Occurrence of Disinfection By-Products and Distribution in Drinking Water

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Abstract

Chlorine disinfection has been used in drinking water supply to disinfect the water-borne microbial disease which may cause to serious human disease. As Chlorination is still the least costly, relatively easy to use, chlorination is the primary means to disinfect portable water supplies and control bacterial growth in the distribution system. However, chlorine also reacts with natural organic matter (NOM), which presents in nearly all water sources, and then produces disinfection by-product (DBps), which may have adverse health

effects. Although the existent DBPs have been reported in drinking water supplies, it is not feasible to predict the levels of the various DBPs due to the complex chemistry reaction involved.

The objectives of this study were to investigate seasonal variation of DBPs formation and difference of DBPs concentration in the plant to tap water. The average concentration of THMs was 20.04 μg/ℓ, HAAs 8-15 μg/ℓ, HANs 2-4.5 μg/ℓ respectively.

Distant variation of DBPs formation is that THMs concentration increase by 17% at 2 ㎞ point from the plant and by 28% at 7 ㎞ and HAAs, HANs also increase each by 16%, 32% at 2 ㎞ from the plant and 35%, 56% at 7 ㎞. DBPs increase in water supply pipe continually.

The seasonal occurrence of DBPs is that in May and August DBPs concentration is very higher than in March, in May DBPs concentration is highest. The temperature is main factor of DBPs formation, precursor also. Precursor which was accumulated for winter flowed into the raw water by flooding in spring and summer and produced DBPs. Therefore for the supply of secure drinking water, it is required to protect precursor of flowing into raw water and to add to BCAA and DBAA to drinking water standards.

Keywords: Tap water, Disinfection By-products (DBPs)

Introduction

In the tap water, chlorine disinfecting for inactivation of the pathogenic microbe is one of the water treatment agents which it can prefer most because it is the most economic and convenient. The material of disinfecting reacts with imbrued material in the water source of most, Specially Natural Organic Material (NOM) and it forms the disinfecting DBPs which harm goes mad to a health.

Therefore disinfecting DBPs which created by microbe inactivation and disinfecting material including a problem must be satisfied in the same time and must not be overlooked just one side. Korea founded 1990 first THMs in the disinfecting byproducts (Trihalomethanes) it set in the water regulation standard which can eat, 2003 HANs (Haloacetonitrile) 3 types and the HAAs (Haloaceticacid) 2 types and Chloral hydrate dignity against a regulation standard it prepares and recently the interest regarding the listening to disinfecting DBPs comes to be high little by little. Actually with 3 purification plant it is producing the tap water a detection ratio and type divided the effect where the season change goes to a disinfecting by-products occurrence and

the disinfecting DBPs especially from the research which it sees and it produced it saw, it observations the consistency difference of the disinfecting DBPs for the disinfecting DBPs consistency and the accommodating which occur from purification plant are detected with the fundamental data for a disinfecting DBPs reduction plan as the basic-information material.

Analysis Methods and Materials

-Subject matter:

3 purification plant water filtration treatment method is different

. A filtration plant : Ozone and activated carbon treatment and altitude treatment facility.

. B filtration plant : After coagulation sedimentation settling the general treatment facility which it rapid filtrates.

. C filtration plant : After slow filtrating and disinfects the chlorine the fundamental equipment.

-Analysis method

Supply analysis specimens picking will ask in 300 ㎖ glass bottle and after filling full to distilled water, 10% $NaAsO_2$ and 5N HCl put it on it. So it sealed up and refrigeration should keep and transported to the laboratory. The supply specimens for a disinfecting DBPs analysis pre-treatment executes within 24 hours. Korea drinking water standard method and drinking water monitoring method. It applied and it analyzed, the THMs used, the Agilent 6890N (ECD) the HANs (Haloacetonitrile) with the HAAs (Halo acetic aside) PerkinElmer Auto system (ECD) it used and with SIM mode it analyzed. The columns case HP-5 of the THMs (30m×0.53mm×1.8 ㎛) and the HANs and the HAAs used and the CP-87 (30m×0.32mm×1.0 ㎛) they analyzed.

Table 1.1 Analytical conditions of Gas Chromatograph

DBPs / Item	THMs	HAAs, HANs
Carrier gas	N_2(99.999%)	N_2(99.999%)
Column flow	8.5 ㎖/min	1.0 ㎖/min
Column	HP-5(30m×0.53mm×1.8 ㎛)	CP-87(30m×0.32m×1.0 ㎛)

Model of GC	Agilent 6890N(ECD)	PerkinElmer Auto system(ECD)
Injection temp.	210℃	220℃
Detection temp.	290℃	290℃
Oven Condition	Initial temp. 40℃, 2.0min 4℃/min to 60℃, 0.0min 8℃/min to 120℃, 2.0min 15℃/min to 200℃, 0.5min	Initial temp. 90℃, 6.0min 5℃/min to 160℃, 1.0min 12℃/min to 195℃, 0.0min

Results and Discussion

Cause of DBPs formation

-Natural Organic Material (NOM)

In natural organic material humic substance appears humic substance relative coherence of humic acid highly.

-Temperature and Seasons change.

The recording DBPs consistency where the temperature will increase generally increase season change it gets up the consistency change of temperature and the DBPs precursor, high temperature scope (24-31) from DBPs consistency increasing trends.

-Chlorine pouring quantity and residual chlorine. When the remaining chlorine quantity increases,

THMs compared to HAAs creation increase The chlorine pouring quantity comes to be higher than the did and memo compared to creation of the trihalogenated increase

-The hour lapse which it follows in distance

The recording hour when the distance will become more distant elapses, recording where the hour will elapse continuous increase.

The seasonal variation of DBPs concentration

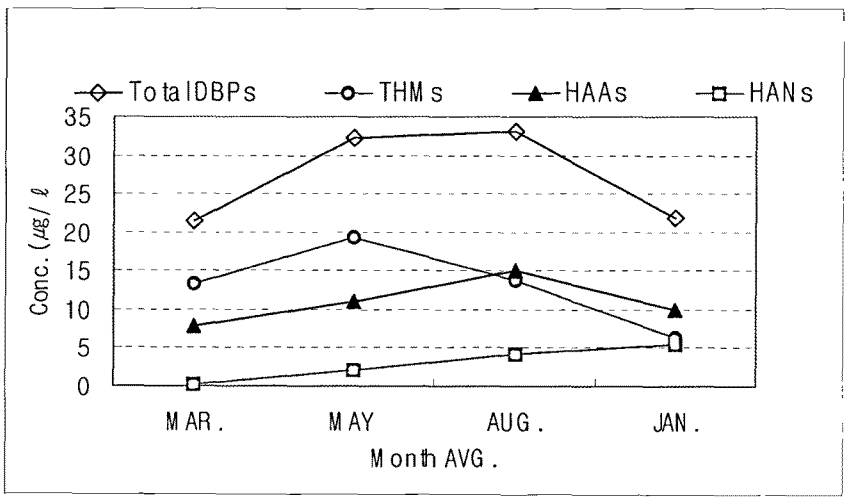

Fig. 1.1 The seasonal variation of DBPs concentration at a plant

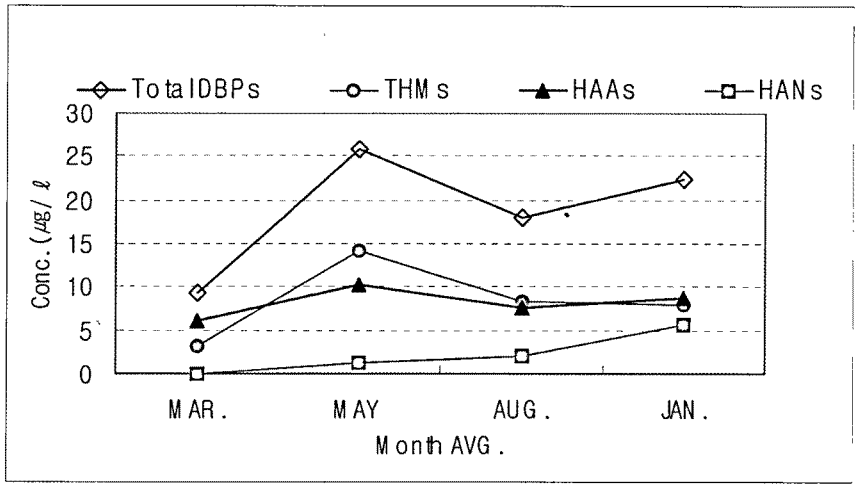

Fig. 1.2 The seasonal variation of DBPs concentration at B plant

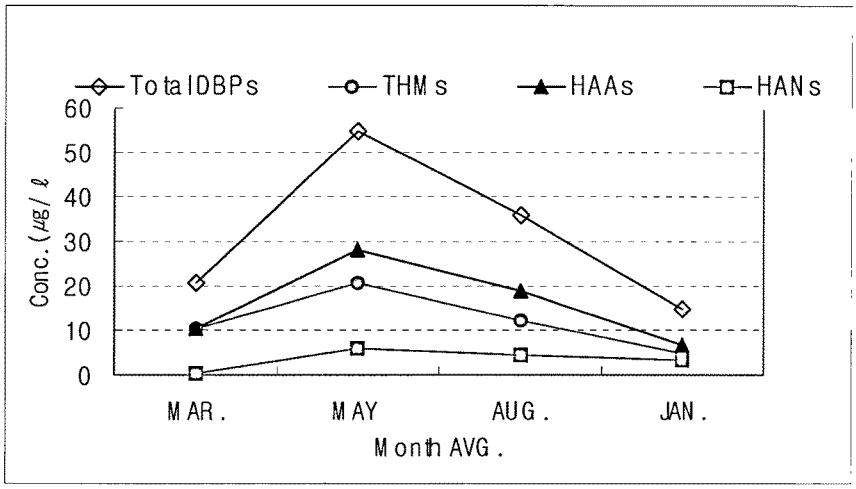

Fig. 1.3 The seasonal variation of DBPs concentration at C plant

Variation of DBPs Concentration According to Distance

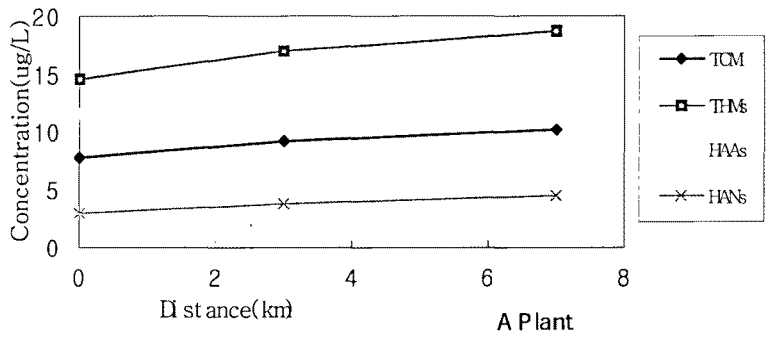

Fig 2.1 The distant variation of DBPs concentration at A plant

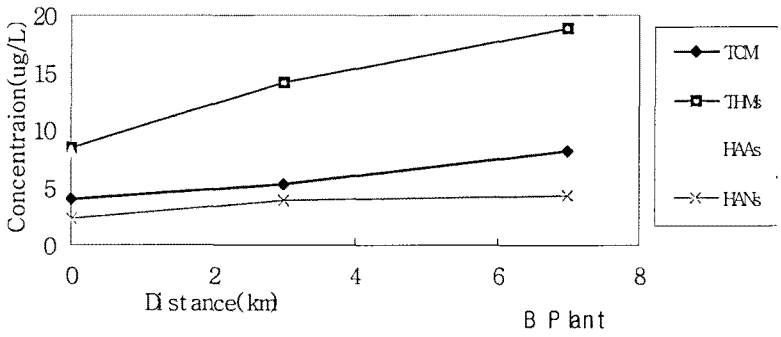

Fig 2.2 The distant variation of DBPs concentration at B plant

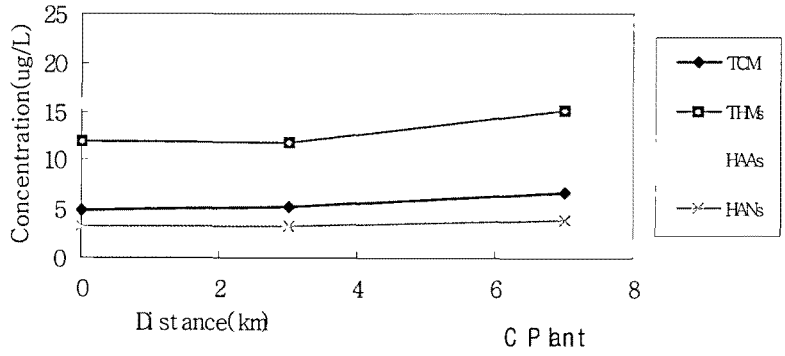

Fig 2.3 The distant variation of DBPs concentration at C plant

Conclusions

-Seasonal disinfecting DBPs occurrence quantity

May and August are high most and January is low most

Reason: If winter season index the light bulb material which is accumulated is caused by at the spring season precipitation, at the constant unit influx.

-In natural organic material humic substance,

humic substance relative coherence of humic acid appears highly in DBPs occurrences.

-DBPs average occurrences quantity : THMs > HAAs > HANs

THMs: 14.4 μg/ℓ HAAs: 13.9 μg/ℓ HANs: 3.5 μg/ℓ

THMs: TCM > DCBM > CDBM > TBM (TCM top 67%)

HAAs: DCAA > BCAA > TCAA > DBAA (DCAA top 42%)

HANs: With the HAAs it is a similar tendency and the DCAN is high most.

-DBPs creations quantity: The hour passes and increases

THMs: 2km 17%, 7km 28% increase

HAAs: 2km 16%, 7km 35% increase

HANs: 2km 32%, 7km 56% increase

-With constant unit influx minimization and precursor removal of precursor tap water immediacy characteristic improvement.

-In the water medulla standard, the BCAA, DBAA item which is not set additional and standard set necessity.

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