Abstracts of Research Papers to be presented at the 48th Annual Sessions 2019

Technical Sessions : A - 01

Estimation of dissolved organic carbon in source and treated water to ascertain treatment efficiency and water safety with respect to trihalomethanes

D Ilangangedara[1]*, A N Navaratne[2]

[1]*National Water Supply and Drainage Board, Sri Lanka*

[2]*Faculty of Science, University of Peradeniya, Sri Lanka*

**Email: dilangangedara@gmail.com*

The use of chlorine as a disinfectant, although essential for pathogen control, leads to the halogenation of organic matter present in source water and produces trihalomethanes (THMs) and halo acetic acids[1] which have been identified as mutagenic and carcinogenic agents.[2] For this reason, the United States Environmental Protection Agency currently regulates THMs and halo acetic acids in drinking water.[3] Therefore, it is necessary to optimise plant conditions to minimize dissolved organic carbon (DOC) content in drinking water. The objectives of this study are to find a reliable method to quantify the DOC in natural water sources, identify the characteristics of DOC in source and treated water with respect to potential of THM formation and water safety and to measure the efficiency of water treatment process, considering the removal of DOC from treated drinking water.

To quantify the DOC in natural water sources, standard solutions of humic substances were prepared using the commercially available humic acid powder (Sigma Aldridge brand) and a graph was obtained by scanning the different standard samples, against a series of wave lengths from 190 to 1100 nm. Thereafter, the wavelength range was narrowed down (230 nm to 630 nm), as the absorbance at the other wavelengths did not provide considerable variations. The concentration of the organic matter in the sample can be estimated by comparison of the unknown with results obtained from the standard graph. To identify the characteristics of DOC in water with respect to THM formation and water safety, specific ultraviolet absorbance (SUVA) was calculated. In addition, graphs were constructed by scanning the raw water samples and treated water samples from the water treatment plants on the same day for comparison to check whether concentrations of DOC is decreased or increased during the water treatment process.

This study reports on the development of a method to measure the concentration of DOC in water using DR 5000 spectrophotometer by scanning the water samples against various wavelengths in the presence of standard DOC solutions. Once the concentration is estimated, SUVA can be used to evaluate the water safety with respect to THM formation. In a treatment plant, SUVA values of raw water and the treated water taken simultaneously can be used to assess the efficiency of the treatment process. According to the study, treated water SUVA values were generally lower than 2 L/mg-m. Therefore, as per the USEPA drinking water guidance on disinfection by-products, our potable water indicates a high fraction of hydrophilic non-humic matter with low UV absorbance, a low chlorine demand and low THM formation potential. Therefore, water can be assumed as safe with regard to formation of THM when chlorinated. However few water sources were contaminated with DOC, showing the highest value of 7.2 at Peradeniya University Water Treatment Plant where the Mahaweli River is the source of raw water. Furthermore, it can be concluded that water treatment plants operated by National Water Supply and Drainage Board at Kandy South Region are effective in DOC removal by the water treatment process.

Keywords

Natural Organic Matter (NOM), Dissolved Organic Matter (DOM), Trihalomethane (THM), Absorbance, Specific Ultra Violet Absorbance (SUVA)

Acknowledgement

The authors appreciate the corporation of National Water Supply and Drainage Board.

References

1. Croue, J.P.; DeBroux , J.F.; Amy, G.L.; Aiken, G.R.; Leenheer, J.A. 1999, Natural Organic matter – Structural characteristics and reactive properties. Formation and control of disinfection by products in drinking water; American Water Works Association.

2. Krasner, S.W.; Weinberg, H.S.; Richardson, S.D.; Pastor S.J.; Chinn, R.; Sclimenti, M.J.; Onstad, G.D.; Thurston, A.D. 2006; *Environmental Science and Technology*; Vol. 40; N0. 23; pp 7175-7185.

3. United States Environmental Protection Agency (USEPA); 2009, *Federal Register*; June 29, 2009; Vol 74, No. 123.

Technical Sessions : A - 02

Synthesis and evaluation of a transition metal ion- selective fluorescence sensor

M K B K Perera[1,2], S M Vithanarachchi[1]*, R D Wijesekera[1]

[1]*Faculty of Science, University of Colombo, Sri Lanka*

[2]*College of Chemical Sciences, Institute of Chemistry Ceylon, Rajagiriya, Sri Lanka*

**Email: ramanee@chem.cmb.ac.lk*

Heavy metals are a common pollutant of the environment. Some of these metals can be toxic and hence, developing methods to detect their presence is important. Fluorescent chemosensors are available for detection of these metal ions. However, some of them have limitations such as low sensitivity, variations in sensitivity at different pH, and low solubility in aqueous systems.[1]

A novel fluorescence probe (**L**) was synthesized by esterification of ferulic acid with 6-hydroxymethyl-pyridine-2-carboxylic acid methyl ester. The synthesized fluorescence probe 6-[3-(4-Hydroxy-3-methoxy-phenyl)-acryloyloxymethyl]-pyridine-2-carboxylic acid methyl ester (**L**), was purified with a yield of 35% and characterized using UV-visible, fluorescence, FTIR and 1H NMR spectroscopy. Fluorescence studies of L showed an emission at 342 nm when excited at the wavelength of 300 nm in acetonitrile/water (3:2) mixture at room temperature.

The fluorescence profile of the ligand in the presence of various metal ions such as Mn(II), Fe(III), Co(II), Ni(II), Cu(II), Zn(II), Cd(II), Hg(I), Mg(II) and Pb(II) was studied at pH ~7. The two main group elements studied; Mg(II) and Pb(II), did not show any quenching of fluorescence. Significant quenching of fluorescence (15%, 21% and 85%) was observed for Ni(II), Co(II) and Cu(II), respectively. From the studied transition metal ions Cu(II) was selected for further studies because it showed the highest quenching demonstrating the selective interaction of Cu(II) with ligand coampared to the other metal ions.

Study of the behavior of **L** and Cu-**L** complex at various pH (1, 3, 5, 7, 9, 12) indicated that quenching by Cu(II) was greater in the pH range 5-8. Copper (II) forms a 1:2 complex with the **L** as indicated by the fluorescence titration and the Job's plot. The Stern-Volmer plot indicated that at least two processes of quenching take place. At lower concentrations of Cu(II), a higher quenching rate is observed suggesting that the quenching process could be due to static quenching with the formation of a Cu(II)-**L** complex. At higher concentrations of Cu(II), a slower quenching rate is observed. This latter quenching could be due to a combination of both static and dynamic quenching. The tolerance limit in the presence of Zn(II) found as molar ratio of 2:1(Zn(II): Cu(II)) demonstrated that **L** is more selective towards Cu(II). The findings of this research suggest that the synthesized probe **L** has the potential to be used as an "on-off" fluorescence probe to detect Cu(II) in environmental samples.

Acknowledgement

Financial assistance by University of Colombo research grant (AP/3/2/2016/SG/18)

References

1. Jung, H. S.; Kwon, P. S.; Lee, J. W.; Kim, J. I. I.; Hong, C. S.; Kim, J. W.; Yan S.; Lee, J. Y.; Lee, J. H.; Joo, T. *J. Am. Chem. Soc.* **2009**, *131* (5), 2008–2012.