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Author(s)	Asano, Masahiro
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Determination of nonylphenol and bisphenol A in the leachate collected from waste disposal landfill sites in Hanoi, Vietnam

Graduate school of Osaka university
Masahiro Asano

1. Introduction

Since the reform and liberation policy of “Doi Moi” was begun, vietnames economy was developed rapidly. However, rapidly industrial growth has caused several of environmental pollution especially the city of Hanoi and Ho Chi Minh. Ground water pollution resulted from waste disposal landfill leachate is a part of environmental pollution. Especially in Hanoi, ground water has been used as supply for drinking water and worried about health damage of residents. So it's important for us to grasp the present condition of ground water pollution and measure chemicals in leachate.

Nonylphenol (NP) and Bisphenol A (BPA) are some of useful chemicals as material of detergent and preservative in industry and household. In recent years, these chemicals are considered endocrine disruptor chemicals (EDCs) and worried about health damage. However, there were some of reports about chemical analysis of ground water and leachate in Hanoi.

In this study, we analyzed water quality of leachate collected from waste disposal landfill site in Hanoi and examined ability of fenton reaction system as leachate treatment.

2. Material and methods

2.1 Waste disposal landfill site and sampling point

Nam Son waste disposal landfill site was located 50 km northeast from central Hanoi. 4 Leachates and surface water were collected from this waste disposal landfill site and provided for water quality analysis and fenton oxidation process. Fig.1 shows sampling point in Nam Son waste disposal landfill site.

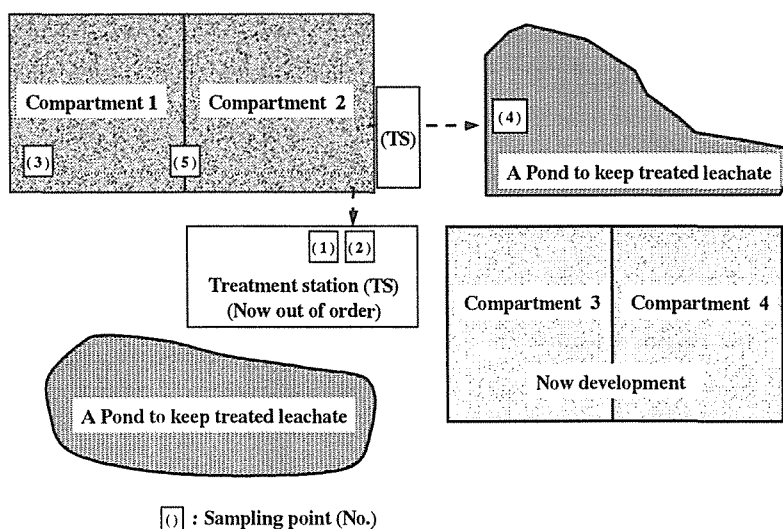


Fig.1 Sampling points in Nam Son waste disposal landfill site

Tay Mo waste disposal landfill site was located 5 km west from central Hanoi. 2 Leachates were collected from this waste disposal landfill site and provided for water quality analysis only for NP and BPA. Kieu Ky waste disposal landfill site was located 30 km north from central Hanoi. 2 Leachates were collected from this waste disposal landfill site and provided for water quality analysis only for NP and BPA.

2.2 Water quality analyses of leachates and surface water

Chemical oxidation demand (COD) was measured as dichromate oxygen demand (COD (Cr)). Humic acid analyze was conducted in accordance with the Japan Analysis Chemistry Association. The concentration of heavy metals were analyzed by atomic adsorption spectrophotometer (Shimadzu AA6800), NP and BPA in the leachates were concentrated by extraction with dichloromethane and cleaned-up by silica gel column chromatography. Cleaned-up samples were derivatized by BSTFA and analyzed using a gas chromatography-mass spectrometry (Shimadzu GC-MS QP5000).

2.3 Fenton reaction system

Fenton reaction system was performed in reactor using a 1l of glass cylinder. This reactor was operated in mixing inside glass cylinder. The fluorescence lamp was irradiated from inner surface of the bottom. In Fenton reaction process, 760mg / l of $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ was added as Fe (II) source. After 2ml of hydrogen peroxide (30%) was added to the old leachate collected from Nam Son waste deposal landfill site, operation was started. In this study, 6 reactors were prepared to examine the treatment activity using by powder activated carbon (PAC) and NP (1ml addition of 1000mg/l of NP solution dissolved in acetone). Table.1 shows the experiments style of this study.

Table.1 Experiments style of Fenton reaction process

Experiment style (No.)	Content
(1)	Normal treatment
(2)	Normal treatment after addition of NP
(3)	Abnormal treatment
(4)	Abnormal treatment after addition of NP
(5)	Addition of NP before Normal treatment
(6)	Addition of NP before Abnormal treatment

Notice : Normal treatment (with PAC), Abnormal treatment (without PAC)

3. Result and discussion

3.1 Chemical analyses of leachate and surface water

Chemical analyses of lechates are shown in Table.2. Leachate collected from No.3 point contained high concentration of COD, humic acid, T-N, heavy metal. It was suggested that this leachate was young. Leachate colle

Table.2 Chemical analysis of collected leachates and surface water from Nam Son waste disposal landfill site

Sampling point (No.)	TSS (g/l)	COD (mg/l)	Humic acid (mg/l)	AOXs (mg/l)	T-N (mg/l)	As (ug/l)	Fe (mg/l)	Mn (mg/l)	Hg (ug/l)	NP (ug/l)	BPA (ug/l)
(1)	0.25	819	89.8	13.5	435	0.61	0.39	0.053	4.072	19.46	0.14
(2)	0.10	135	5.7	3.74	87	0.84	0.14	0.012	0.597	68.08	9.73
(3)	3.36	19957	296.8	re-meas.	868	1.16	2.74	0.140	-	49.89	18.6
(4)	0.27	708	72.4	12.0	504	0.33	0.67	0.122	0.803	25.16	0.02
(5)	0.29	593	47.1	9.34	314	0.32	0.37	0.062	0.094	52.81	6.80

-cted from No.2 point contained low concentration of COD, humic acid, T-N, heavy metal. It was suggested that this leachate was old. And it was supposed that young leachate is unorganized in time. NP and BPA were detected from collected leachates and surface water. In this table, old leachate has a tendency to contain high concentration of NP. And young leachate has a tendency to contain high concentration of BPA. And young leachate which was collected from Tay Mo waste disposal landfill has a tendency to contain high concentration of NP and BPA. (data wasn't shown). It was supposed that present condition of leachate pollution resulted from NP and BPA were different in each waste disposal landfill sites. However, spike and recovery test using old leachate, recovery percentage of NP and BPA was 22 ~ 39 %. It was supposed that these data weren't reflected in polluted condition of NP and BPA in leachates and surface water.

3.2 COD and color removal from leachate by Fenton reaction process

Table.3 shows about COD and color removal from leachate by Fenton reaction process. In experiment style No.1

Table.3 COD and color removal from leachate by Fenton reaction system

Experiment style (No.)	COD removal (%)	Color removal(%)
(1)	54.68	81.47
(2)	-23.40	90.73
(3)	47.56	82.47
(4)	-46.04	91.13
(5)	-49.25	92.62
(6)	-85.2	89.34
Blank (Raw leachate)	0.00	0.00

and No.3, average 50 % of COD were removed by Fenton reaction process. However, there was no difference between No.1 and No.3 about PAC addition. It was difficult to estimate of COD removal about experiment style No.2,4,5,6. It was supposed that function of OH radicals which are used for degradation of organic chemicals were inhibited by NP. As for color removal, this process removed average 87.96 % of colors. In experiment style No.2,4,5,6 , average 90 % color was removed. In these experiment style, colored scum were floated inside cylinder. It was supposed that this high removal of color was resulted from surfactant activity of NP. It was supposed that removal of COD and color were influenced by existence of NP.

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