and Antiepidemic Station of Huaiyang County, Henan Prov., P.R. China

Wang Guofang and Yin Lisai, The Zhoukou Prefectural Sanitation and Antiepidemic Station, Henan Prov., P.R.China

China Biogas, 1990, 8(2), 43-46

Translated by Hu Rongdu and Wu Libin, BRTC

summary

Biogas Digesters for Environment and Sanitation

In 1984-6 the effects on environment and health were investigated in a village with biogas digesters for 97% of all households as compared to a village without any biogas plants. The number of flies caught and the hookworm and roundworm larvae found in the soil served as indicators. In addition, faeces examinations were carried out for the population. These showed intestinal infections to have continually decreased in the village with the biogas plant during the course of time; in 1986 these were about 25% of the village without a biogas plant.

sommaire

Les Installations de Biogaz pour l'Environnement et la Santé Publique.

Dans un village où 97% de tous les ménages possèdent une installation de biogaz, on a étudié entre 1984 et 1986 les effets sur l'environnement et la santé par rapport à un village sans installations. Le nombre de mouches capturées et les vers.....ainsi que les oeufs de vers ronds trouvés dans le sol servaient d'indicateur. De plus, on a procédé à des analyses de selles de la population. A ce sujet, il s'est avéré que les infections intestinales ont constamment diminué dans le village équipé d'installations de biogaz; en 1986 elles ne représentaient que 25% environ de celles enregistrées dans le village sans installations de biogaz.

resumen

Instalaciones de Biogas para el medio ambiente e higiene pública

En un pueblo donde el 97 % de los hogares utiliza las instalaciones de Biogas, se llevó a cabo 1984-86 un estudio hacerca de las consecuencias del medio ambiente y la salud y se comprobó con un pueblo sin instalación de Biogas. Como indicadores sirvieron la cantidad de moscas cazadas y los huevos y gusanos de los tipos encontrados en el suelo. Fuera de esto se llevó a cabo un análisis de la evacuación de vientre de la población. En este caso se demostró que las instalaciones del tubo digestivo en pueblos con instalaciones de Biogas se reducieron constantemente en el curso del tiempo; 1986 alcanzaron solo el 25 % de la cantidad del pueblo sin instalaciones de Biogas.

Technical Know-How on Installing Anaerobic Filter for the Rural Biogas Digester

The anaerobic filter is a high efficiency device of fermentation technology which has been successfully applied in industry (like distilleries, sewage plants and urban biogas septic tanks). In recent years, some effects have been obtained by selectively applying this technology on rural biogas digesters. The associated technology is discussed in the following:

A. Analysis of the hydraulic biogas digester based on the principles of microbiology

The hydraulic biogas digester is the main type which has been popularized in rural areas of China. It is characterized by its low capital cost, locally materials available both for construction and fermentation, and short payback period etc., however the gas production rate by digester volume and the utilization rate of raw materials are low. As the gas consumption per household per year is 200-300 m^3, the energy

1992/1 special

Contents

BIOGAS FORUM

IMPRESSUM

ISSN: 0936 — 8728

BIOGAS FORUM is compiled by BORDA in cooperation with the GTZ.
Editor: BORDA, Bremen Overseas Research and Development Association, Bahnhofsplatz 13 (im Überseemuseum), D-2800 Bremen 1, Fed. Rep. of Germany, Tel. (0421) 39 21 72, Editorial responsibility: Ludwig Sasse.

Financed by: State Office for Development Cooperation, Senate for Economy, Technology and Foreign Trade of the Free Hanseatic City of Bremen, Slevogtstr. 48, D-2800 Bremen 1 and Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH, Postfach 51 80, D-6236 Eschborn

Issued: 4 times a year and one or two special issues per year.

The BIOGAS FORUM was established after the 1. Bremen Biogas Workshop 1979 serving as a medium for the exchange of experience amongst those working in the field of biogas. The BIOGAS FORUM understands itself as a link between scientists and practicians and as a platform for practical men and women.

The editor reserves the right of necessary shortening of articles and simplyfiying the language and presentation of the same. BORDA does not claim any copyright under the condition that the BIOGAS FORUM is mentioned as source in case of using articles or drawings. The authors agree on this point when handing over articles to the FORUM.

Articles signed by the name of the author do not necessarily express the opinion of neither the editor nor the sponsor.

The editorial work includes tight cooperation with gate - German Appropriate Technology Exchange — to show GTZ-experiences in biogas extension.