Treatment process of rural domestic sewage based on small purification tank technology

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Abstract. With the continuous development of our country's economy, the living standard in rural areas has been greatly improved, rural water consumption has also increased significantly, especially in recent years, the popularity of rural tap water, improve the rural water availability, rural sewage has also increased significantly. As China's rural sewage treatment technology and facilities are generally backward, some rural areas even have no sewage treatment facilities, a large number of living directly into the surface or rivers. According to the characteristics and analysis of the discharge of rural domestic sewage, this paper puts forward the method of purifying rural domestic sewage with the technology of tank.

Keywords: Rural sewage; small purification tank; principle and process.

1. The introduction

There is a big gap between urban and rural areas in China, and the attention paid by villages and towns to domestic sewage treatment in the early stage and the proportion of investment are very few. As the country attaches great importance to rural sewage treatment, it is particularly important to find the appropriate water treatment technology to solve the rural domestic sewage problem. The small purification tank is suitable for single or multi-household domestic sewage on-site treatment and discharge. No network design is required and installation is not influenced by terrain. The product sewage treatment effect is good, and the treatment effect is stable, the equipment service life is long. Only the fan is the power device of the system, which is quick in construction, simple in operation and maintenance in the later period, and no personnel on duty is required.

2. Factors affecting rural water pollution

2.1. Influence of geographical environment and living habits.

Rural land area is vast, residential housing is fragmented. In rural areas, there is no centralized sewage collection facility, and even some remote mountainous areas still continue the form of riverside laundry, increasing the nitrogen and phosphorus content in the river, water gradually nutrients.

2.2. Large pollution emission from breeding industry.

The rural breeding industry develops rapidly, and there are many kinds of livestock and poultry farms. In addition, grazing livestock and poultry at will to further expand the pollution area.
2.3. Utilization of pesticides and fertilizers.
Fertilizer has a positive effect on the growth of crops, but the natural ecosystem is damaged due to farmers' improper fertilization methods. In addition, pesticide spraying has impacts on the environment and health, especially organic refractory compounds that permeate surface water to expand the contaminated area.

2.4. Household garbage.
Nowadays, the quantity of domestic garbage is increasing gradually, but the facilities for collecting and treating rural garbage are not perfect. When the garbage discharged into the river water will produce leachate, microbial viruses, bacteria and other deep groundwater. Fifth, factories and enterprises discharge pollutants. More factories and enterprises in rural areas discharge more unqualified polluted wastewater, which has a fatal impact on farmland and rivers. The increase of water pollution load exceeds the self-purification level of water, which affects people's lives and destroys the ecosystem. In a word, the pollution sources of rural living are scattered and not concentrated, and the residents in towns and villages have weak environmental protection awareness. In addition, the economic level lags behind, which makes it difficult to control. Under the combined effect of these factors, rural domestic sewage has become one of the main factors affecting water quality.

3. Small purification tank
Japan is the birthplace of the purification tank, the earliest source, is an integrated, suitable for the treatment of distributed sewage treatment device Japan in order to solve the problem of from the life of the city water pollution, make up the city sewage treatment plant of blind area, then developed a separate processing type purification tank, can not connect with the urban pipeline in Japan in the remote areas, economy and practicability of the separate treatment purification tank has won the acceptance of many families and the rapid popularization and application. The series of small purification tank products are suitable for the areas far away from the urban sewage collection trunk network and the construction of sewage collection network is difficult or the construction cost is high, suitable for the rural or suburban areas far away from the city.

3.1. Process principle of small purification tank
Hydrolysis and contact oxidation are the main principles for the purification of the tank, and the effective microbial (EM) solution can also be added to achieve the effective effect of sewage treatment. Solid particles or floaters are removed by precipitation separation tank and anaerobic filtration tank. The pretreatment of sewage is mainly to precipitate inorganic solids, parasite eggs and a considerable part of suspended organic matter. The filter tank is filled with plastic filler and the filler is equipped with anaerobic biofilms to remove soluble organic matter. The separation and removal of pollutants can be achieved through aeration tank or contact aeration tank, rotating plate contact tank, the principle is the use of contact oxidation process, aeration, high filtration rate, interception of suspended solids and regular back washing characteristics in one. The concentration of pollutants can be further reduced by oxidative decomposition, adsorption and retention of microorganisms in the biofilms attached to the reactor, food chain feeding in the direction of water flow, and nitrification of anaerobic segments. The treated waste water further precipitates through the settling tank, and a disinfection box is set at the end of the tank, filled with solid chlorine material. The effluent is contacted with solid chlorine material by the disinfection box to complete the disinfection effect on the sewage, and finally the remaining sludge can be reflux, and the other part is transported to the landfill plant after concentration. The process flow of the treatment principle of the purification tank is shown in fig.1:
3.2. Small tank sewage treatment system

The sewage treatment system of a small purification tank includes three modules: indoor sewage discharge system, outdoor sewage discharge system, and purification tank system. The sewage pipes of the kitchen, feces, bath, and laundry are independent of each other. Four inspection wells are set for confluence and dredge, and finally flow into the purification tank through the main pipeline. The composition of the sewage treatment system of a small purification tank is shown in Fig. 2:

![Small tank sewage treatment system](image)

**Fig. 2** Small tank sewage treatment system

3.3. Technological process of small purification tank

A small purification tank is a sewage treatment facility that USES physical and biological methods to purify and treat domestic sewage. The small purification tank can not only meet the needs of individual treatment of the sewage discharged by each household, but also can collect the domestic sewage discharged by the residential areas for centralized treatment. Specifically, the process of treating domestic sewage by a small purification tank is shown in Fig. 3:

![Process flow of small purification tank](image)

**Fig. 3** Process flow of small purification tank

3.4. Expected treatment effect of small purification tank process

Small purification tank process can effectively remove nitrogen, suspended matter, organic matter and other pollutants in domestic sewage, the effluent water quality will meet the "municipal sewage treatment plant pollutant discharge standards" (gb18918-2002) class B standard.
Table 1. Expected treatment effect of small purification tank process

| Items  | CODcr | BOD5  | TN   | SS   |
|--------|-------|-------|------|------|
| Inlet  | ≤350mg/L | ≤200 mg/L | ≤45 mg/L | ≤160 mg/L |
| Effluent | ≤60 mg/L | ≤20 mg/L | ≤20 mg/L | ≤15 mg/L |

4. Conclusion

At present, small purification tank technology has been successfully applied in many places in China, and has achieved good results. For example, the taihu lake basin in wuxi has introduced 6 kinds and 12 purification tanks manufactured by the Japanese daji (dalian) company to control the eutrophication of the taihu lake basin. The effect is very good, and the cost is low, which only requires electricity and pharmaceutical expenses. In addition, xiaotang village, xiaofeng town, anji county, zhejiang province, and moganshan nongjiale domestic sewage treatment project, deqing county, and dongqing village, yushan town, changshu city, jiangsu province, all adopted small purification tank technology and achieved good results.

To sum up, the active promotion and popularization of small purification tank technology in rural areas, on the one hand, can effectively avoid the trouble of large-scale planning, on the other hand, can effectively solve the rural sewage problem, is a better process choice for rural decentralized sewage treatment, plays a positive role in the new rural construction.

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