

DECENTRALIZED APPROACHES TO RURAL WASTEWATER TREATMENT IN CHINA: SITUATION AND CHALLENGE

Hui Zhao

Ministry of Housing and Urban-Rural Development of the People's Republic of China E-mail: zhui@mail.cn.gov.cn

ABSTRACT

In China, the amount of nitrogen discharged from town and village was 1.6 times more than domestic wastewater production now. The decentralized wastewater treatment is the suitable way to solve the problem of rural sewage. However, there is less than 4% spray drainage and wastewater treatment was constructed up to now. Although, the ecological technologies such as constructed wetland and soil treatment were emphasized due to the policy direction and economic reasons in the past several years, due to the lack of professional construction and operation in rural area, it is difficult to ensure construction and effluent quality at present. The combined biological and ecological treatment technologies were developed for economic consider and improving the water quality of effluent. It's urgently to establish the evaluation system of effluent quality, technology selection, construction and management of decentralized treatment technologies.

Keywords: Decentralized wastewater treatment, Rural area, Village, Bio-Eco

Introduction

In China, the rural sewage includes domestic wastewater, toilet sewage, garden dirt (rain) water, and a small number of livestock manure. The wastewater contains pathogens, suspended solids, nutrients (nitrogen and phosphorus) and other organic pollutants. China currently has more than 600 thousands administrative villages. According to the investigation conducted by Ministry of Housing and Urban-Rural Development of the People's Republic of China(MOHURD), the total amount of sewage produced from villages and towns was 9.2×10^8 t per year, The total amount of COD discharged reached 8.0×10^6 t per year, and nearby equal to the amount discharged from city. At the same time, the amount

of nitrogen discharged from town and village was 1.6×10^6 t per year, and 1.6 times more than domestic wastewater production. However, there is less than 1% wastewater treatment was constructed in the most area of villages and towns as shown in Fig.1. Therefore, providing reliable and affordable wastewater treatment in rural areas is a challenge in China.

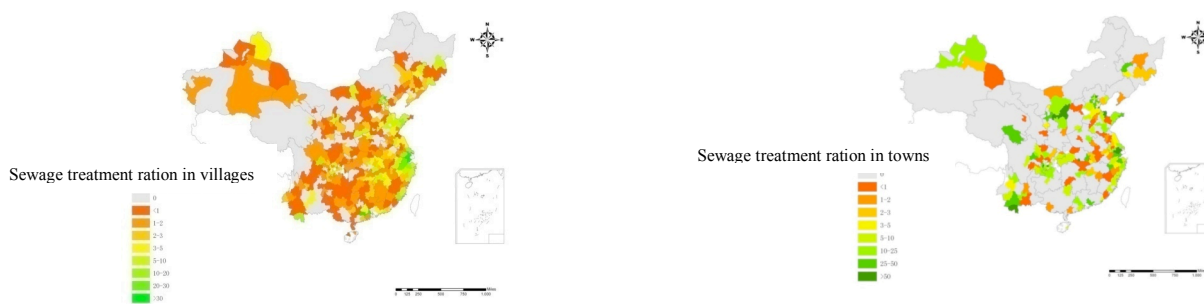


Fig.1 The sewage treatment ratio in villages (left) and towns (right)

From decentralized rural sewage treatment technology options, it is necessary to satisfy the demand of public health and water quality goals. It was also considered to meet the economic suitability of processing technologies, as well as the operation simple and easy routine maintenance and management. Recently, biological treatment technology, ecological technology and combined biological and ecological technology were applied in China.

Results and discussion

Decentralized wastewater treatment technologies

Although septic tanks were widely used in China rural field, the systems that were built without thought of water-proof and/or that have not been properly maintained can fail, leading to surface and groundwater contamination. This potential for failure most often results from neglect of maintenance or inappropriate design. In the past several years, the ecological technologies such as constructed

wetland and soil treatment were emphasized due to the policy direction and economic reasons. However, a lots of large scale constructed wetland is applied for directly rural domestic wastewater treatment for a village. Due to the lack of professional construction and operation in rural area, it is difficult to ensure construction and effluent quality at present.

Recently, the combined biological and ecological treatment technologies were developed for economic consider and improving the water quality of effluent. A process combined anaerobic and drop aeration and constructed wetland technologies used in Jiangsu province (Wu et al., 2008). The nitrogen removal could be reached by the anaerobic and aerobic process; also, a part of P was uptake by the plants in the constructed wetland. The other case illustrated in Fig.2 was operated in a rural tourism are located in Yunnan Province (Liang et al., 2009). In this combined system, the bio-technique unit is an integrated oxidation ditch with vertical circle (IODVC), and the eco-technique unit consists of a wetland eco-filter, a surface infiltration and an eco-ditch. The concentration of COD, ammonia nitrogen and total phosphorous in effluent was less than 10, 1 and 0.1 mg/L, respectively. The effluent of the full-scale wastewater treatment station was used as the source water of a local landscape ecological wetland.



Fig.2 Bio-Eco system

Developing of decentralized technology in China

The advantages and disadvantages of the most common decentralized technologies applied in China were summarized in Table 1. According to our investigations about the decentralized technologies used in rural area, the following problems need to be addressed urgently. Some applications of the decentralized treatment process are not suitable according to the realities of rural areas of appropriate technologies, resulting in high-cost investment has failed to achieve the corresponding environmental benefits. Due to the absence of appropriate standards, the long-term operation and management, quality supervision and training of personnel in practice are not well solved sewage treatment facilities in rural areas.

Table 1 Advantages and disadvantages of the most common technologies

Technology	Main advantages	Main disadvantages	application
Septic tank	inexpensive; simple to maintain	potential pollution source of groundwater	primary sediment tank or anaerobic unit
anaerobic digester	low cost; energy use	low removal rate	biogas use
Activated sludge	flexible and effective for COD and ammonia removal; automatic control	expensive for single family management is relative complex	second treatment cluster system for a village
Biofilm	effective for COD and ammonia removal; routine maintenance is relative easy.	low temperature will affect the removal rate of contaminations in north area	second treatment for on-site or cluster system
Lagoon	low coat; effluent for irrigation	not effective for pollutants removal land use; poor sanitation	large area of land
MBR	high effluent quality	expensive in capital and operation	sensitive area
Soil treatment	constructed and operation simple; low cost	pollution of groundwater ;poor quality of effluent	large area of land
Constructed wetland	constructed cost; flexible land use	low removal rate; management	gray wastewater or enhancing process
Bio-Eco treatment	high effluent quality balance the capital and operation cost	climate effect	protecting environmental quality

Now, we are making the national strategy of wastewater treatment in rural area, establishing technical specification of wastewater treatment in villages for sustainability of decentralized

technologies. "The guide of rural wastewater treatment technologies in different districts" and "The collection of wastewater treatment in village in China" were published by MOHURD. The demonstration project is also are being implemented in Taihu Lake and other developed rural area.

Conclusions

Decentralized wastewater treatment is the suitable way to solve the problem of rural sewage in China. It's urgently to establish the evaluation system of effluent quality, technology selection, construction and management of decentralized treatment technologies.

References

- Liang, H., Liu, J., Guo, X., Shan, B., Zhao, J., Yu, L., Li, L., Liu, J. (2009) A novel bio-eco technology combined system for rural domestic wastewater treatment in a tourism area: a full-scale study. *Environmental Engineering Science* 26 (9):1419-1427
- Wu, C., Xiang, S., Lu, X. (2008) Combined technology of biological contact oxidization and constructed wetland for processing rural domestic sewage. *Hubei Agricultural Sciences* 47(1): 44-46