*Journal of Global Environment Engineering*, Vol.10, pp.187-196, 2004

Technical Note Report

# PROPOSAL OF ENVIRONMENTAL ACCOUNTING HOUSEKEEPING (EAH) BOOKS OF DOMESTIC WASTEWATER BASED ON WATER POLLUTANT LOADS PER CAPITA: A CASE STUDY OF SANBANZE TIDAL COASTAL ZONE, TOKYO BAY

*Yoshiaki Tsuzuki*[1]

## Abstract

Domestic wastewater contributes much to water pollution in enclosed coastal zones, especially close to urban areas in the developed countries. Wastewater treatment plants are sometimes considered as pollutant sources. Therefore, scientific and quantitative information dissemination for citizens would be necessary in regards to domestic wastewater. This paper proposes a measure of dissemination and environmental education in the field of water pollution, which makes relations between water pollution problems of an enclosed coastal zone, Sanbanze tidal coastal zone, Tokyo Bay, and municipal lives. Firstly, pollutant loads analysis was conducted based on publicly available data, and pollutant loads per capita was calculated for the Ebigawa River drainage area. Secondly, based on the calculation results, basic concepts and examples of the format of environmental accounting housekeeping (EAH) books of domestic wastewater prepared depending on its treatment methods are proposed.

**KEYWORDS**: *pollutant loads per capita, environmental accounting housekeeping (EAH) book, environmental education, Sanbanze, Tokyo Bay*

## 1. Introduction

In regards to land based water pollutants flowing into Tokyo Bay, much portions are occupied by domestic wastewater (Ministry of Environment, 2002). Therefore, measurements to reduce the domestic wastewater pollutant loads are considered to be effective to reduce total pollutant loads running into Tokyo Bay (e.g. Chiba Prefecture and Funabashi City, 1999). Several measures to reduce pollutant loads derived from domestic wastewater have been and will be developed from the viewpoint of amending urban river pollution, however, water quality of urban rivers is considered not to be improved so much in a decade (Sudo, 2000). Therefore, some effective measurements would be desirable in this field. This paper proposes wastewater load per capita divided by wastewater treatment methods as an essential and comprehensive index for domestic wastewater pollutant loads, and concepts and examples of the format of environmental accounting housekeeping (EAH) books of domestic wastewater as an effective tool for marine and river water pollution problems.

[1] Dr. Eng., Former Lecturer (Researcher), Graduate School of Engineering, Utsunomiya University, Japan. E-mail: tsuzuki.yoshiaki@nifty.com.

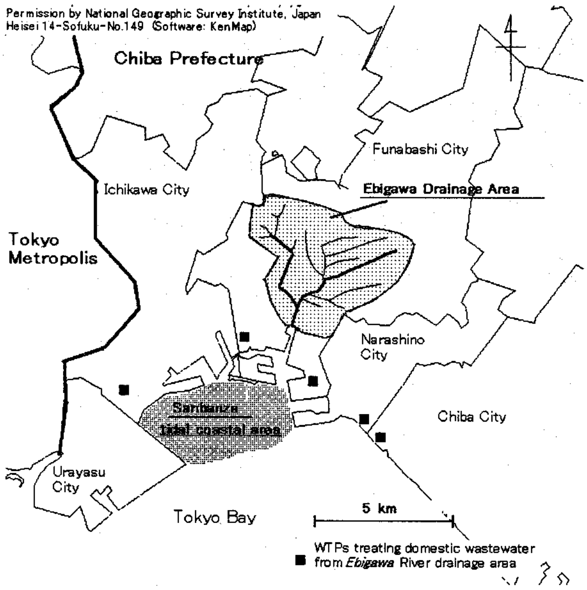


**Fig. 1** Sanbanze tidal coastal zone and Drainage area of Ebigawa River.

As dissemination and environmental education methods in the fields of river and coastal zone water pollution problems, miscellaneous activities including clean up activities along rivers and coastal lines and committees on water environments in which citizens are participating have been held (e.g. Funabashi City homepage; Ebigawa River Drainage Area Conference on Promotion of Water Circulation, 1999; and Funabashi City, 2002). These dissemination and environmental education measurements are considered to be preferable and should be continued. One of the problems in these measurements is how people with the least interest in environment be interested in these measurements including environmentally friendly way of life in regards to water pollution.

Land filling planning has been stopped in Sanbanze tidal coastal zone and a series of the Sanbanze Reclamation Plan Investigation Conference (Sanbanze Roundtable Conference) had been held since April 2003 to January 2004 in Chiba Prefecture (e.g. Tsuzuki 2002, Chiba Prefecture homepage). In the Sanbanze Roundtable Conference, some citizens and NGO representatives pointed out that wastewater treatment plants (WTPs) are pollutant loadsources. It is not mistake, however, more scientific approach and quantitative information dissemination would be preferable in regards to the diversities of characteristics of drainage areas and performance of each wastewater treatment methods.

EAH books for reduction of $CO_2$ emission as a countermeasure to the global climate change are examples of administrative measurements to reduce pollutant loads emission from municipal lives, which are introduced in Japan by local governments, environmental NGOs and companies.

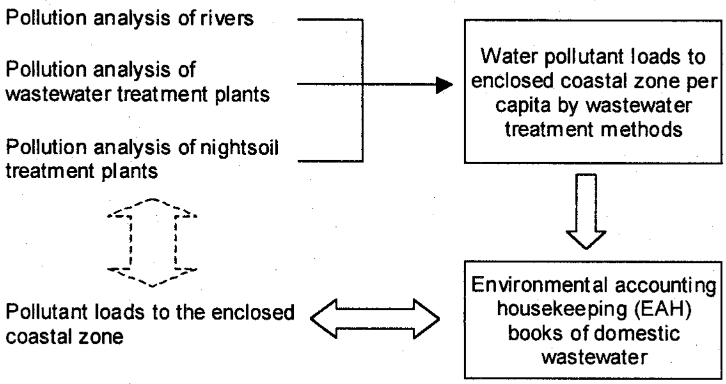


**Fig. 2** Overall framework of the water pollutant loads study of domestic wastewater in this paper.

Basic concepts of domestic wastewater management manual or EAH books of domestic wastewater are proposed in this paper. The main purposes of the management manual are to disseminate basic information on the relation between water pollution problem including red tide and blue tide in Tokyo Bay or Sanbanze tidal coastal zone (Fig. 1) and municipal lives; and to make a contribution to environmental information dissemination and environmental education to reduce pollutant loads to water area.

Ebigawa and Mamagawa Rivers are major inner-city rivers flowing into Sanbanze coastal zone. Fountainheads of Ebigawa River drainage area are in Funabashi City and Ebigawa River is running into Sanbanze tidal coastal zone. The drainage basin of Ebigawa River is about 32% of Funabashi City (Fig. 1). Drainage area of Mamagawa River is the left bank of Edogawa River of Ichikawa City, a part of Funabashi Ciy, western area of Kamagaya City and south area of Matsudo City.

Besides wastewater treatment facilities deployment and subsidies for combined *jokaso* (286 cases at the period without rainfall in 2000), Funabashi City has deployed and manage a riverside purification facility (Funabashi City, 2001). The riverside purification facility has been placed by Takase River, a branch stream of Ebigawa River in 1994. All amount of river water of Takase River is treated by riverside purification facility and sent back to Takase River at the period without rainfall. Average inflow BOD of the facility was 40 mg $l^{-1}$, outflow BOD was 8.7 mg $l^{-1}$ (designed as 10 mg $l^{-1}$) and BOD removal rate was 78% (Funabashi City, 2001). There are similar riverside purification facilities along branch streams of Mamagawa River (Ichikawa City, 2002).

## 2. Methods

Fig. 2 shows the schematic overall flow of this research. Firstly, pollutant loads of organic carbon, nitrogen and phosphorus flowing through Ebigawa River and Mamagawa River were investigated based on publicly available data and information (e.g. National Environmental Conference Water Department Gross Pollutant loads Control Professional Committee, 1999; Tokyo Bay Area Local Government Environment Conservation Conference, 2001; Ogura ed., 1993; Funabashi City homepage; Ichikawa City homepage; Funabashi City, 2003a, b, c).

The water quality and flow rate data at Yachiyobashi Bridge, which is placed at the river mouth of Ebigawa River was investigated to calculate pollutant loads flowing into Sanbanze tidal coastal zone

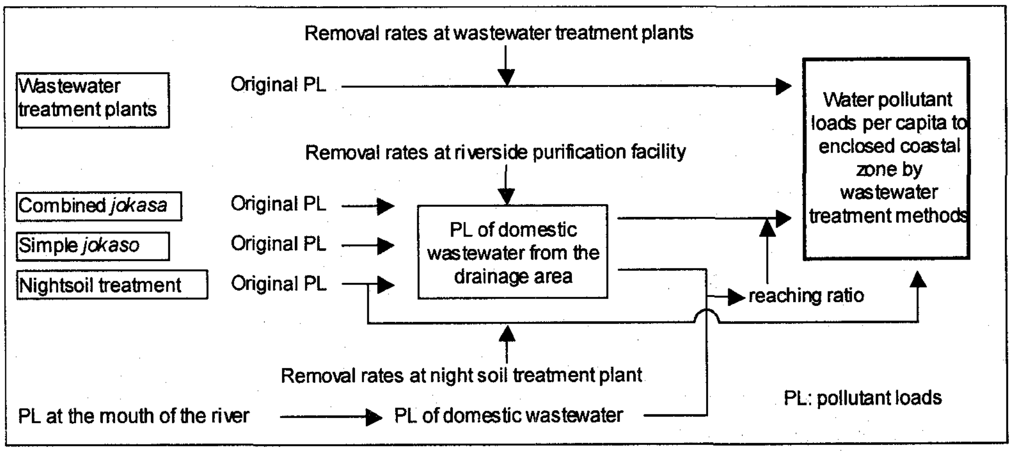


**Fig. 3** Flow chart of pollutant loads per capita analysis.

through the river. The data investigated were monthly data from 1990 to 2000 and 24-hour data from 1983 to 2000. 24-hour measurements were conducted twice a year during this period.

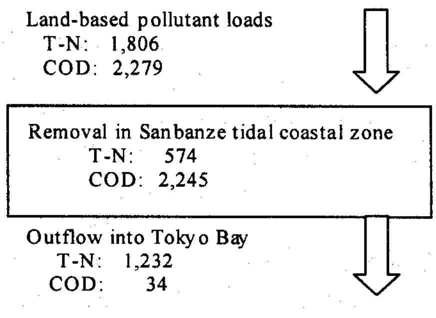


**Fig. 4** Budget of T-N and COD in Sanbanze tidal coastal area (t year$^{-1}$). (Source: calculated by the author based on Chiba Prefecture (1998))

Schematic flow chart of analysis of pollutant loads per capita running into coastal zone is shown in Fig. 3. Firstly, populations by wastewater treatment methods and by towns were calculated based on the statistics (Funabashi City, 2003a,b,c). Secondly, EAH books for domestic wastewater for Ebigawa River drainage area were prepared based on the calculation results.

Pollutant loads per capita running into the coastal zone divided by wastewater treatment methods were calculated as the followings. Basic units of domestic wastewater pollutant loads are derived from Fujimura and Nakajima (1998). For WTPs population, COD, T-N and T-P removal rates of WTPs were calculated based on the recent four or five-year data of water quality and quantity of inflow and effluent of five municipal and drainage area WTPs (Chiba Prefecture Wastewater Treatment Corporation Foundation, 1998-2002; WTPs management data of Edogawa-Sagan Drainage, Tsudanuma, Takase and Nishiura WTPs, 1998-2002). Pollutant loads per capita for WTPs are calculated based on these removal rates.

For combined and simple *jokaso* and night soil treatment population, basic discharge units is derived from Fujimoto (1988) and Fujimura (1996). For the drainage area of the river side treatment facility, the removal rates of pollutants by the facility were considered. Contributions of domestic wastewater to pollutant loads of Ebigawa River calculated at the river mouth, and total pollutant loads of combined and simple *jokaso* and night soil treatment populations were compared, and overall reaching ratios were calculated for COD, T-N and T-P, respectively. Pollutant loads per capita running into the Sanbanze tidal coastal zone through Ebigawa River for combined and simple *jokaso* and night soil treatment were calculated based on the reaching ratios. For night soil treatment population, pollutant loads through a night soil treatment plant were calculated based on basic units of pollutant loads and removal rates at the treatment plant. Then, pollutant loads through Ebigawa River and those through the treatment plant were added to obtain total pollutant loads per capita for night soil treatment population.

# 3. Results

## 3.1 Pollutant loads analysis of Sanbanze tidal coastal zone

Pollutant loads budget was calculated based on Chiba prefecture (1998). Nitrogen and organic carbon (COD) pollutant loads running from Sanbanze tidal coastal zone into Tokyo Bay, outside of Sanbanze tidal coastal zone, were calculated as 1,232 t-N year$^{-1}$ and 34 t-COD year$^{-1}$ as shown in Fig. 4 (Tsuzuki 2003, Ogawa et al. 2003).

BOD load fluctuation in 24 hours at the river mouth of Ebigawa River is shown in Fig. 5 and yearly change of BOD load at the river mouth of Ebigawa River calculated based on the 24 hours data is shown in Fig. 6 as examples of the results. Based on these data, recent pollutant loads running into Sanbanze tidal coastal zone were calculated as 970 kg-BOD day$^{-1}$, 950 kg-COD day$^{-1}$, 800 kg-N day$^{-1}$ and 89 kg-P day$^{-1}$, respectively. The COD and T-N load represents 15% and 16% of total pollutant loads running into Sanbanze tidal coastal zone, respectively. The COD, T-N and T-P load represents 0.4%, 0.3% and 0.4% of total pollutant loads running into Tokyo Bay in 1999, respectively (Table 1).

Pollutant loads calculation was not conducted for Mamagawa River in this research because of the lack of flow rate data at the river mouth of the river. Iimura (1998) conducted water pollutant loads analysis of Mamagawa drainage area and clarified domestic wastewater occupies 66-85% of total pollutant loads in the river, which are almost the same as the calculation results of the Ebigawa River described above.

## 3.2 Pollutant loads per capita running into coastal zone

The drainage area and population in the drainage area were calculated as 26 km$^2$ and 220 thousands, respectively. Fig. 7 shows populations and their ratios by wastewater treatment methods

COD, T-N and T-P removal rates of WTPs were calculated as 90%, 57% and 78%, respectively.

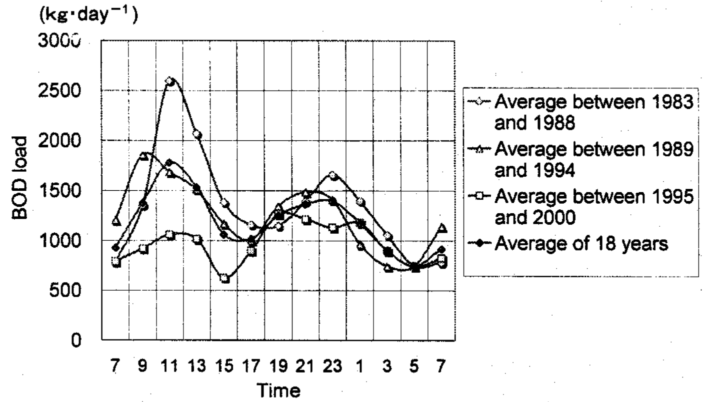


**Fig. 5** BOD load fluctuation in 24 hours at the river mouth of Ebigawa River.

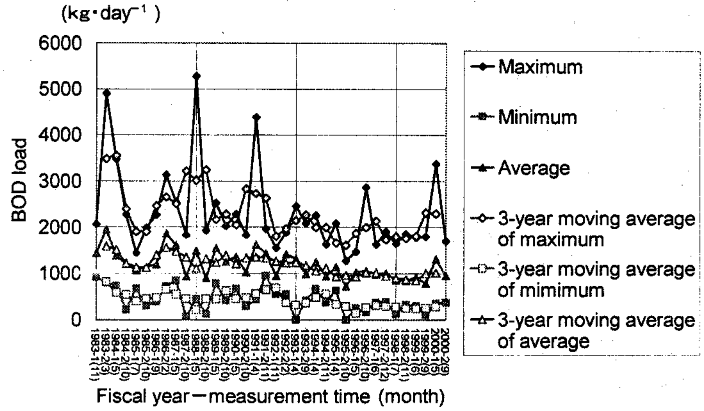


**Fig. 6** BOD load at the river mouth of Ebigawa River from fiscal year (FY) 1983 to FY 2000.

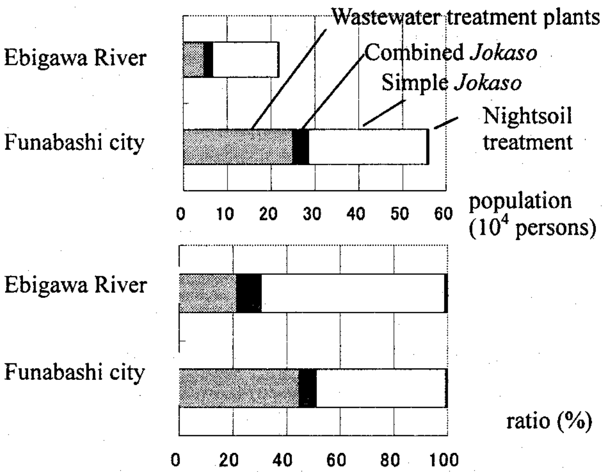


**Fig. 7** Population of Ebigawa River drainage area by wastewater treatment methods.

**Table 1** Pollutant loads per capita by domestic wastewater treatment methods, which are compared with those running into Sanbanze tidal coastal zone, Tokyo Bay, and those at the mouth of Ebigawa River.

| Pollutant loads ＼ Pollutants | | COD | T-N | T-P |
|---|---|---|---|---|
| Pollutant loads to Tokyo Bay (kg day$^{-1}$)[1] | | 247,000 | 254,000 | 21,100 |
| Pollutant loads to Sanbanze tidal zone (kg day$^{-1}$)[2] | | 6,243 | 4,948 | − |
| Pollutant loads at the river mouth of Ebigawa River (kg day$^{-1}$)[3] | | 951 | 797 | 88.5 |
| Pollutant loads by domestic wastewater at the mouth of Ebigawa River (kg day$^{-1}$)[4] | | 770 | 642 | 71.4 |
| Pollutant loads per capita runnning into the coastal zone (g person$^{-1}$ day$^{-1}$)[4] | Wastewater treatment plant | 2.3 | 3.7 | 0.22 |
| | Combined *jokaso* | 1.5 | 3.6 | 0.39 |
| | Simple *jokaso* | 5.2 | 3.9 | 0.43 |
| | Nightsoil treatment | 5.1 | 4.3 | 0.41 |
| | Combined *jokaso* + Riverside purification facility | 0.3 | 2.5 | 0.28 |
| | Simple *jokaso* + Riverside purification facility | 1.0 | 2.7 | 0.30 |
| | Nightsoil treatment + Riverside purification facility | 1.8 | 4.1 | 0.37 |

References: 1)National Environmental Conference Water Department Gross Pollutants Load Control Professional Committee (1999); 2)Chiba prefecture (1998); 3)Tsuzuki (2003); 4)Tsuzuki and Ogawa(2004)

**Table 2** A format of environmental accounting housekeeping (EAH) books of domestic wastewater treatment: Simple *jokaso* population, Ebigawa River drainage area.

| Simple *jokaso* | PL ratio[1] | Pollutant looads running into coastal zone | | | Today's decrease | | | Decrease in this month | | | Estimation for calcualtion |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | COD | T-N | T-P | COD | T-N | T-P | COD | T-N | T-P | |
| | % | mg | mg | mg | g | g | g | g | g | g | |
| Nightsoil | 30 | 1560 | 1170 | 130 | | | | | | | |
| Bath | 20 | 1040 | 780 | 90 | 730 | 0 | 0 | 22 | 0 | 0 | |
| Decrease shampoo and soap | | 730 | 0 | 0 | 730 | 0 | 0 | 22 | 0 | 0 | The decrease effect to be 30% |
| Kitchen | 40 | 2080 | 1560 | 170 | 150 | 330 | 10 | 4.5 | 9.9 | 0.3 | |
| No use of detergent | | 450 | 0 | 0 | | | | | | | The previous used amount to be 5ml person$^{-1}$ day$^{-1}$ (2g-COD person$^{-1}$ day$^{-1}$) |
| Decrease detergent | | 225 | 0 | 0 | | | | | | | Decrease to half |
| Do not drain rice washing water | | 450 | 10 | 1 | | | | | | | Pollutant loads of rice washing water to be 2g-COD person$^{-1}$, 24mg-TN person$^{-1}$ and 2mg-TP person$^{-1}$ |
| Use paper filter for kitchen | | 150 | 330 | 10 | 150 | 330 | 10 | 4.5 | 9.9 | 0.3 | The removal rate to be 7(COD), 21(T-N), 4(T-P)% |
| Use net for kitchen | | 60 | 230 | 3 | | | | | | | The removal rate to be 3(COD), 15(T-N), 2(T-P)% |
| Treatment during and after cooking | | 1040 | 780 | 86 | | | | | | | The removal rate to be 50% |
| Do not drain residual liquid | | | | | | | | | | | |
| Dressing 5ml | | 750 | 15 | 8 | | | | | | | |
| Chinese noodle soup 50ml | | 290 | 6 | 3 | | | | | | | |
| Used edible oil 10ml | | 3800 | 76 | 0 | | | | | | | |
| Washing clothes | 10 | 520 | 390 | 43 | | | | | | | |
| Decrease detergent | | 290 | 0 | 0 | | | | | | | The decrease to be 5g person$^{-1}$ (1.3g-COD person$^{-1}$) |
| Total of current pollutant load per capita | 100 | 5200 | 3900 | 430 | 5200 | 3900 | 430 | 156 | 117 | 12.9 | |
| Decrese of pollutant load per capita | − | − | − | − | 880 | 330 | 10 | 27 | 10 | 0.3 | |

Note: 1) Source of pollutant loads (PL) ratio is Ministry of Environment (2002)

Pollutant loads per capita to Sanbanze tidal coastal zone, Tokyo Bay, were calculated as 0.3-5.2 g-COD person$^{-1}$ day$^{-1}$, 2.5-4.3 g-N person$^{-1}$ day$^{-1}$ and 0.22-0.43 g-P person$^{-1}$ day$^{-1}$, respectively, as shown in Table 1. COD and T-N loads of "combined *jokaso* and riverside water purification facility" population and T-P load of WTPs population were calculated as minimum of the several treatment methods in this drainage area.

## 3.3 EAH books of domestic wastewater

Tables 2-4 are examples of the format of EAH books of domestic wastewater proposed in this paper for simple and combined *jokaso* and WTPs populations, respectively, in Ebigawa River drainage area.

In the EAH books of domestic wastewater, the initial pollutant loads per capita before pollution reduction activities are supposed to be average level of each wastewater treatment methods

**Table 3** A format of environmental accounting housekeeping (EAH) books of domestic wastewater treatment: Combined *jokaso* population, Ebigawa River drainage area.

| Combined *jokaso* | PL ratio[1)] | Pollutant looads running into coastal zone | | | Today's decrease | | | Decrease in this month | | | Estimation for calcualtion |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | COD | T-N | T-P | CO | T-N | T-P | CO | T-N | T-P | |
| | % | mg | mg | mg | g | g | g | g | g | g | |
| Nightsoil | 30 | 440 | 1100 | 120 | | | | | | | |
| Bath | 20 | 290 | 700 | 80 | | | | | | | |
| Decrease shampoo and soap | | 87 | 0 | 0 | | | | | | | The decrease effect to be 30% |
| Kitchen | 40 | 580 | 1500 | 160 | | | | | | | |
| No use of detergent | | 130 | 0 | 0 | | | | | | | The previous used amount to be 5ml person$^{-1}$ day$^{-1}$ (2g-COD person$^{-1}$ day$^{-1}$) |
| Decrease detergent | | 65 | 0 | 0 | | | | | | | Decrease to half |
| Do not drain rice washing water | | 130 | 10 | 0 | | | | | | | Pollutant loads of rice washing water to be 2g-COD person$^{-1}$, 24mg-TN person$^{-1}$ and 2mg-TP person$^{-1}$ |
| Use paper filter for kitchen | | 41 | 320 | 0 | | | | | | | The removal rate to be 7(COD), 21(T-N), 4(T-P)% |
| Use net for kitchen | | 17 | 230 | 0 | | | | | | | The removal rate to be 3(COD), 15(T-N), 2(T-P)% |
| Treatment during and after cooking | | 290 | 750 | 0 | | | | | | | The removal rate to be 50% |
| Do not drain residual liquid | | | | | | | | | | | |
| Dressing 5ml | | 210 | 4 | 2 | | | | | | | |
| Chinese noodle soup 50ml | | 82 | 2 | 1 | | | | | | | |
| Used edible oil 10ml | | 1100 | 22 | 0 | | | | | | | |
| Washing clothes | 10 | 150 | 400 | 40 | | | | | | | |
| Decrease detergent | | 82 | 0 | 0 | | | | | | | The decrease to be 5g person$^{-1}$ (1.3g-COD person$^{-1}$) |
| Total of current pollutant load per capita | 100 | 1500 | 3700 | 400 | | | | | | | |

Note: 1) Source of pollutant loads (PL) ratio is Ministry of Environment (2002)

**Table 4** A format of environmental accounting housekeeping (EAH) books of domestic wastewater treatment: WTPs population, Ebigawa River drainage area.

| Wastewater treatment plant | PL ratio[1)] | Pollutant looads running into coastal zone | | | Today's decrease | | | Decrease in this month | | | Estimation for calcualtion |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | COD | T-N | T-P | COD | T-N | T-P | COD | T-N | T-P | |
| | % | mg | mg | mg | g | g | g | g | g | g | |
| Nightsoil | 30 | 680 | 1100 | 70 | | | | | | | |
| Bath | 20 | 450 | 700 | 40 | | | | | | | |
| Decrease shampoo and soap | | 135 | 0 | 0 | | | | | | | The decrease effect to be 30% |
| Kitchen | 40 | 900 | 1500 | 90 | | | | | | | |
| No use of detergent | | 200 | 0 | 0 | | | | | | | The previous used amount to be 5ml person$^{-1}$ day$^{-1}$ (2g-COD person$^{-1}$ day$^{-1}$) |
| Decrease detergent | | 100 | 0 | 0 | | | | | | | Decrease to half |
| Do not drain rice washing water | | 200 | 10 | 0 | | | | | | | Pollutant loads of rice washing water to be 2g-COD person$^{-1}$, 24mg-TN person$^{-1}$ and 2mg-TP person$^{-1}$ |
| Use paper filter for kitchen | | 63 | 320 | 0 | | | | | | | The removal rate to be 7(COD), 21(T-N), 4(T-P)% |
| Use net for kitchen | | 27 | 230 | 0 | | | | | | | The removal rate to be 3(COD), 15(T-N), 2(T-P)% |
| Treatment during and after cooking | | 450 | 750 | 0 | | | | | | | The removal rate to be 50% |
| Do not drain residual liquid | | | | | | | | | | | |
| Dressing 5ml | | 320 | 6 | 3 | | | | | | | |
| Chinese noodle soup 50ml | | 127 | 3 | 1 | | | | | | | |
| Used edible oil 10ml | | 1600 | 32 | 0 | | | | | | | |
| Washing clothes | 10 | 230 | 400 | 20 | | | | | | | |
| Decrease detergent | | 127 | 0 | 0 | | | | | | | The decrease to be 5g person$^{-1}$ (1.3g-COD person$^{-1}$) |
| Total of current pollutant load per capita | 100 | 2300 | 3700 | 200 | | | | | | | |

Note: 1) Source of pollutant loads (PL) ratio is Ministry of Environment (2002)

population in the drainage area. For example, COD loads are calculated to be 1,560 mg day$^{-1}$ person$^{-1}$ from night soil, 1,040 mg day$^{-1}$ person$^{-1}$ from bath, 2,080 mg day$^{-1}$ person$^{-1}$ from kitchen and 520 mg day$^{-1}$ person$^{-1}$ from washing clothes for simple *jokaso* (Table 2). When the person decreases the amount of shampoo and soap in the bath, decreased amount of COD load is supposed to be 730 mg day$^{-1}$ person$^{-1}$. Pollutant loads decrease in a month would be 22 g month$^{-1}$ person$^{-1}$ and 88 g month$^{-1}$ for the family of four.

In the same way, when the person use paper filter for kitchen, decreased amount of pollutant loads are calculated to be 150 mg-COD day$^{-1}$ person$^{-1}$, 330-N mg day$^{-1}$ person$^{-1}$ and 10 mg-P day$^{-1}$ person$^{-1}$, respectively. Decrease in the month would be 4.5 g-COD month$^{-1}$ person$^{-1}$, 9.9g-N month$^{-1}$person$^{-1}$ and 0.3 g-P month$^{-1}$ person$^{-1}$, respectively. For the family of four, the decreased pollutant loads would

**Table 5** Pollutants removal rates by filter paper and net at kitchen. (Funabashi City, 2000)

| Pollutant | Removal rate | |
|---|---|---|
| | Paper filter | Net |
| SS | 52 | 31 |
| COD | 7 | 3 |
| T-N | 21 | 15 |
| T-P | 4 | 2 |

**Table 6** BOD derived from cooking with and without treatment. (Funabashi City, 2000)

| Cooking | BOD | | | SS | | |
|---|---|---|---|---|---|---|
| | Without treatment | With treatment | Efficiency (%) | Without treatment | With treatment | Efficiency (%) |
| *Happosai* | 8.1 | 4.8 | 41 | 4.5 | 2.4 | 47 |
| *Miso* boiled mackerel | 10.1 | 2.7 | 73 | 2.1 | 0.7 | 68 |
| Fried chicken | 21.0 | 1.8 | 91 | 25.0 | 1.4 | 94 |
| Mixed fry | 6.0 | 1.6 | 74 | 6.1 | 0.6 | 90 |

**Table 7** BOD derived from drink, food and cooking. (Funabashi City, 2000)

| Drink, food etc. | BOD (mg/L) | Amount of waste (mL) | BOD load (g) |
|---|---|---|---|
| Sauce | 240,000 | 10 | 2.4 |
| Dressing | 660,000 | 10 | 6.6 |
| Tea | 290 | 180 | 0.05 |
| Coffee | 5,900 | 180 | 1.1 |
| Milk | 83,000 | 180 | 14.9 |
| *Sake* | 188,000 | 180 | 34 |
| Rice washing waste | 11,100 | 700 | 7.8 |
| Chinese noodle soup | 26,000 | 180 | 4.7 |
| *Miso* soup | 37,000 | 180 | 6.7 |
| Edible oil waste | 1,670,000 | 15 | 25 |

be 18 g-COD $month^{-1}$, 40 g-N $month^{-1}$ and 1.2 g-P $month^{-1}$, respectively.

# 4. Discussion

The pollutant loads per capita by wastewater treatment methods were calculated for Ebigawa River drainage area (Table 1). For their comparison, further considerations are necessary including stability of treatment, degradability of carbon and nutrients in the environment, and pollutant loads of rainy days. Small value of T-P load of WTPs might reflect the advancement of nutrient removal technology at the WTPs.

Miscellaneous measurements are encouraged to reduce pollutants from domestic wastewater including Funabashi City (1999), Ebigawa River Drainage Area Conference on Promotion of Water Circulation (1999) and Matsudo City (1999). Such information is disseminated to reduce pollutants derived from domestic wastewater as pollutants removal rates of paper filter and mesh net at kitchen sink, pollutants removal rates of wiping up of dishes and cooking materials, and BOD derived from drink, food and cooking (Tables 5-7) (Funabashi City, 2000).

Domestic wastewater measurements at kitchen have been said to reduce BOD and COD pollutants discharge by 20-30% (Ogura ed., 1993).

It does not seem to be easy for citizens to consider quantitatively on the relation between domestic wastewater and water pollution problems including water pollution in a coastal zone. Only some citizens with good environmental intentions take measures to reduce pollutant loadsuch as using paper filter or mesh net at kitchen sink, decreasing detergent for washing clothes and decreasing shampoo and soup at bath, and quitting to drain residual liquid including dressing, noodle soup and used edible oil.

Basic concepts or important and necessary points for the preparation of EAH books for domestic wastewater are considered as the followings:

(1) Tables are prepared for each domestic wastewater treatment method;
(2) Basic parameters of water quality are COD (or BOD), T-N and T-P;
(3) Citizens can easily fill the tables in regards to the effective actions to reduce pollutant loads; and
(4) Pollutant loads reduction effects can be easily calculated.

While output of EAH books for $CO_2$ reduction is one parameter, i.e. $CO_2$ waste amount, those of domestic wastewater are three parameters, COD, T-N and T-P. This is a little more complicated characteristics, however, it would be a worth tool to let ordinary citizens to understand complicated aspects of water pollution problems.

EAH books of domestic wastewater should be calculated for each drainage area, because pollutant loads per capita running into coastal zones or rivers by wastewater treatment methods are dependent on the drainage area. EAH books are considered to be essential and effective tools for dissemination and environmental education in the fields of water pollution, because only some basic administrative information and environmental data are necessary for their calculation and preparation.

It is desirable that EAH books of domestic wastewater would be widely considered and introduced in the fields of enlightenment, dissemination and environmental education projects and activities, especially in drainage areas of rivers flowing into a closed coastal zone. Preparation of these kinds of materials would be preferable with participation of citizens with environmental consciousness and citizens with little concern on environment. Interests with lives, materials and water quality would increase through the EAH books and it would be desirable for environmental and scientific education.

## 5. Conclusions

In regards to land-based pollutants, reducing pollutant loads derived from domestic wastewater would be indispensable especially in urban area. Dissemination of scientific and quantitative information is necessary to let ordinary citizens collaborate to pollutant loads reduction activities in their lives and to avoid misunderstanding on water pollutants sources.

Pollutant loads per capita by domestic wastewater treatment methods and EAH books of domestic wastewater are proposed as essential indexes and effective tools in the field of water pollution.

Introduction of these indexes and measurements to actual wastewater pollutant loads reduction activities would be preferable for water pollution control in each drainage area.

## Acknowledgements

Some data and information are obtained from Funabashi City and Nishiura, Takase, Edogawa-Sagan, Hanamigawa and Tsudanuma WTPs. Original sources of many basic data for the preparation of the EAH books are studies of Chiba Prefecture Environmental Protection Research Institute.

## References and Information Sources

Chiba Prefecture homepage, Homepage of Chiba Prefecture Sanbanze Conference (http://www.pref.chiba.jp/syozoku/b_seisaku/sanbanze/). (in Japanese)

Chiba Prefecture (1998): State of environment in the Ichikawa second phase district and the Keiyo-ko port second phase district plan (Summary). (in Japanese)

Chiba Prefecture Wastewater Treatment Corporation Foundation (1998-2002): Imbanuma drainage area wastewater treatment system Hanamigawa second WTP maintenance and management annual report. (in Japanese)

Chiba Prefecture and Funabashi City (1999): Ebigawa River. (in Japanese)

Ebigawa River Drainage Area Conference on Promotion of Water Circulation (1999): Ebigawa River action plan for reclamation of water circulation, Let's recover our Ebigawa River by everyone. (in Japanese)

Funabashi City homepage, http://www.city.funabashi.chiba.jp/ (in Japanese)

Funabashi City (2000): Funabashi city promotion plan of domestic wastewater measurement, Diet

Water, Housewife Mariko's domestic wastewater measurements manual. (in Japanese)
Funabashi City (2001): Environments in Funabashi city of *Heisei* 13 (2001), Toward wholesome, benevolent and fruitful environments in the future. (in Japanese)
Funabashi City (2002): City planning making a good use of coastal area, Fundamental concepts and fundamental planning, Towards a natural biosynthesis drainage area and reclamation of city. (in Japanese)
Funabashi City (2003a): Funabashi city statistics of *Heisei* 14 (2002). (in Japanese)
Funabashi City (2003b): State of WTPs of *Heisei* 14 (2002). (in Japanese)
Funabashi City (2003c): Cleaning and environmental sanitation projects report of *Heisei* 14 (2002). (in Japanese)
Fujimoto C. (1988): Pollutant loads of rivers flowing into Inbanuma and Teganuma marshes, Basic units of domestic wastewater, Chiba Water Quality Conservation Institute Annual Report of *Syowa* 62 (1987), pp.89. (in Japanese)
Fujimura Y. (1996): Pollutant loads basic units of domestic wastewater and discharge rate of *jokaso*, Chiba Prefecture Water Quality Conservation Institute Annual Report of *Heisei* 7 (1995), pp.33-38. (in Japanese)
Fujimura Y. and Nakajima A. (1998): Domestic wastewater pollutant loads and Combined *jokaso*, Inbanuma Marsh Nature and Culture, No.5, pp.27-34. (in Japanese)
Ichikawa City homepage, http://www.city.ichikawa.chiba.jp/ (in Japanese)
Ichikawa City (2002): Environment in Ichikawa city of *Heisei* 13 (2001), Ichikawa city environment white paper. (in Japanese)
Iimura A. (1998): Pollutant loads analysis of Mamagawa River drainage area, Chiba Prefecture Water Quality Conservation Institute Annual Reports of *Heisei* 10 (1998), pp.55-62. (in Japanese)
Matsudo City (2000): Let's make rivers in Matsudo clean rivers together! (in Japanese)
Ministry of Environmental (2002): Environment white paper of *Heisei* 13 (2001). (in Japanese)
National Environmental Conference Water Department Gross Pollutant loads Control Professional Committee (1999): The way of fifth gross control of water pollutants (Interim report of gross pollutant loads control professional committee). (in Japanese)
Ogawa K., Tsuzuki Y. and Uchiyama M. (2003): Miscellaneous aspects on the Sanbanze tidal zone problem found in environmental education class of the Natural History Museum and Institute, Chiba, Proceedings of 37th Annual Meeting of Japan Society on Water Environment, pp.228. (in Japanese)
Ogura N. ed. (1993): Tokyo Bay, Environmental fluctuation in a century, *Kouseisyakouseikaku*, Tokyo. (in Japanese)
Sudo R. (2000): Water environmental administration in 21st century, 39th Seminar of Japan Society on Water Environment. (in Japanese)
Tokyo Bay Area Local Government Environment Conservation Conference (2001): Water quality report of Tokyo Bay of *Heisei* 11 (1999). (in Japanese)
Tsuzuki Y. (2002): Thinking of Sanbanze roundtable conference from a point of view of a citizen, Newsletter of Chiba Environmental Partnership, No.28. (in Japanese)
Tsuzuki Y. (2003): Proposal on dissemination and environmental education on pollutant loads to Tokyo Bay and Sanbanze tidal coastal zone and municipal lives, Proceedings of 11th Global Environment Symposium, Japan Society of Civil Engineers, pp.213-218. (in Japanese)
Tsuzuki Y. and Ogawa K. (2004): Proposal on dissemination and environmental education on water pollutant loads, Proceedings of the 31st Kanto District Annual Meeting CD-ROM, Japan Society of Civil Engineers. (in Japanese)
WTP management data of Edogawa-Sagan Drainage Area WTP (1998-2002). (in Japanese)
WTP management data of Nishiura Municipal WTP (1998-2002). (in Japanese)
WTP management data of Takase Municipal WTP (1998-2002). (in Japanese)
WTP management data of Tsudanuma Municipal WTP (1998-2002). (in Japanese)