

Swine Waste Management Through Kyusei Nature Farming and EM

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Abstract : Ten swine farms were installed waste management systems. Farm size was different from 200 to 3,000 pigs. Pigs were managed under a fully automated system. Treatments were made with 2 x 3 Latin square arrangements. Two seasonal effects were hot summer (25 - 35°C) and cold winter (10 - -15°C). Three EM levels were 1:1,000, 1:5,000, 1:10,000 dilution directly into waste fermentation tanks. Heavy foams were created during mid-day of hot summer in all EM treatment levels. However, the severeness was diminished in low dilution rate. Aeration and spray helped to reduce foam formation during this period. During winter, the fermentation not proceeded and then the waste remained several months. Therefore, heating system helped fermentation process. In order to optimize waste treatment system, the solid materials were screened and then relative liquid type waste was put into fermentation system. The fermentation was best condition with screening method in all levels of EM treatment during summer time. In conclusion, pig waste was completely fermentable with EM treatment with liquid type manure and the optimum condition should be adjusted by environmental temperature and farm size.

Introduction

Offensive odour from swine farms is a source of water pollution and environmental contamination. This odour is mainly ammonia and sulphur gas. In order to reduce the smell, available materials are aromatic oil mix, sarsaponin, sphagnum peat moss, and other chemicals. Animal waste is produced 115,000m³ every day in Korea. Waste is reutilized as compost and spray in the field. Waste management system is continuous fermentation process with aerobic and anaerobic microorganisms. Fermented final liquid will be recycled for pig barn floor cleaning by Kyusei Nature Farming system. Effective microorganism (EM) has been widely used for agriculture natural farming. EM improves soil microbial activity and their characteristics for the plants. EM contains many different microorganisms, which are naturally occurring in ground. When they spray in the barn or manure, pathogenic microbes and odour are significantly reduced. Dried yeast (*Saccharomyces boulardii*) supplement (0.1% and 10%) significantly reduced salmonella. Sun et al., (1998) reported that EM-Bokashi supplementation reduced ammonia production. Anjum (1998) reported that EM-Bokashi supplementation significantly decreased pathogen population in chicks. The objectives of this study were to manage swine waste by EM and Kyusei Nature Farming.

Materials and Methods

Ten pig farms were installed a waste management system (Table 1). Farm size differed from 200 to 3,000 pigs. Pigs were managed fully by a automated system. Treatments were made with 2 x 3 Latin square arrangements. Two seasonal effects were hot summer (25 to 35°C) and cold winter (10 to -15°C). Three EM levels at 1:1,000, 1:5,000,

1:10,000 dilution were directed into waste fermentation tanks. Waste was collected from input and output flow of the management system and then analyzed BOD, COD, N, and P content.

Table 1. Automatic Swine Waste Management System

	Size (m)	Capacity	Power	Material
Storage 1	W2.5 x L6 x D2	30 m ³	1.5kW	Concrete
Ferment+Aeration	W4xL6xD2	48 m ³	1.5kW	Concrete
Ferment	W4xL6xD2, spray 0.1m ³ /min	48 m ³	0.4kW	Concrete
Aeration 1	W4xL6xD2, aeration 0.9m ³ /min	48 m ³	3.7kW	Concrete
Aeration 2	φ1500xH1xSOS304		0.4kW	Stainless
Sediment	(W4.5xL2xD2)x3	18 m ³		Concrete
Storage2	W2.5xL3.5xD2	14 m ³	0.7kW	Concrete
Compost	W2.5xL2xD2	10 m ³	1.5kW	Concrete

Results and Discussion

Waste management system was developed by a local company based on the Kyusei Nature Farming method (Figure.1). The system consisted of storage, fermentation, aeration, sedimentation tanks. In order to improve aerobic fermentation, aeration pumps were installed and continuously operated. Spray pumps were equipped 30-100cm above liquid level in order to reduce foam formation. This system was operated automatically for 24 hrs with time intervals in each step.

Heavy foams were created during mid-day of hot summer in all EM treatment levels (Table 2). However, the severeness was diminished in low dilution rate. Aeration and spray helped to reduce foam formation during this period. BOD and COD content were significantly decreased by EM treatment at all dilution rates ($P<0.01$). Nitrogen and P content were also significantly reduced by the treatment ($P<0.01$). These results were consistent with Sun et al., (1998) where EM-Bokashi supplementation reduced ammonia production. The final outflow is suitable for cleaning floor.

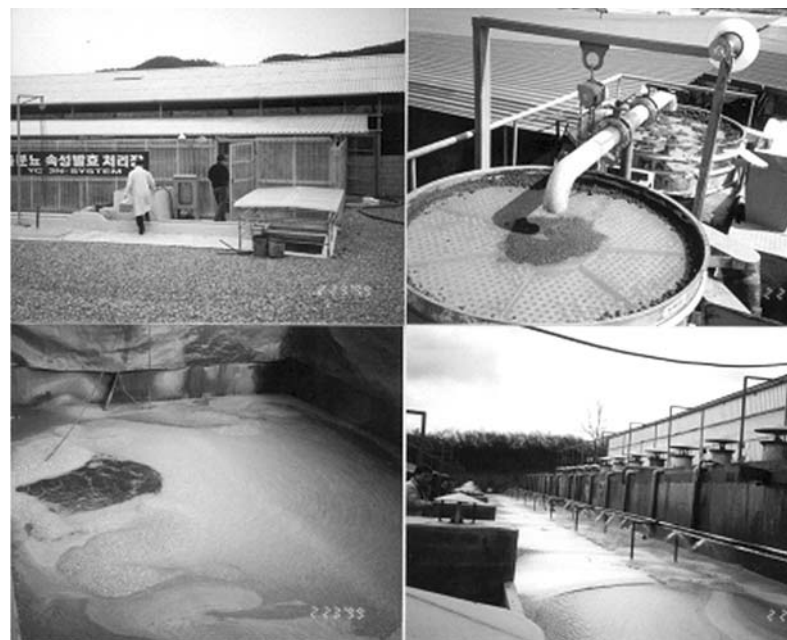


Figure. 1. Operation - Automatic Swine Waste Management System

Table 2. BOD, COD, N, and P Content from Swine Waste Management with Different EM Dilutions during Summer (ppm)

	Control	1:1,000	1:5,000	1:10,000
BOD	43,289	5,410	7,430	12,491
COD	5,280	43	240	753
N	1,780	43	147	367
P	1,122	323	482	820

During winter, the fermentation proceeded a little and then the waste remained several months in system. Therefore, a heating system helped the fermentation process. BOD and COD were reduced, but the level was not high for re-utilization. The microbes were not active for fermentation due to cold environment (10 to -15°C). Sahm (1984) reported that anaerobic waste water treatment should be at optimized temperature for microbial activity (Archer and Krisop, 1991). In order to optimize the waste treatment system, the solid materials were screened and then relative liquid type waste was introduced into the fermentation system. The fermentation was best with screening method in all levels of EM treatment during summer time. In conclusion, pig waste was completely fermentable with EM treatment with liquid type manure and the optimum condition should be adjusted by environmental temperature and farm size.

Table 3. BOD, COD, N, and P Content from Swine Waste Management with Different EM Dilutions during Winter (ppm)

	Control	1:1,000	1:5,000	1:10,000
BOD	32,850	18,420	24,190	28,418
COD	4,250	2,419	33,218	35,206
N	2,071	1,204	1,626	1,857
P	1,736	893	1,134	1,441

Conclusions

Pig waste was completely fermentable with EM treatment with liquid type manure and the optimum condition should be adjusted by environmental temperature and farm size.

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