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Technology Design for Controlling Cultivation Contamination in Erhai Basin Based on the Theory of Recycling Economy

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Abstract

The pollution situation of which is going to analyzed later, the water resource in Erhai Basin is chosen to be the subject of this research by presenting the technology called the solar medium heat steel form solid-liquid joint fermentation biogas technology, which is based on 3R principle. The aim of this research is to do further improvement in recyclable use of resource, reducible discharge of waste water and also realization of win-win cooperation of society, economy and ecological environment in certain area.

Keywords: Recycling economy, Pollution controlling, Technology design, Medium heat biogas energy technology

1. Introduction

In the past twenty years, with population increase and the rapid economic development around the basin, as well as the growing exploitation of natural resources, the quality of Erhai water increasingly decline. Aiming at the analysis of the current status of serious agricultural pollution problems in Erhai Lake basin, we put forward the solar medium heat steel form solid-liquid joint fermentation biogas technology based on 3R principle. Through the intensive utilization of farms droppings and sewage, using marshy energy construction technical scheme and integration of Yunnan advanced technology of solar energy utilization, excrement and sewage will be transformed into energy and fertilizer in order to realize

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recyclable resource, therefore, sewage discharge could be minimized to the greatest extent to make agriculture and environmental harmonious together with sustainable development in the basin.

2. The pollution situation of Erhai Lake basin

Erhai basin mainly consists of some premier rivers, such as Mici, Fengyu, Haiwei, Miju, Luoshi jiang, Yong’an jiang, Cang Mountain 18 streams, etc, and also several lakes called Haixihai, Zibi, West lake, East lake, Green Jade pool etc. Its functions can go with water supply, agricultural irrigation, power generation, navigation, aquatic products, tourism and others, which play an important role in development of Dali area. Because of human activity intervention, the water level of the lake is getting down with the lake area narrowing down. Besides, the water quality is seriously polluted by nonpoint source. Since the 1990s, Erhai Lake water quality has kept changing from the intermediate level of nutrition to advanced level. (Table 1)

Table 1 the changing trend analysis for enriched nutrients in Erhai Lake

<table>
<thead>
<tr>
<th>Item</th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>TP (mg/L)</td>
<td>0.02</td>
<td>0.03</td>
<td>0.027</td>
<td>0.025</td>
<td>0.026</td>
<td>0.025</td>
<td>0.028</td>
<td>0.03</td>
</tr>
<tr>
<td>TN (mg/L)</td>
<td>0.38</td>
<td>0.3</td>
<td>0.32</td>
<td>0.34</td>
<td>0.33</td>
<td>0.32</td>
<td>0.3</td>
<td>0.37</td>
</tr>
<tr>
<td>Levels of nutrients</td>
<td>medium</td>
<td>medium</td>
<td>medium</td>
<td>medium</td>
<td>medium</td>
<td>rich</td>
<td>rich</td>
<td>rich</td>
</tr>
</tbody>
</table>

According to environmental state bulletins of Dali prefecture in 2005, by monitoring pollution data of the main rivers into the Lake itself around Erhai Lake basin, we could see its pollution situation as follows. (Table 2)

Table 2 the water environmental quality situation of Eryuan county in 2005

<table>
<thead>
<tr>
<th>Name (river)</th>
<th>TP (mg/L)</th>
<th>TN (mg/L)</th>
<th>NH3-N (mg/L)</th>
<th>DO (mg/L)</th>
<th>CODMn (mg/L)</th>
<th>BOD5 (mg/L)</th>
<th>Types of water quality</th>
<th>Main pollutants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Miju</td>
<td>0.077</td>
<td>0.87</td>
<td>0.26</td>
<td>6.00</td>
<td>3.02</td>
<td>2.88</td>
<td>IV</td>
<td>TP, TN</td>
</tr>
<tr>
<td>Luoshi jiang</td>
<td>0.118</td>
<td>4.27</td>
<td>0.99</td>
<td>1.38</td>
<td>8.10</td>
<td>2.66</td>
<td>&gt; V</td>
<td>TP, TN, COD</td>
</tr>
<tr>
<td>Yong’an jiang</td>
<td>0.066</td>
<td>2.30</td>
<td>0.32</td>
<td>4.68</td>
<td>3.96</td>
<td>2.23</td>
<td>V</td>
<td>TP, TN, COD</td>
</tr>
<tr>
<td>Zibi</td>
<td>0.015</td>
<td>0.64</td>
<td>0.15</td>
<td>7.13</td>
<td>2.14</td>
<td>2.54</td>
<td>III</td>
<td>TN, TP</td>
</tr>
<tr>
<td>West lake</td>
<td>0.112</td>
<td>0.83</td>
<td>0.22</td>
<td>7.90</td>
<td>6.38</td>
<td>4.60</td>
<td>V</td>
<td>TP, TN, COD</td>
</tr>
<tr>
<td>Haixihai</td>
<td>0.040</td>
<td>0.41</td>
<td>0.24</td>
<td>6.83</td>
<td>1.60</td>
<td>2.42</td>
<td>III</td>
<td>TP, TN</td>
</tr>
</tbody>
</table>

Water pollution problem of Erhai Lake watershed mainly embodies in the following two aspects:

1) Serious agricultural pollution

In all sources of pollution, agricultural pollution accounts for up to 70% in total load capacity of the rivers and lakes nutrients that becomes the main pollution resource of nitrogen and phosphorus in Erhai Lake. Actually, the loss of poultry and animal feces and fertilizers gives a large proportion of pollutants to this lake, while the dairy farming industry not only in Dali city but in Erhai basin is often characterized as one of some spectacular industries. But the seriously polluted ecological environment in Erhai Lake should attribute to the rapid development of aquaculture.

2) More than 78% pollutants brought with the entry river water in proportion to the total pollutants into the lake
According to synchronous monitoring results from a series of lake, river and stream surrounded by Erhai Lake in 2004, most of entry rivers have contributed to the percentage of TN and TP in itself, which is up to 78% and 87% respectively. In addition, several main rivers, such as Miju, Yong’an jiang, Luoshi jiang, 18-stream, Boluo jiang and so forth, when flowing into the Erhai Lake, carry the TN and TP, whose contributions add up to 63.0% and 71 percent individually.

3. Recycling economic theory and plan for pollution-controlling technology

3.1 Recycling economic theory

The so-called circular economy refers to the abbreviation of material closed-loop liquidity economy, the goal of which is high efficiency utilization of resources recycling, with the "Reduce, Reuse, Recycle" considered as the original criterion (3R principle for short). Its economic model behaves on the movement of material closed-loop recycle and energy use in terms of the characteristics of arrangement in the natural ecosystem material recycle and energy flow mode. Thus, this type of recycling economy is trying to transform the traditional linear growth economy dependent on resource consumption into another one relying on some circular development for ecological resources.

3.2 Erhai Lake basin pollution controlling technology plan

According to Erhai basin pollution situation, directed by 3R principle, we plan to adopt the combination of application promotion for pollution controlling technology and facilities construction for pollutant controlling, and through the infrastructure construction, the application of controlling pollutants wants to come true.

In farms, to construct the drainage facilities, implement dry dung technology so as to separate the rain water and pollutants, we can build up sewerage network and reduce the anti-pollution quantity. In the meantime, it is advocated that automatic drinking fountains might be adopted in order to use blunt circle water as little as possible to decrease the waste of livestock and poultry drink, so "reduction" can be achieved.

Using temperature energy ecotype biogas technology, through integration equipment integration in dry type temperature anaerobic fermentation we can produce biogas. Fermentation residue is separated by solid and liquid, in which high concentration sewage goes into mixed liquid part of wet temperature anaerobic fermentation to make the biogas, eventually liquid fertilizer is deployed successfully, while solid part into high-temperature aerobic compost is made into solid organic manure. Biogas desulfurization after dehydration gas is supplied to village collectively; low concentration sewage can be used to recharge water after contacting oxidation and precipitation as planting. We could reuse cow scale farm manure and sewage in Erhai basin as a kind of resource, at the same time, products produced by biogas system may be provided to local farmers for use to improve utilization status of the local farmers’ energy and fertilizer, allowing the "reused" resource while controlling pollutants.

Using soil water absorption craft, we are to establish the fixed appropriate ecological plantation to forage for best, laying special irrigation pipe to absorb farms of educe organic manure, biogas water, recycled water, and ecological plantation can be realized through "recycled".

4. Erhai Lake basin breeding pollution controlling process design

4.1 Concrete operation of Erhai basin breeding pollution control
By comprehensive consideration of the Erhai basin, according to the specific conditions of the local agricultural economy development direction, big livestock manure quantity, and the relative concentration of discharge, the backward rural energy utilization, the excessive use of traditional chemical fertilizer as characteristics, we could choose overall solutions by village level solar temperature drought-wet joint fermentation gas centrally supplying biogas standing. Meanwhile, for the project area temperatures in poorer relatively large, solar enrich the climate characteristics of biogas technology, this project is built on the basis of system construction in solar technology to use the local plenty of solar energy to heat on the transformation in the way of which the digester adjust temperature, and to control the digester fermentation temperature for a long year’s time maintaining at 35 degrees Celsius. Finally it can achieve requirements for high temperature digester operation and increase the operation of the system efficiency to make sure that the solid waste disposal capacity is realized. Specific operation is as follows:

1) With solar energy hot water high temperature means to realize high temperature anaerobic fermentation, it can solve different technological hurdles just like low efficiency of conventional digester operation, unstable running, and inability to supply gas in vernal and hibernal seasons.

2) Choosing solid-liquid joint anaerobic fermentation technology, with three products formed by gas, solid organic manure, liquid organic fertilizer etc., we can realize the marketization of biogas products and break through biogas industry financial bottleneck.

3) Transplantation technology of urban industrial gas transmission is applied to rural villages to change the traditional energy concept, promoting rural environmental protection and social progress constructing the socialist new countryside.

4) The use of standardized design, manufacture, installation, modular steel bar standardization and complete sets of biogas station equipment operation help to greatly reduce investment costs and increase the reliability of biogas standing.

4.2 Erhai Lake basin breeding pollution controlling technical structure

This project is made of the solar medium heat solid-liquid joint biogas fermentation technology, which is composed of nine parts: raw material crushing and procurement systems; solar heat exchanging system; dry temperature anaerobic fermentation system; wet high temperature anaerobic fermentation system; produce aerobic fermentation compost system; biogas water deployment of organic manure system; fermentation refined organic systems; refined biogas purification and storage system; methane gas pressure control and conveying system.

4.3 Process flow of Erhai Lake basin breeding pollution controlling

Farms use dry dung technology, manure after smashing allocate first natural anaerobic acidification (2 days), which again is put into solid anaerobic fermentation tank fermentation (12 days) for biogas production, and then comes the solid-liquid separation. Solid parts are solid aerobic compost (18 days), (10 days) after cooked is made solid fertilizer, sold out then. Rinse again the colony house after clearing feces (limited to 100kg/head). The filtered sewage from the pipe collection and raster sieve converge to clarify, and clear liquid explosive gas contact oxidation (5 days), and clear water once more for irrigation for forage plantations. Precipitation confusion of biogas water by solid-liquid separation, whose clarification sludge wet anaerobic fermentation (10 days), fermented clarified biogas water fertilizer for irrigation for forage plantations. Solid and liquid anaerobic ferment producing biogas desulfurization after dehydration is stored in gas holder, through the gas pipeline to a nearby villager’s family, as the use of life fuel (Figure 1)
5. Conclusion

What the one of main comprehensive prevention and control measures is to vigorously promote cattle excrement and farm wastewater reuse and realize the effective pollution control of agricultural non-point pollution as for Erhai. According to these corresponding characteristics in Dali, the development and promotion of medium-sized solar biogas digester temperature plays an important part in protecting ecological environment around the Erhai Lake watershed and promoting the construction of agricultural circulation economy.

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References


