International Workshop
Livestock, Climate Change and the Environment

Studying on pig manure treatment in order to minimize environmental pollution and use bioenergy

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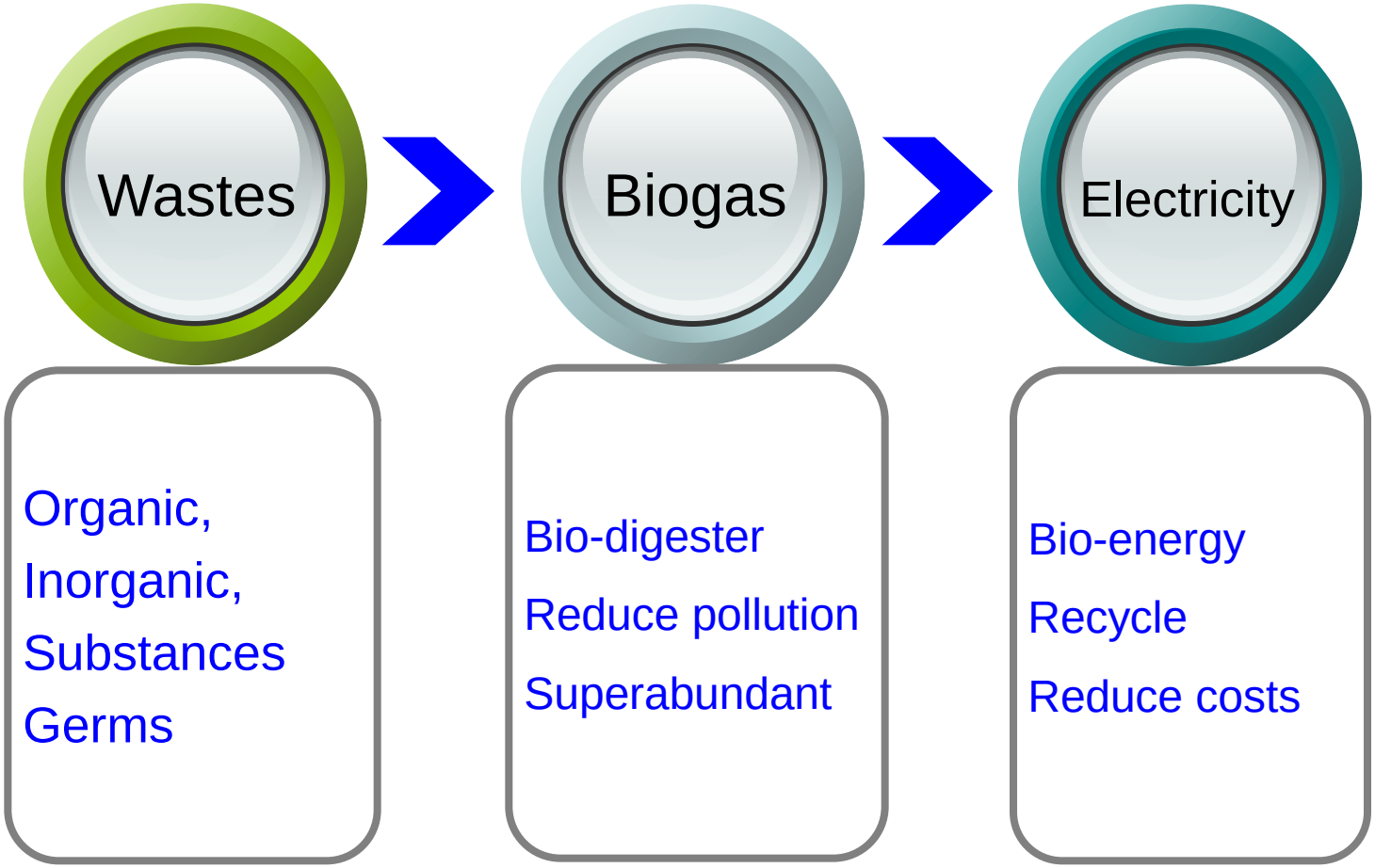
Introduction

Pig production plays an important role (meat supply, income, soil fertility)

Pig population increased about one millions per year (Before 2007)

Pig production in large scale farms is more and more important

→ ***Pig wastes management?***


Wastes
Biogas
Electricity
Organic,
Inorganic,
Substances
Germs
Bio-digester
Reduce pollution
Superabundant
Bio-energy
Recycle
Reduce costs

Materials and methods

Pig manure production

- Study was carried out at a pig farm in Hung Yen in two seasons (winter and summer) from October 2008 to August 2009 (measured 8 times per month)
- Identify feed consumption and daily waste rejected by different kinds of pig (growing pigs and sows)
- Coefficient of manure rejection was determined by the ratio between rejected manure and consumed feed

Biogas treatment and Electricity

- Identifying biogas produced by the method of volumetric measurement of biogas bags
- Analyzing some chemical criteria such as BOD_5, COD, dissolved sulphide, Cu^{2+}, Zn^{2+}, Cl^-, NH4-N in liquid waste before and after the treatment by biogas system
- The electric energy produced from an electric generator running with biogas is measured by an watt-hour meter

Results and discussion

Table 1. Pig production scale of the studied farm

Kind of pigs	Unit	Quantity
Sows	Head	36
Boars	Head	3
No of weaned piglets	Head/year	200
Weight of weaned piglets	Ton/year	1.5
No of fattened pigs	Head/year	300
Weight of fattened pigs	Ton/year	33

Table 2. Feed intake and coefficient of manure rejection of different pig categories (n=48)

Kind of pigs	Consumed feed (kg/head/day)	Rejected manure (kg/head/day)	Coefficient of manure rejection
	Mean ± SEm	Mean ± SEm	Mean ± SEm
Weaned – 15kg	0.42 ± 0.01	0.25 ± 0.01	0.59 ± 0.01
15-30 kg	0.76 ± 0.01	0.47 ± 0.01	0.61 ± 0.02
30-60 kg	1.64 ± 0.02	0.80 ± 0.02	0.49 ± 0.01
60 kg – finishing age	2.30 ± 0.02	1.07 ± 0.01	0.46 ± 0.05
Sow in gestation I and waiting for insemination	1.86 ± 0.01	0.80 ± 0.01	0.43 ± 0.01
Sow in gestation II	2.12 ± 0.01	0.88 ± 0.01	0.41 ± 0.01
Suckling sow	3.7 ± 1.54	1.62 ± 1.57	0.44 ± 1.58

Table 3. Estimating the manure annual production for fattened pigs and sows

Pig category	Fattened pig* (estimating for one fattened pig's life)	Sows (estimating for 1 year)
Consumed feed (kg)	257.50	797.00
Manure produced (kg)	127.05	342.22
Coefficient of manure rejection	0.54	0.43
** Fattened pigs are counted after weaning to finishing, ready for slaughter (110kg)*		

Table 4. Biogas quantity generated by waste treatment in winter and summer (n=6)

Criteria	Unit	Winter	Summer
		Mean ± SEm	Mean ± SEm
Temperature	^{0}C	14.93 ± 0.14	32.56 ± 0.30
Humidity	%	77.50 ± 1.52	81.12 ± 0.36
Manure to biodigester	kg/day	39.03 ± 2.09	40.18 ± 2.05
Liquid waste to biodigester	m^3/day	6.85 ± 0.36	7.19 ± 0.42
Biodigester volume	m^3	24	24
Biogas generated after 24 hours	m^3/day	4.16 ± 0.22	9.06 ± 0.46

Table 5. Efficiency of biogas transformation to electric energy

Criteria	Winter	Summer
	Mean	Mean
Biogas produced per day (m^3/day)	4.16	9.06
Number of kW generated (kW)	4.50	9.80
Biogas quantity generating 1 kW (m^3)	0.92	0.92

Table 6. Chemical criteria of liquid waste before and after treatment of biogas

Criteria (mg/lit)	Before treatment	After treatment	Tolerable hygienic standard*
	Mean ± SEm	Mean ± SEm	
BOD_5	1030.11 ± 2.86	235.50 ± 3.29	300
COD	2019.78 ± 3.81	341.81 ± 2.55	400
Sulfua	28.45 ± 0.45	3.37 ± 0.15	1
Cu^{2+}	0.67 ± 0.22	0.32 ± 0.03	5
Zn^{2+}	0.35 ± 0.04	0.22 ± 0.01	5
Cl^-	336.57 ± 5.75	237.50 ± 1.45	-
NH_4^+	6.51 ± 0.13	3.13 ± 0.05	5

* *according to 10TCVN 678 – 2006*

Conclusions

- The coefficients of manure rejection was lowest in sows (0.43) followed by fattened pigs from 60 kg to finished (0.46), pigs from 15 kg to 30 kg have the highest coefficient (0.61)
- Produced biogas quantities in summer were over 2 times higher than those in winter
- The coefficient of biogas transformation to electric energy is rather high (0.92 m3), generating 1 kW
- Using biogas digestors can reduce the environmental pollution, especially with respect to BOD_5 and COD concentrations

⟶ ***Developing the biodigester for treating the animal waste can contribue to reducing the enviromental polution as well as having an important source of bioenergy.***

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