EVALUATION OF 2-MIB LEVELS IN SRI LANKAN WATER BODIES WITH SPECIAL EMPHASIS ON PRINCIPAL COMPONENT ANALYSIS (PCA)

G.S.S. Ganegoda[1,2], S.D.M. Chinthaka[3] and P.M. Manage[1,2*]

[1]*Centre for Water Quality and Algae Research, Department of Zoology, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*
[2]*Faculty of Graduate Studies, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*
[3]*Department of Chemistry, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*

2-Methylisoborneol (2- MIB) is well known to cause a musty, moldy taste and odor (T & O) in drinking water and also known to cause significant damage to the fish farming industry. The presence of T & O in potable water supplies is an increasing problem worldwide. In some parts of Sri Lanka, consumer complaints have been recorded for T & O issue even for treated water. Diverse ranges of algae and cyanobacteria are mainly responsible to produce odorous chemicals known as 2- MIB. The present study evaluates the relationship of water quality and 2-MIB in some selected water bodies using Principal Component Analysis (PCA). Sampling was carried out from June 2016 to June 2019 covering dry and wet seasons. 2-MIB contamination level in 17 reservoirs were analyzed by solid phase micro extraction coupled with gas chromatography mass spectrometry. Physico-chemical water quality parameters and identification and enumeration of phytoplankton were carried out following standard APHA (2003) method. In the PCA analysis, four clusters were identified along PC_1 axis in the score plot. The groups I, II, III and IV corresponded to samples with different water quality parameters. The pH, 2-MIB, total phosphorous, total cell density, conductivity, hardness, dissolved oxygen and total nitrogen exhibited a strong relationship among them and influenced the separation to four groups. Ridiyagama, Parakrama Samudraya, Nallachchiya and Kala reservoirs were clustered together to create the first cluster being the largest group of reservoirs in the study, whereas, Unnichchai, Kanthele, Jayanthi and Sagama reservoirs from Eastern Province were clustered together with similar temperature values to form the second cluster. All these reservoirs from Eastern Province are located around or within forest areas. Some similarity in geography might have illustrated in the second cluster. The third cluster consisted of reservoirs of Anuradhapura District, *viz.* Nachchadoowa, Tissa, Thuruwila and Nuwara with high DO, total nitrogen and conductivity values. Most of these reservoirs are located around residential and agricultural areas. Hence, the presence of high total nitrogen values is possible especially with usage of nitrogen fertilizers. Minneriya and Kaudullaresevoirs in Pollonnaruwa District belonged to the final cluster with high hardness, total cyanobacterial cell density, total phosphorous and pH values. The Pollonnaruwa District is highly affected with 'chronic kidney disease with unknown etiology' (CKDu) and two of the hypotheses for CKDu are 'hardness' and 'cyanotoxins'. With high alkalinity and high phosphorous levels, cyanobacteria tend to produce higher levels of toxins. Thus, PCA analysis arises a question of whether both of these hypotheses contribute together for CKDu. The principal components, $PC_1$and PC_2 contributed 71.0% of the total variance (81.1% cumulative variance), whereas PC_1 had variance of 4.54 (50.5% total variance) and PC_2 had variance of 1.83 (20.4% total variance). Altogether, PCA analysis found that 2-MIB level is strongly correlated with water quality parameters, such as, total phosphorous, pH and total cell density. Moreover, water bodies exhibited a geographical separation, as displayed in Anuradhapura and Pollonnaruwa Districts and Eastern Province being clustered in three independent clusters.

Financial assistance from the National Science Foundation, Sri Lanka (Grant No. NSF/RG/2016/EB/04) is acknowledged.

Keywords: 2-MIB, PCA analysis, Taste and odor, SPME, Cyanobacteria

*pathmalal@sjp.ac.lk