27. EFFECTS OF DISSOLVED ORGANIC MATTER(DOM) ON THE ENRICHMENT OF CADMIUM(Cd) BY MICROCYSTIS AERUGINOSA

YANG li[1]* , Tadashi YAMADA[2]

[1]Graduate school of Civil and Environmental Engineering Chuo University
(1-13-27, Kasuga,Bunkyo-ku,Tokyo 112-8551, Japan)
[2]Department of Civil and Environmental Engineering, Chuo University.
(1-13-27, Kasuga,Bunkyo-ku,Tokyo 112-8551, Japan)
* E-mail: *yangli@civil.chuo-u.ac.jp*

To study the effects of different sources of DOM on the enrichment of cadmium by Microcystis aeruginosa is important to the control of pollution prevention in water. In this study, UV - visible spectroscopy , Fourier transform infrared , three-dimensional fluorescence spectroscopy are used to analyze the Morphology, structure and composition of the three kinds of DOM; Three-dimensional fluorescence spectroscopy and UV - visible spectroscopy are useed to study the action of different components in DOM(such as HA and FA)when complex with heavy metal ;Adding DOM and Cd^{2+} to the water which contains Microcystis aeruginosa ,then use UV - visible absorption spectroscopy and three-dimensional fluorescence spectrometry to measure the content of heavy metals in and outside the cells,in order to analysze the effects of DOM on the enrichment of cadmium by Microcystis aeruginosa .

Key Words : *DOM , Microcystis aeruginosa , Cadmium , Enrichment*

1. INTRODUTCION

Eutrophication is one of the water pollution problems all around the world, Cadmium is an important class of pollutants in eutrophic lakes. Organic matter from different sources (soil, sediment,algae)have different composition and structure leading their differences in binding of heavy metals. As the enrichment of organic matter is an important feature of lake eutrophication and Microcystis aeruginosa is a dominant species caused water bloom in eutrophic lake[1)] , the interaction between metal ions in water - organic matter - algae can significantly affect the migration and fate of metal ions in the water.

2. THE PROCESS OF EXPERIMENT

(1) The cultivation of Microcystis aeruginosa:

Microcystis aeruginosa's provenance buy from somewhere in China(Microcystis aeruginosa,FACHB 905). Then cultivate the Microcystis aeruginosa's provenance into the period of Logarithmic phase as showed in **Fig.1** Algea's growth curve,The ingredient of culture medium is showed as **Table 1** The ingredient of culture medium and **Table 2** The ingredient of A5 culture ,The need of mother liquor (mL) every 1000 mL culture. The culture conditions: ①Light intensity is 40～60 μmol· (m^{-2}· s^{-1}), ②Light 14 hours a day ③temperature is 2℃ ④Static culture⑤Shaking several times a day.

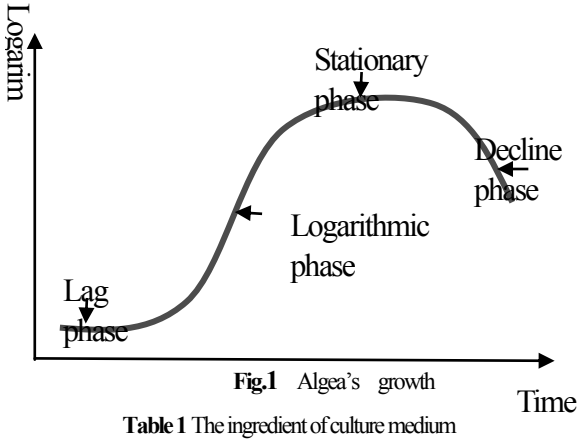

Fig.1 Algea's growth

Table 1 The ingredient of culture medium

No.	Drug	culture (g/L)	mother liquor (g/L)	The need of mother liquor (mL) every1000mL culture
1	$NaNO_3$	1.5	150	10
2	K_2HPO_4	0.04	4	10
3	$MgSO_4 \cdot 7H_2O$	0.075	7.5	10
4	Citric acid	0.006	0.6	10
5	Ferric citrate	0.006	0.6	10
6	Na_2CO_3	0.02	2	10
7	Na_2EDTA	0.001	0.1	10
8	$CaCl_2 \cdot 7H_2O$	0.036	18	2
9	A5 culture	-	-	1

Table 2 The ingredient of A5 culture

Drug	culture (g/L)	Mother liquor (g/L)
$MnCl_2 \cdot 4H_2O$	1.86×10^{-3}	1.86
$ZnSO_4$	2.22×10^{-4}	0.222
Na_2MoO_4	3.9×10^{-4}	0.39
H_3BO_3	2.86×10^{-3}	2.86
$CuSO_4 \cdot 5H_2O$	7.9×10^{-5}	0.079
$Co(NO_3)_2 \cdot 6H_2O$	4.94×10^{-5}	0.0494

(2) The preparation of DOM

There are three main resources of DOM which are from sediment, solid and algea .

a) The preparation DOM from solid

The soil is red soil and it dried the soil and then milled through a 60 mesh sieve , add deionized water as soil -water ratio 1:10 , placed in 20 ℃, 200 r/min Shaker extract 12 h, the resulting samples were centrifuged 10000 r/min for 30 min, using 0.45μm sterile membrane filter to treat the supernatant , the filtrate is DOM, placed in brown reagent bottle refrigerated at 0 ℃ .

b) The preparation DOM from sediment

Lake sediments collected from Meiliang Bay , sifted dry after collecting spare . After milling through a 60 mesh sieve, adding deionized water as soil-water ratio of 1:10 , placed in 20 ℃, 200 r/min Shaker extraction 12 h, the resulting samples were centrifuged 10000 r/min 30 min, use 0.45μm no

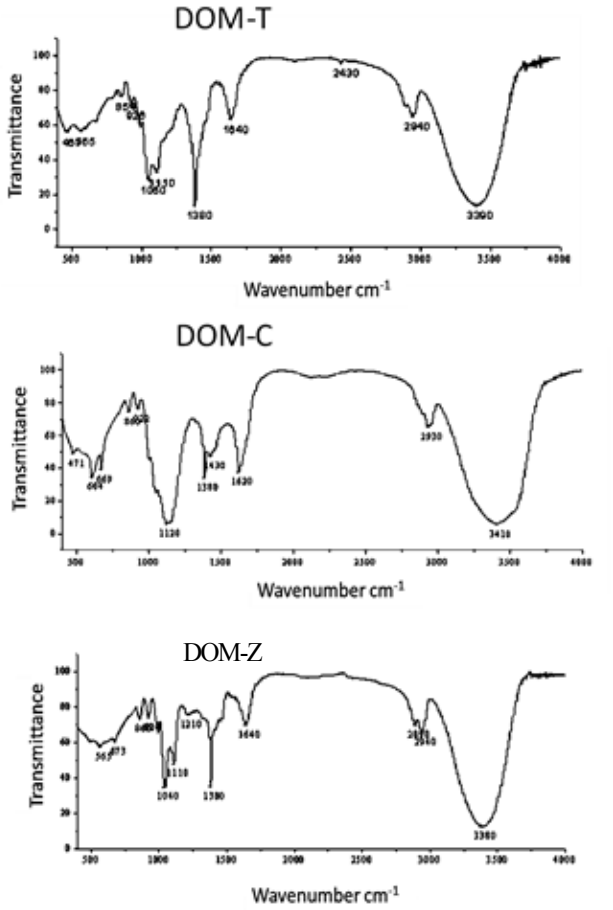

Fig.2 IR Spectra of DOM

bacterial membrane filtration to treat the supernatant, the filtrate is DOM, placed in brown reagent bottle 0 ℃ cold storage.[2)]

c) The preparation DOM from algea

Source of Microcystis aeruginosa is lab-grown algae . Algae was collected by centrifugation , frond was washed twice , add some deionized water and then through cell cracker broken for 10minits, the supernatant was collected by centrifugation over 0.45μm sterile filter , filtrate is algal - derived DOM.[3)]

(3) Determination of the nature of DOM and the determination of Heavy Metals in and outside the cells of Microcystis aeruginosa

Total organic carbon content of the samples was measured using a TOC analyzer , the main surface functional groups was scanned by UV , intelligent three-dimensional Fourier transform infrared spectroscopy and Three-dimensional fluorescence spectroscop.

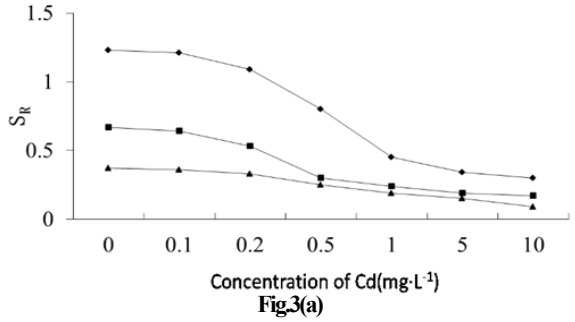

Fig.3(a)

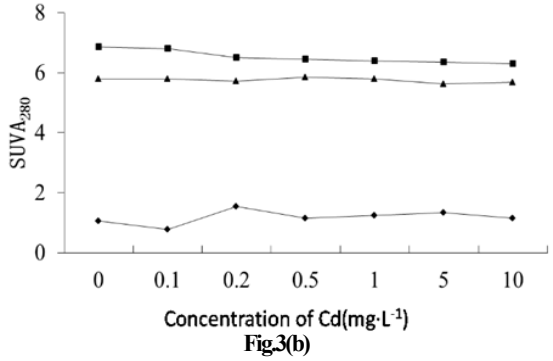

Fig.3(b)

3. RESULT AND ANALYSIS

(1) Determination of the nature of DOM

Determination of the nature of DOM is showed in the **Fig.2** IR Spectra of DOM .There are distinct absorption peaks in the infrared spectral curve of 3390cm^{-1}, 1040cm^{-1}, 1380cm^{-1} which suggests the three DOM contain many structure and functional groups that can complex with heavy metal,such as -COO-、-C=O、-NH_2.[4)]

(2) The action of DOM complex with heavy metal

S_R reflect the distribution, $SUVA_{280}$is positively correlated with organic matter distribution as showed in **Fig.3(a)(b) .**

The parameters of UV show that the changes of the concentration of cadmium impactes DOM-T most, followed by DOM-C, DOM-Z was least impacted, so DOM-C has the strongest humification and aromatic.

(3) Effects of dissolved organic matter(DOM) on the enrichment of cadmium(Cd) by Microcystis aeruginosa

From the **Fig.4** and **Fig.5**, we can see that intracellular cadmium the content of cadmium in and outside the cells have increased with increasing concentrations of cadmium and time going , so DOM from different sources are increased intracellular cadmium .

4. CONCLUSION

The cells both inside and outside of Microcystis aeruginosa have a good performance at enriching for cadmium and it will be more serious if DOM is in the water ,especially DOM-T. So we should pay attention to DOM in the water ,and do further study on DOM .

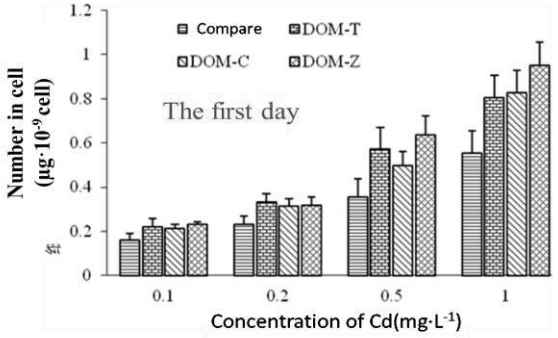

Fig.4(a)

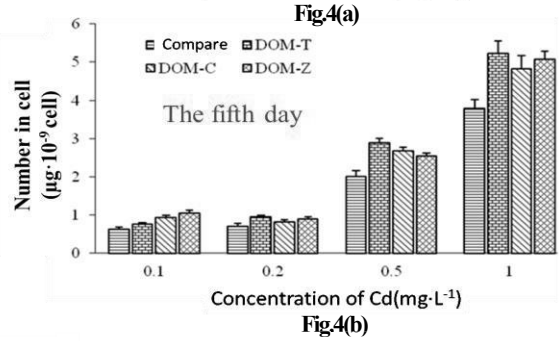

Fig.4(b)

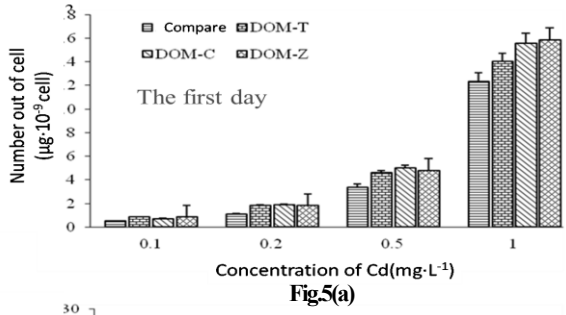

Fig.5(a)

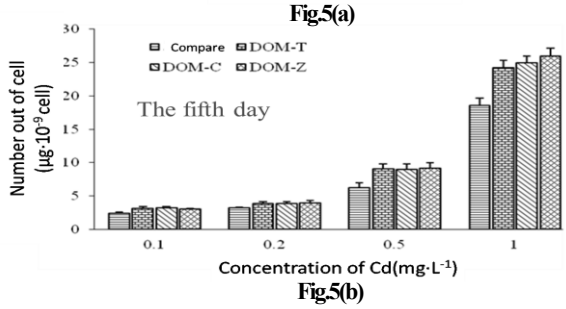

Fig.5(b)

5. REFERENCES

1)蒋疆，Cu_2_Cd_2_Pb_2_Zn_2_与草炭溶解态有机质络合关系的研究，硕士学位论文，2000.12

2)HUNT J F，OHNO T，HE Z，et al. Inhibition of phosphorus sorption to goethite，gibbsite，and kaolin by fresh and decomposed organic matter ［J］. Biol Fertil Soils，2007，44(2):277-288.

3)HUNT J F，OHNO T. Characterization of fresh and decomposed dissolved organic matter using excitation-emission matrix fluorescence spectroscopy and multiway analysis ［J］. Agric Food Chem，2007，55(6):2121-2128.

4)MCCART J F，ROBERSON L E，BURRUS L W. Association of benzo(a) pvrene with dissolved organic matter: prediction of dome from structural and chemical properties of the organic matter ［J］. Chemosphere，1989，19(12):1911-1920