ASSESSMENT OF SELF-PURIFICATION IN THE SMALL RIVER AND IMPROVEMENT OF WATER QUALITY BY NATURAL PURIFICATION PROCESS

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The pollutants in the small river are removed by its biological, chemical and physical self-purification. Therefore, it is required that self-purification in the river is correctly estimated in the field for the effective management of river water quality. In this study, we carried out the investigation of mass balance and metabolism of Osan river through in-situ and indoor experiment to understand self-purification activity in aquatic system. And we introduced the natural purification process using porous concrete as a contact media, and examined the purification efficiency of it for water of Osan river.

Mass balance was estimated from the difference of loads that was calculated by multiplying concentration and flow rate at OS1 and OS3. From our result, we can know that the difference of the flow rate of input (53.2×10^3 m^3/day) and output (56.1×10^3 m^3/day) was not much and flow rate was conserved flowing to downstream (ratio of O/I: 1.06). The O/I values for all matters except for T-P and Cl^- were lower than 1 and this fact mean that these matters were selectively removed. Especially removal of SS (205.8 kg/day) was remarkable.

We examined the variation of DO concentration with time to estimate the amount of organic matter removed by metabolism. From our indoor experiment, decrease of DO at night was recognized due to respiration of attached microorganism and, simultaneously, degradation of organic matter was increased. But at daytime, production of organic matter was recognized by photosynthetic reaction. From the DO data, the respiration rate and net production rate of carbon per 1 m^2 and 1 day in the river were calculated considering bottom area of chamber (0.1 m^2), river water volume of chamber (25 L) and the area of riverbed in investigation site (33700.4 m^2). Based on the results, inorganization of organic matter was estimated as –26.1 kgC/day. Therefore, it is estimated that organic matter in this investigation site was produced by metabolism.

From sedimentation rate experiment, sedimentation amounts per one day were 212.7 kg/day for SS and 85.0 kg/day for VSS. Therefore inorganic sedimentation amount was corresponded to 60% of total sedimentation and organic sedimentation was 40%, and total sedimentation amount (212.7 kg/day) obtained by experiment was estimated more than that obtained by mass balance (205.8 kg/day).

Also nutrient amount assimilated by attached algae during one day was calculated to 43.8 kg/day for carbon, to 7.1 kg/day for nitrogen and to 1.5 kg/day for phosphorous.

Under the indoor experimental conditions, the variations of NO_3-N and NH_4-N concentration with time were investigated to understand nitrification and denitrification reaction. Nitrification and denitrification amount between OS1 and OS3 during one day

was calculated 23.8 kg/day and 10.1 kg/day, respectively. This denitrification amount corresponds to 16.3% 0f total removal amount (62.0 kg/day) obtained by mass balance.

Estimation of mass balance based on self-purification need to understand matter cycle occurred in aquatic system and to correctly manage and assessment water quality in the small river. Therefore we calculate mass balance based on self-purification from our experimental results and show Table 1. In Table 1, it is estimated through assessment of natural purification ability that 212.7 kg/day in inorganic matter inputted was removed by adsorption and sedimentation in the river and this value was corresponded to 37.2% in total inorganic matter inputted (574.7 kg/day). Organic matter however showed more complex than inorganic matter. Production of organic matter by photosynthetic reaction was occurred actively and the amount of it (42.1 kg/day) was corresponded to 12.6% compared with total organic matter inputted. Totally, 6.2% of organic matter inputted was removed in river by self-purification reaction (mainly degradation and assimilation).

The removal percentage of pollutants by natural purification process applying porous concrete was 92.2 % for SS and 67.2 % for BOD. These results showed relatively high removal percentage by porous concrete. Therefore porous concrete is estimated as a suitable material for improvement of water quality using natural purification process.

Table 1. Mass balance based on self-purification between OS1 and OS3

	Input (kg/day)		Output (kg/day)	
Inorganic matter	OS1	252.8 (44.0 %)	OS3	368.9 (64.2 %)
	BS1+BS2+BS3	270.4 (47.0 %)	Adsorption and sedimentation	212.7 (37.0%)
	SW1+SW2+SW3	51.5 (9.0 %)	Unconfirmed parts	-6.9 (-1.2 %)
	Total	574.7 (100 %)	Total	574.7 (100 %)
Organic matter	OS1	166.7 (49.8 %)	OS3	313.8 (93.8 %)
	BS1+BS2+BS3	149.7 (44.7 %)	Production	-42.1 (-12.6 %)
	SW1+SW2+SW3	18.2 (5.4 %)	Degradation by respiration	16.0 (4.8 %)
	-	-	Assimilation of attached algae	43.8 (13.1 %)
	-	-	Unconfirmed parts	3.1 (0.9 %)
	Total	574.7 (100 %)	Total	334.6 (100 %)