Long-term Estimation on Nitrogen flux in the Yamato River Basin Influenced by the Construction of Sewerage Treatment Systems

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The quantification of the nitrogen discharge in water were most important indicators of the water environment in coastal area because these processes are related to the transport of large nutrient loads. The nitrogen pollution sources of the surface water environment are divided into point source pollution and non-point source pollution according to the different spatial distribution (Niraula et al. 2013; Lee et al. 2010). Nonpoint source nitrogen pollution is a leading contributor to world water quality impairments. (Steffen et al 2015). Sewage treatment system can significantly reducing pollutant emissions by multiple methods.

The construction of sewage treatment systems does not happen overnight, it is divided into two parts: construction of sewage treatment plant and laying of underground pipelines into buildings. Especially for plumbing system, it is a long process. During this period, non-point source pollution from urban areas will be gradually transformed into point sources.

Yamato river is a very important river in west Japan. It has a watershed area of 1067 square kilometers, covering almost half area of Nara prefecture. These have 5 sewage treatment plant in the watershed, 3 of them are located in Osaka Prefecture and others are in Nara Prefecture. These sewage treatment plants were successively constructed and put into use between 1974 and 1985. The progress of pipeline laying varies widely in different cities. As of 2010s, the overall sewage treatment pipeline in the basin covers more than 90% of buildings.

SWAT model could meet this need and has proven to be an effective tool for assessing nonpoint source pollution for a wide range of scales and environmental conditions (Gassman et al. 2007), and it supports inputting point source data according to monthly data (Neitsch et al, 2005). This study used the SWAT model to simulate nitrogen fluxes in the Yamatogawa Basin for more than 50 years, divided into 4 period including 1) no sewage treatment system; 2) sewage treatment plant construction stage; 3) plant completion, pipeline laying stage and 4) full completion stage.

The results show that: 1) SWAT has a very good effect on the nitrogen simulation of mixed watershed with urban and agricultural area. 2) The construction of a sewage treatment plant has a very good effect on the improvement of the river basin environment. As of 2010s, total nitrogen emissions were 9.7 kg/ha, of which point source emissions accounted for 65%.

Keywords: Nitrogen discharge, sewerage treatment, point source, non-point source, urban BMP