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Effect of Total Phosphorous, pH and Electric Conductivity on the Seasonal Occurrence of Geosmin in Some Water Bodies Sri Lanka

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Abstract

Cyanobacteria and actinomycetes are well known for their capability to produce taste and odour (T and O) causing compounds in water as their secondary metabolites. Geosmin (trans-1, 10-dimethyl-trans-9-decalol) is one of the major T and O causing compounds producing earthy T and O and has become a major issue in worldwide water sector. Despite of not detecting as a human health hazard, presence of this odorant directly causes drinking water aesthetically unacceptable and leads to consumer rejection of treated drinking water due to conventional treatment processes do not remove Geosmin. Geosmin is prevailing in some Sri Lankan raw water bodies where water is taken for treatment purposes by National Water Supply and Drainage Board. The objective of the present study was to find the seasonal variation of Geosmin in Sri Lankan water bodies with respect to some physico-chemical aspects aiming to manage the T and O issue in Sri Lanka. Sampling was carried out from June 2016 to June 2018 covering both dry and wet seasons. Geosmin contamination level in 20 water bodies in Sri Lanka were analysed by Solid Phase Micro Extraction (SPME) coupled with Gas Chromatography Mass Spectrometry (GC/MS). The physico-chemical parameters of the water body were measured using standard spectrometric and titrimetric methods. Quantification and enumeration of phytoplankton were carried out with standard method using Acidified Lugol's solution at final concentration of 1% following natural sedimentation. Geosmin concentration of the analysed samples varied between 7.8 ± 3.27 to 34.6 ± 1.32 ng/L throughout the dry season and from 0 to 18.3 ± 1.22 ng/L during the wet season. Among the selected raw water bodies; the highest level of Geosmin was recorded in Sagama tank (34.6 ± 1.32 ng/L) while the lowest was detected in Nallachchiya tank (7.8 ± 3.27) during the dry season. During the wet season, the highest level of Geosmin was recorded in Sagama tank (18.3 ± 1.22 ng/L) where not detected levels were recorded in Kondawatuwana tank, Jayanthi tank, Kanthale tank and Unnichchi tanks. *Anabaena* sp., *Microcystis* sp., *Cylindrospermopsis* sp., *Oscillatoria* sp., *Cyclotella* sp., *Volvox* sp., *Gloeocystis* sp., and *Uroglenopsis* sp. are the major taste and odour forming cyanobacteria recorded from the reservoirs during the study. Total cyanobacteria cell density varied between $102,560 \pm 2.28$ cells/ml (Thuruwila tank) to $3,649 \pm 0.34$ cells/ml (Ridiyagama tank) in dry season whereas from $98,235 \pm 4.73$ (Beire lake) cells/ml to 135 ± 3.11 cells/ml (Kanthale tank) during wet season. Detected Geosmin level in dry season was greater than the wet season. The Pearson's correlation coefficient analysis revealed a significantly strong positive correlation between Geosmin level and the total phosphorus concentration ($r=0.850$, ($p<0.05$)), water pH ($r=0.788$ ($p<0.05$))) and the Electrical Conductivity level ($r=0.612$, ($p<0.05$)). Further, it was found that cyanobacteria cell density ($r=0.691$, ($p<0.05$))) had a significant positive correlation with Geosmin level in water bodies. These findings are crucial in understanding and managing natural reservoirs to eliminate T and O issue to provide a better quality drinking water to Sri Lankan general public.

Keywords: Geosmin, SPME, GC/MS, Physico-chemical parameters, Seasonal variation