DIOXIN CONCENTRATION IN RAW/TREATED WATER AT THREE RIVER SYSTEM IN JAPAN

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Introduction

The authors have reported on dioxin concentrations[1,2] and formation mechanisms[3,4] for Japanese tap water. This time, dioxin concentration of raw and treated water were determined for 20 water purification plants belong to three river systems.

Methods and Materials

Twenty raw/treated water samples from water purification plants were collected at three river systems (Edo River, Sagami River and Yodo River system). "Large Volume *in-situ* Pre-concentration Sampler" was employed to collect water samples for accurate determination at a femto gram TEQ levels. Sample sizes were 200 and 2,000L for raw and treated water respectively. Descriptions of sampling method are shown in previous report[1].

Analysis

Detection of PCDDs/PCDFs was carried out by HRGC/HRMS method after soxhlet extraction and gel clean-up procedures. Collected samples (polyurethane form plugs(PUFP) and glass fiber filter(GFF)) were dried in a desiccator. After spiking with internal standards, PUFP and GFF were extracted with methylene chloride for 24hrs, using a soxhlet extractor. Multi layer silica gel and activated carbon column chromatographies were employed for sample clean up. Concentration of PCDDs/PCDFs and PCBs were determined by HRGC (6890, Hewlett Packard, US)/HRMS (AutoSpec-Ultima, Micromass, UK). Seventeen native (Wellington Laboratories, Canada) and ^{13}C 2,3,7,8-substituted PCDDs/PCDFs isomers (Wellington Laboratories, Canada) and twelve native (Accustandard, US)and ^{13}C PCBs (Wellington Laboratories, Canada), that have TEF of WHO-1998, were used as standards and isotope spikes. To detect fg/L concentrations of PCDDs/PCDFs, organic solvents used for analysis were purified by sub-boiling distillations. Glassware, GFF and silica gel were heated to 400-450ºC after an organic solvent wash. All procedures were carried out in a chemical hazard clean room (class<10,000). HRGC was equipped with BPX-DXN (SGE, Australia) and RH-12ms (Inventx, USA) to separate all 2,3,7,8-substituted isomers[5]. Analyses were performed in accordance with ISO/IEC 17025(JCLA4).

Table 1. Summary of TEQ for twenty water purification plants.

Edo River System				Sagami River System				Yodo River System			
No.	Raw (pg-TEQ/L)	Treated (pg-TEQ/L)	Removal (%)	No.	Raw (pg-TEQ/L)	Treated (pg-TEQ/L)	Removal (%)	No.	Raw (pg-TEQ/L)	Treated (pg-TEQ/L)	Removal (%)
A	0.11	0.0071	93.5	I	0.062	0.0050	91.9	O	0.047	0.0028	94.0
B	0.15	0.033	78.0	J	0.057	0.0020	96.5	P	0.037	0.0041	88.9
C	0.10	0.0016	98.4	K	0.074	0.0038	94.9	Q	0.20	0.0074	96.3
D	0.12	0.0066	94.5	L	0.067	0.0034	94.9	R	0.13	0.00052	99.6
E	0.12	0.013	89.2	M	0.063	0.0061	90.3	S	0.060	0.00068	98.9
F	0.12	0.0037	96.9	N	0.082	0.0021	97.4	T	0.21	0.0051	97.6
G	0.082	0.0071	91.3	AV	0.068	0.0037	94.3	AV	0.11	0.0034	95.9
H	0.084	0.0049	94.2								
AV	0.11	0.0096	92.0								

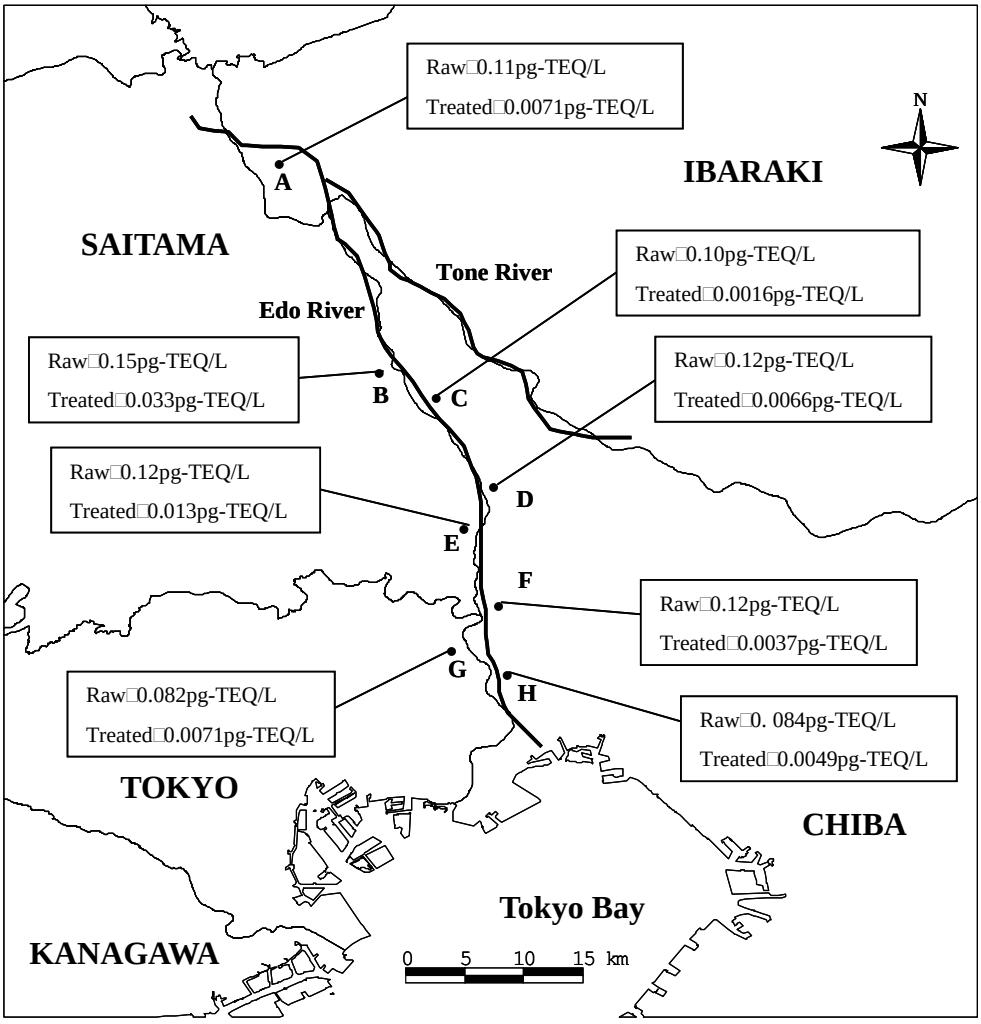

Figure 1. Distribution of TEQ in Edo River System.
Each ● (A-H) represents location of water purification plant.

Results and Discussion

Obtained results are shown in Figure 1,2 and 3. Average TEQ of raw water for Edo, Sagami and Yodo river systems were 0.11, 0.068 and 0.11 pg-TEQ/L respectively. Average TEQ of treated water for three river system were less than 0.01 pg-TEQ/L (0.0096, 0.0037 and 0.0034 pg-TEQ/L for Edo, Sagami and Yodo river systems). 78.0-99.6% of dioxins were removed by water treatment in purification plant.

Calculated daily intake of dioxin was <0.02pg-TEQ (<0.01pg-TEQ/L x 2L intake). This intake only amount to 0.008-0.03% of TDI (1-4pg/kg/day).

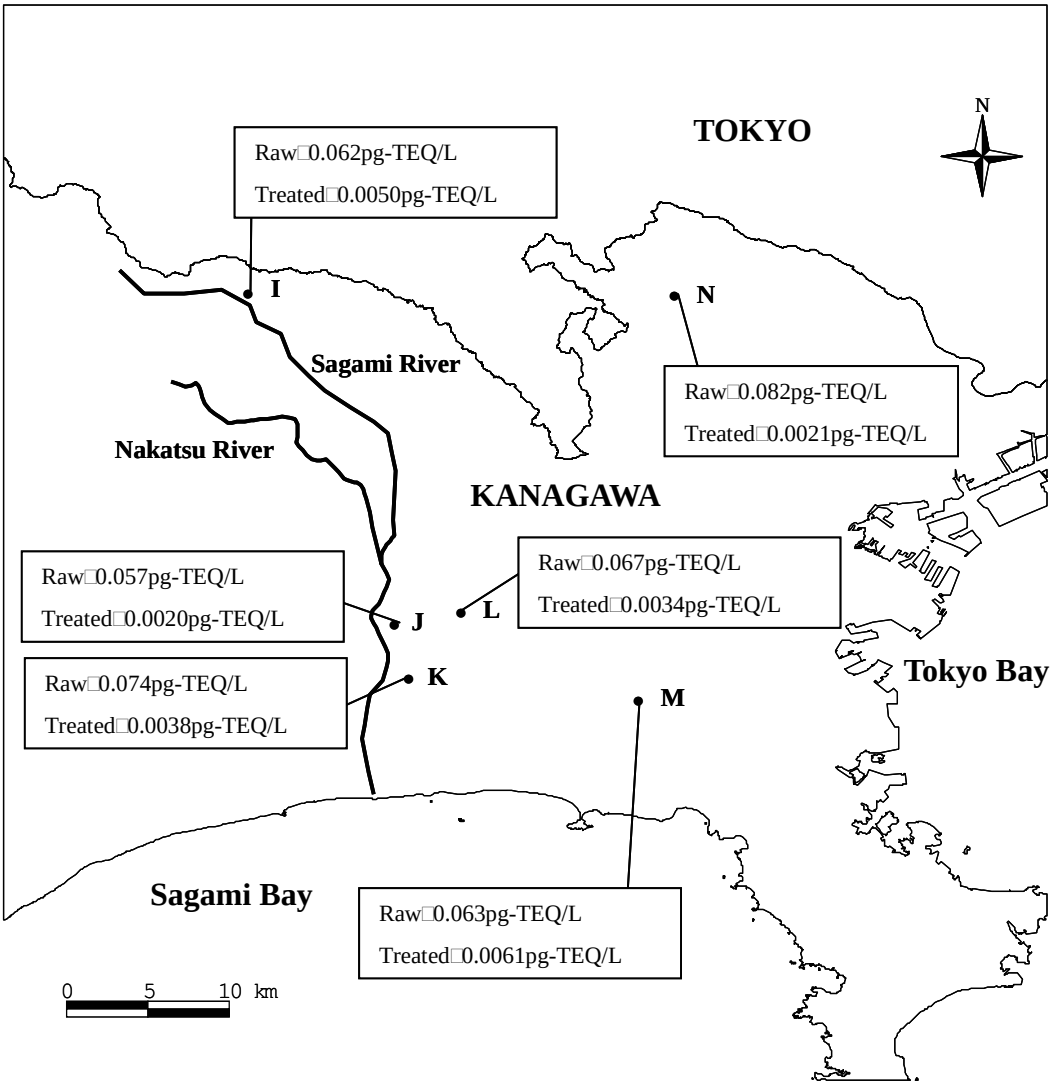

Figure 2. Distribution of TEQ in Sagami River System.
Each ● (I-N) represents location of water purification plant.

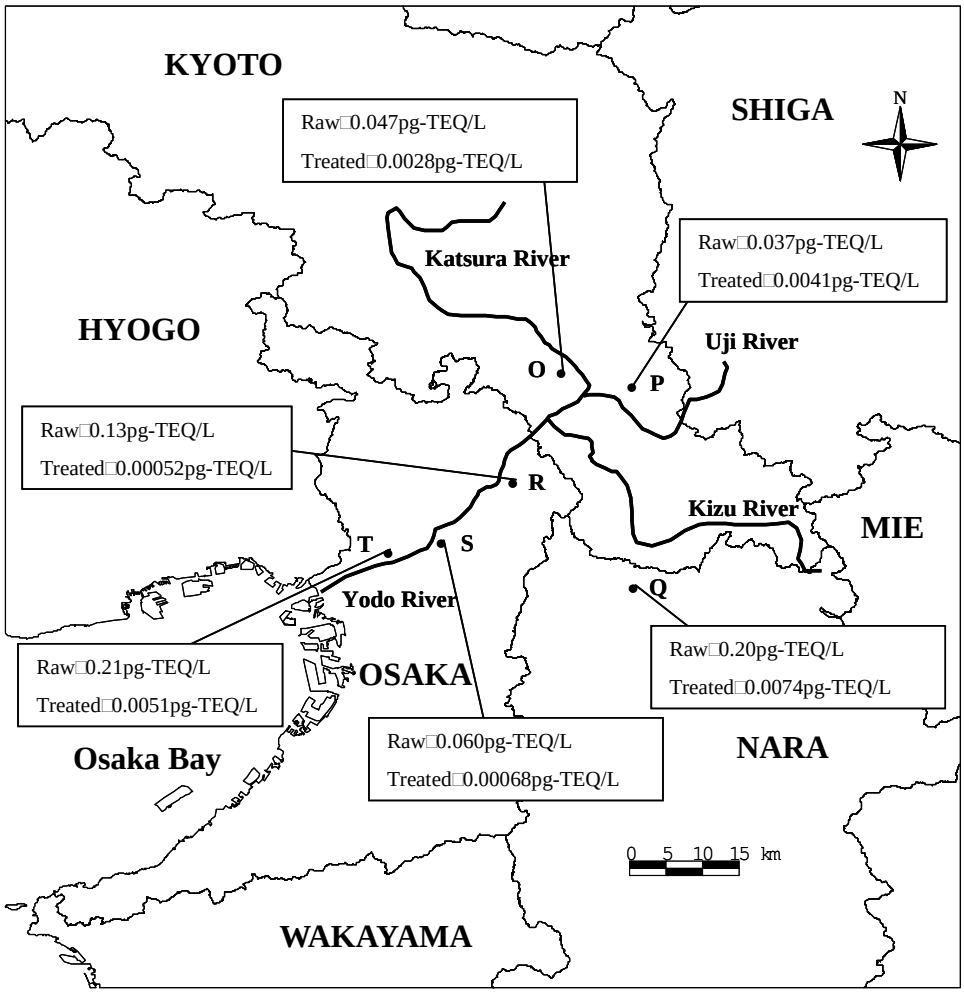

Figure 2. Distribution of TEQ in Yodo River System.
Each● (O-T) represents location of water purification plant.

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