ANALYSIS OF NPS CONSIDERING RAINFALL FACTORS IN THE JUNGRANG STREAM BASIN

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In this study, the unit loads of NPS were estimated by collecting data on the pollutants and discharge at the inlet of the Jungrang Sewage Treatment Plant and the Gunja Bridge gauge station located downstream in the Jungrang Stream basin, during one year of surveying.

Before estimating the NPS, it is essential to measure the discharge and the pollutant loads during dry days, and the results showed that the sewer BOD in dry days was highest at about midnight and decreased until 7~9 a.m. at the inlet of the Jungrang Sewage Treatment Plant (Fig. 1). As for the discharge, it showed its lowest value at 7~8 a.m. and its highest value at about 1 p.m., although there were slight variation depending upon the day and the seasonal activities of residents (Fig. 2).

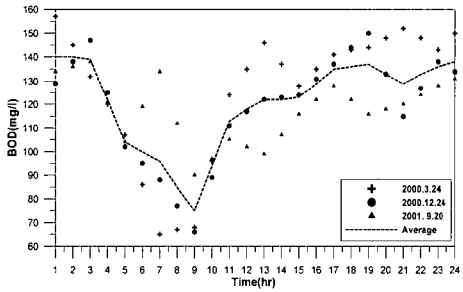

Fig. 1 Variation of BOD Concentration (Inlet #3 of Jungrang Sewage Treatment Plant, dry weather period)

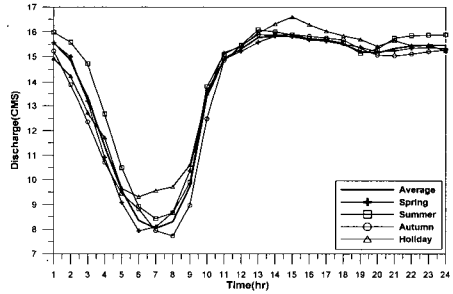

Fig. 2 Discharge Variation by Daily Hour and Season (Inlet #3 of Jungrang Sewage Treatment Plant)

The EMC_S and unit loads of NPS were estimated by measuring the pollutants and discharge, and by simulation with the SWMM model based on the assumption that most NPS loads are concentrated during initial rainfall in the Jungrang Stream basin. We found that the significant increase of water level in the stream (Jungrang Bridge Station) and overflow of the combined sewer occurred when the cumulative rainfall exceeded about 15mm and the rainfall intensity is greater than about 3 to 4mm/hr in the Jungrang Stream

basin. At this time, sewage discharge was around 30 CMS, which is more than twice the capacity of the treatment plant. The estimated NPS unit loads in the Jungrang Stream basin were 372 kg/ha/year for BOD, 713 kg/ha/year for COD, 719 kg/ha/year for SS, 86 kg/ha/year for T-N, and 23 kg/ha/year for T-P. Those results are reasonable when compared with other precedent studies of urbanized basins in Korea(Table. 1).

In this study, we carried out linear regression analysis between the total unit NPS loads and each independent variable - the precedent dry period, rainfall, and intensity. The results showed that the factors of cumulative rainfall and effective rainfall depth had more co-relationship with the unit loads than the other factors, of mean rainfall intensity and precedent dry periods (Table. 2).

Table 1. Comparision of NPS Unit Loads (kg/ha/year)

Researcher	BOD	COD	SS	T-N	T-P
This research (Average)	245 ~ 590 (372)	236 ~ 1,302 (713)	482 ~ 1,236 (719)	32 ~ 147 (86)	5 ~ 54 (23)
Lim, Bong-su (1984)	319.7	690.6	831.1	-	-
Choi, Ui-so et al. (1991)	270.1	1226.4	854.1	157.0	31.0
Choi, Ji-yong (1995)	313.6	388.7	929.0	49.98	7.66
Whipple et al. (1976)	40.2 (29.2 ~ 51.1)	201 ~ 310	-	8.03 (6.9 ~ 9.1)	3.3 (1.1 ~ 5.5)
Cemola et al. (1979)	76.7 (54.8 ~ 84.0)	-	1701 (730 ~ 4793)	8.4 (3.3 ~ 17.9)	1.83 (1.1 ~ 5.1)
Sonzogni et al. (1980)	-	-	1460 (620 ~ 2300)	6.17 (5.0 ~ 7.3)	0.88 (0.4 ~ 1.3)
Wanielista et al. (1981)	50	-	460	8.4	2.01

Table 2. Regression Equations and Coefficients of Determination (R^2)

Items	Regression Equation	Coeff. of Determination (R^2)
Cumulative rainfall (mm)	Y = 127.79X – 217.95	0.97
Effective rainfall (mm)	Y = 729.65X - 42.14	0.96
Mean rainfall intensity (mm/hr)	Y = 1350.90X + 185.09	0.63
Precedent dry period (days)	Y = 902.06X – 431.67	0.67

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Huber, W.C et al. (1998). *Stormwater Management Model Ver.4, Part A* : User's Manual, E.P.A.

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