

Environmental Policy and Replication Strategies for Livestock Waste Management in China

**Institute of Environment and Sustainable
Development in Agriculture, CAAS**



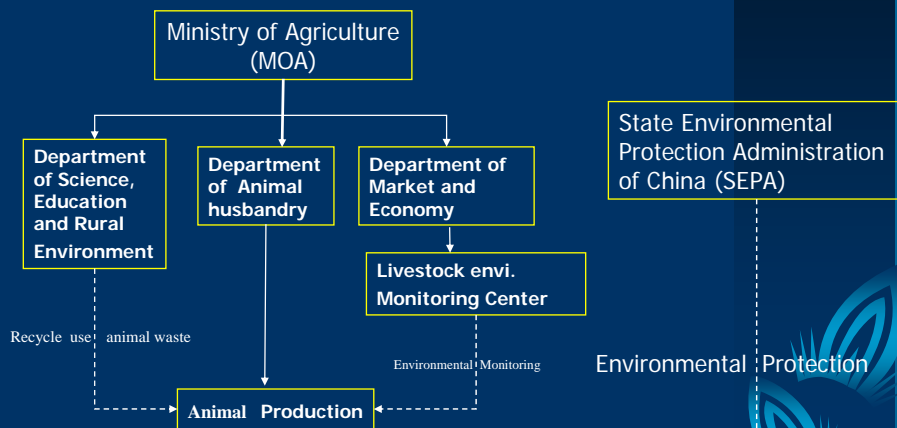
Contents

- ⇒ Current environmental policy
 - ⇒ Problems and challenge
 - ⇒ Replication Strategies and suggestions
- 

Current environmental Policy

- Governmental bodies
- Law and regulation
- Discharge standards
- Recycling standards
- Subsidy programs
- Training and awareness raising

Framework of Livestock Environmental Administration in China



Regulation of Pollution Prevention and Management for Livestock and Poultry Farms

500 pigs, 30,000 chickens, and 100 cattle in stock

- ⇒ promulgated on March 20, 2001 by SEPA
- ⇒ New farm or expanded farm must pass EIA
- ⇒ License to discharge, meet national and local standards
- ⇒ Recycle utilization as the first choice for animal pollution prevention



Animal Husbandry Law

- ⇒ is promulgated on Dec 29, 2005
- ⇒ went in effect as of July 1, 2006



Integrated wastewater discharge standard

GB 8978-1996

⇒ is promulgated on Oct 04, 1996

⇒ went in effect as of January 01, 1998

Integrated Wastewater Discharge Standard

Pollutants	1 st grade value	2 nd grade value	3 rd grade value
BOD ₅ (mg/L)	30	60	300
COD (mg/L)	100	150	500
SS (mg/L)	70	200	400
NH ₄ ⁺ -N (mg/L)	15	25	--
P (mg/L)	0.5	1.0	--
Sulfide	1.0	1.0	2.0
Cyanide	0.5	0.5	1.0
Cu	0.5	1.0	2.0
Zn	2.0	5.0	5.0

Discharge Standard of Pollutants for Livestock and Poultry Breeding

GB 18596-2001

⇒ is promulgated on Dec 28, 2001

⇒ went in effect as of January 1, 2003



Discharge standard of pollutants for livestock and poultry breeding

Pollutants	Standard Value
BOD ₅ (mg/L)	150
COD (mg/L)	400
SS (mg/L)	200
NH ₄ ⁺ -N (mg/L)	80
TP (mg/L)	8.0
Fecal Coliforms (count / mL)	10000
Ascarid Egg(count / L)	2.0



Standards for Irrigation Water Quality

GB 5084-2005

⇒ is promulgated on July 21, 2005

⇒ went in effect as of Nov 01, 2006

Standards for Irrigation Water Quality

Pollutants	Paddy field	Dry farmland	Vegetables
BOD ₅ (mg/L)	60	100	40, 15
COD (mg/L)	150	200	100, 60
SS (mg/L)	80	100	60, 15
Coliforms (amount / 100mL)	4000	4000	2000, 1000
Ascarid Egg (amount / L)	2	2	2, 1
Chloride		350	
Pb		0.2	
As, Cr		0.1	
Cd		0.01	
Hg		0.001	

Recycle Use Standards

- ⇒ Technical requirement for non-hazardous treatment of animal manure
- ⇒ 8 standards related with medium- and large- scale biogas digester, 13 standards related to household biogas digester
 - ⇒ Household biogas oven -GB
 - ⇒ Normative design drawing collection for household biogas digester - GB
 - ⇒ Criteria of quality inspection and assessment for household biogas - GB
 - ⇒ Technical requirement for the operation, maintenance and safe manipulation of large scale biogas digester in concentrated animal feeding operations -GB

Local regulations

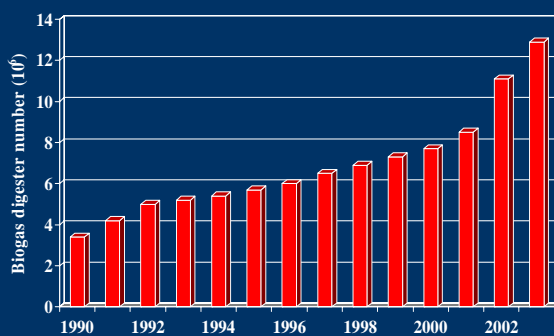
In 1992 《Shanghai interim provisions of the wastewater discharge for medium and large scale animal feeding operations》

Subsidy Programme Addressing Pollutions of CAFOs

- ⇒ Household biogas digesters
- ⇒ Medium- and large- scale biogas digesters
- ⇒ Standardized waste treatment system for Centralized Animal Production Park



Household biogas digesters



By the end of year 2006, the number of household biogas digester had reached 21.75 million with a approximate biogas production of 8.5 billion m³

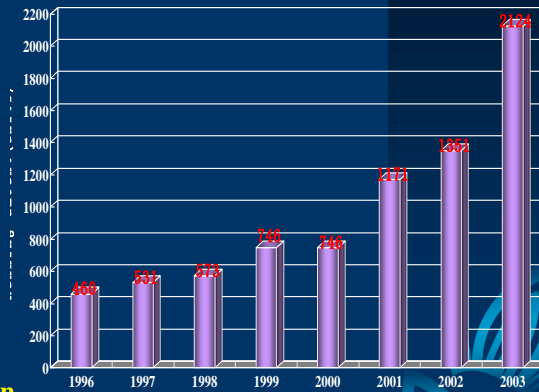
1000 Yuan/digester, 30-40%



Medium- and large- scale biogas plants

The number of large-scale biogas digesters for livestock waste treatment had reached 1228, with medium- and large- scale biogas digesters amount to 5200 by 2006.

1.0 to 1.5 million Yuan with maximum subsidy of 2 million 50%



Standardized waste treatment system for centralized animal production park

- ⇒ 3000 pigs in stock
- ⇒ 500 dairy cattle
- ⇒ the system has been demonstrated in 7 provinces: 7 centralized swine production park and 14 centralized dairy cattle production park



0.7 million Yuan for each farm

Training and Awareness Raising

- ⇒ Household biogas digester constructing technologies—18 million
- ⇒ Animal manure & wastewater monitoring technique



National Pollution Census in 2008— CAFOs

Coverage:

- ⇒ Rural household animal feeding operations
- ⇒ Centralized Animal Production Park
- ⇒ Concentrated Animal Feeding Operations

Activities:

- ⇒ Investigate the quantity of manure and wastewater
- ⇒ Study on manure and wastewater producing and discharge coefficients



Training on Manure & Wastewater Monitoring Technique

- ⇒ Bei Jing
- ⇒ Shan Xi Gan Su
- ⇒ Hu Nan
- ⇒ Si Chuan
- ⇒ Local trainings: Tian Jin, Hu Bei, Shan Xi

Problems and Challenge

- ⇒ The number of livestock environmental monitoring centers is very few (only 3 right now: 2 located in Beijing, and 1 in Shandong province)
- ⇒ There is no standards for livestock waste application
- ⇒ More investment is needed for animal waste treatment

How to balance environmental protection and CAFOs development

Replication Strategies and suggestions

- ⇒ Establish livestock environmental monitoring centers
- ⇒ Set up related standards
- ⇒ Support scientific research
- ⇒ Demonstration and extension of applicable technologies
- ⇒ Subsidy for organic fertilizer application

Establish Livestock Environmental Monitoring Center

- ⇒ manpower resources
- ⇒ Instruments
- ⇒ Measuring techniques

Set up related standards

- ⇒ Set up new national standards, such as livestock manure and wastewater application standard
- ⇒ Set up departmental standards
- ⇒ Revision on the existed standards
- ⇒ Set up technical standards



Support Scientific Research

- ⇒ Minimize waste excretion through animal nutrition optimization and ration formula improvement
- ⇒ Reduce waste in the course of animal production
- ⇒ Develop state-of-the-art technologies to tackle livestock wastes



Demonstration and extension of the applicable technologies

People engaging in demonstration and extension should get training certificate of authority first



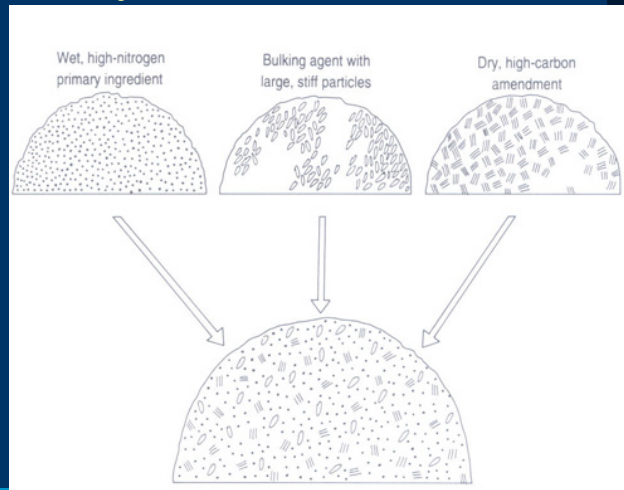
Manure Treatment Technologies

- mitigating pollution
- without odor
- cost-effective system
- with rich nutrient and organic
- pathogens free

Environment-friendly processes transfer the waste into necessary sources for safety food production



Desired characteristics for composting achieved by amendment



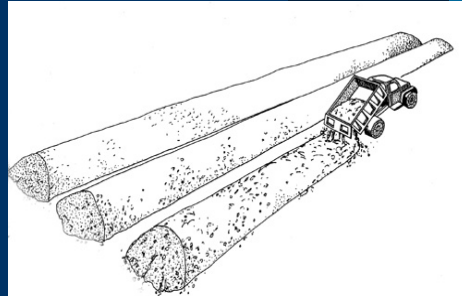
Composting Methods

- ⇒ Windrow composting
- ⇒ Aerated static composting
- ⇒ Aerobic fermentation system

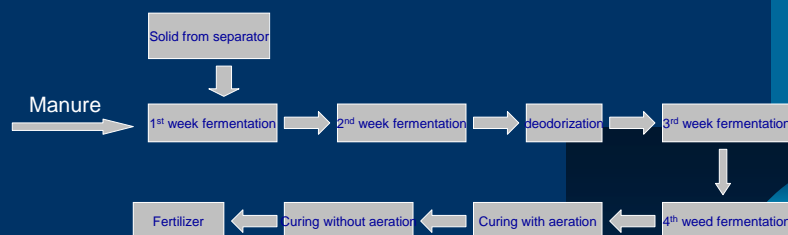
Windrow composting

Advantages:

- ⇒ Low investment
- ⇒ Equipment need: a tipcart
- ⇒ Plastic greenhouse to minimize odor



Aerated Static Composting (1)



Aerated Static Composting (2)

Advantages:

- Low capital investment in comparison with compost bins or Aerobic Fermentation system
- Small land requirement
- No need for agitation or turnover to the compost substrates
- No odor emission



aerators outside



The aeration duct in the floor and its distribution

Aerobic Fermentation System

Advantages:

- ⇒ mass production of animal manure
- ⇒ Investment is relatively high, with much output and income



Wastewater treatment technologies

- ⇒ Large-scale Biogas Digester
- ⇒ UASB combined with land application
- ⇒ Constructed Wetland
- ⇒ UASB + MBR

Large-scale Biogas Digester



Large-scale Biogas Digester

Mesophilic Biogas Digester



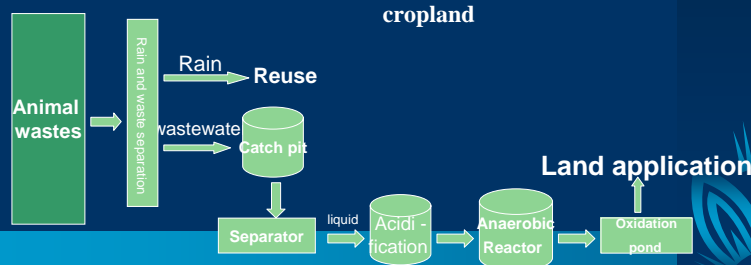
- ⇒ Pigs (Poultry) – Biogas – Fish
- ⇒ Pigs (Poultry) – Biogas – Fruits (Greenhouse)

UASB combined with land application

Treated wastewater is applied to farmland as liquid fertilizer for resource reuse

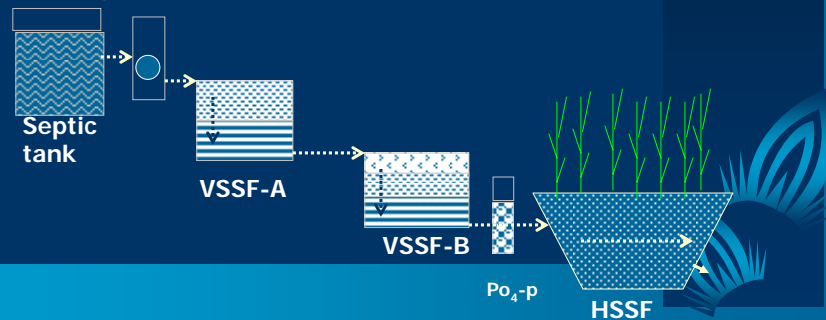
Advantages:

- ◆ Low capital investment in comparison with biogas or other wastewater treatment technologies
- ◆ Zero operation expenditure
- ◆ Anaerobically digested wastewater is used to farmland as fertilizer.
- ◆ Suitable for the animal farms which are surrounded by large amount of cropland



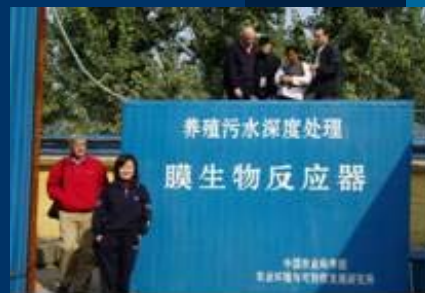
Constructed Wetland

- ⇒ Free Water Surface Flow (FWSF)
- ⇒ Vertical subsurface flow (VSSF)
- ⇒ Horizontal subsurface flow (HSSF)
- ⇒ Integrated Vertical Flow (IVCW)



UASB + MBR

- ⇒ The quality of treated water meet the standard of **GB 18596-2001**
- ⇒ Suitable for the AFOs located in the near suburb of city like Beijing
- ⇒ Operation fee is needed



Subsidy for Organic Fertilizer Application

- ⇒ encourage farmer to use organic fertilizer through application subsidy
- ⇒ attracting private and company to invest for animal waste treatment for both profit and environment protection purpose
- ⇒ investor should consider animal manure and waste water treatment concurrently



Thank You!

