

学 位 论 文 要 旨

氏 名

Li Yutong

題 目

The Study on Influent Dynamic State and Optimization of Operation Management in Rural Wastewater Treatment Facilities

In order to reduce maintenance cost of rural sewerage facilities and improve management efficiency, this study explores fluctuation factors and inflow characteristics, investigated and constructed the management method corresponding to location conditions, dynamics of inflow, water temperature, precipitation and etc. of rural sewerage facilities. In addition, this study tried to construct a management method unified the water recycle and improvement of management efficiency through assessing the crop growth cultivated with treated waste water and its cultivation risk. The results of this thesis are summarized as follows.

1. Maximum daily flow rates, average daily flow rates and minimum daily flow rates with examination of fitting non-excess probability distribution in order to comprehend the actual situation of sewerage flow rates on observed rural sewerage facilities. The discussion on influence factors of daily flow rates variation is based on real time data measured by flow meters installed in observed rural sewerage facilities. The daily flow rates are confirmed to be influenced by the land use and site conditions of rural sewerage facilities. Besides, it is clarified that hourly flow rate fluctuations and peak coefficients was influenced by the duct line length, utilization rate and floating population rate. The results of this study are expected to be reflected in setting appropriate design units and management methods of rural sewerage facilities in the future.
2. The daily inflow rate of wastewater was separated (a) the trend component, (b) the seasonal change component, (c) the weekly change component, and (d) the precipitation-corresponding component. These components were well correlated with influent quantity. The value predicted by the state space model well explained actual inflow discharge data. The daily inflow rate of wastewater related with (i) influent quantity that corresponding with population in basin, (ii) the dynamics of population in basin, (iii) the amount of precipitation, and (iv) events including summer holiday, near the close to another year, and so on. The analysis with the state space model has a few agenda of prediction precision of the precipitation-corresponding component and understanding of the seasonal change mechanism.
3. ORP of first aeration tank in intermittent aerobic suspended-growth sewerage treatment facilities should be held in range of 100~125mV in order to ensure BOD removal performance, and DO behavior characteristics vary with operation condition such as types of diffused aeration devices, aeration intensity, and aeration time. K_La can be classified by types of diffused aeration devices, and it can be deduced from aeration intensity, temperature and MLSS of aeration tank mixed fluid, also, BOD reaction rate constant can be deduced from aeration intensity, aeration time and temperature of aeration tank mixed fluid. It is shown that operation efficiency of intermittent aerobic suspended-growth sewerage treatment facilities can be improved by choosing the recommend combination of aeration intensity ($0.03\text{m}^3 \cdot \text{m}^{-3} \cdot \text{min}^{-1}$) and aeration time (30min) which is appropriate to the diffused aeration device, as the result, required BOD removal performance can be obtained with less consumption of air quantity.