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**Cyanobacteria and Geosmin: The Influence of Nitrogen versus Phosphorous
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Abstract

Geosmin (*trans*-1, 10-dimethyl-*trans*-9-decalol) is a key compound which causes taste and odour (T&O) issues in water. Despite no recorded health hazards, water consumers reject the water with geosmin due to its unpleasant earthy T&O. Cyanobacteria are prokaryotes, grow in light habitats preferring neutral or alkaline conditions and recorded to produce geosmin. The aim of this study was to screen any correlation between geosmin and cyanobacteria. Geosmin contamination level in 12 raw water bodies used to drinking and treatment purposes in Sri Lanka covering 5 districts (Anuradhapura, Pollonnaruwa, Ampara, Batticaloe and Trincomalee) were analyzed using Gas Chromatography-Mass Spectrometry coupled with Solid-phase micro extraction. Enumeration and identification of cyanobacteria was carried out using standard APHA method. Prominent cyanobacteria identified were *Anabaena* sp., *Microcystis* sp., *Oscillatoria* sp. and *Cylindrospermopsis* sp. Geosmin levels ranged from 7.8 to 10.9 ppt where the highest level was recorded in Nuwara tank (10.9 ppt) and the lowest was detected in Nallachchiya tank (7.8 ppt). Jayanthi tank, Sagama tank, Kondavatuwana tank, Unnichchi tank and Kantale tank had geosmin levels below 1.5 ppt (Minimum detection level 1.5 ppt) during the sampling time. 68% of the sampling locations exceeded the human threshold level (5 ppt). According to a questionnaire survey, more than 95% end water consumers rejected drinking water contaminated with geosmin (N=200). Total Cyanobacteria cell Density (T.C.D) was positively correlated with geosmin and total phosphorous ($p < 0.05$). Moreover *Oscillatoria* sp., *Anabaena* sp. and *Cylindrospermopsis* sp. densities showed significant positive correlations ($p < 0.05$) with geosmin contamination levels along Pearson Correlation Coefficients (P.C.C) of 0.765, 0.750 and 0.620 accordingly. However there was no significant correlation observed between *Microcystis* sp. and geosmin. Further geosmin showed significant positive correlation ($p < 0.05$) with total phosphorous (P.C.C 0.850), electrical conductivity (EC) (P.C.C 0.796), and pH (P.C.C 0.788). Increment of pH value leading to alkalinity is a known optimum condition for cyanobacteria growth while the current study shows alkalinity is favorable for geosmin. No significant correlation was obtained between total nitrogen (Addition of Nitrate-N, Nitrite-N, Ammonia-N) and geosmin nor T.C.D and total nitrogen. According to Nitrogen to Phosphorous (N:P) ratio, Jayanthi tank, Sagama tank, Nachchadoowa tank, Kala tank, Nallachchiya tank, Thuruwila tank and Parakrama Samudra had nitrogen limiting situation ($N:P < 10$), whereas Kondawatuwanana tank, Unnachchi tank, Kanthale tank and Tissa tank had phosphorus limiting situation ($N:P > 17$). Nuwara tank had a N: P ratio of 16.2 which signifies either nitrogen or phosphorous can be limited ($N: P = 10-17$). Based on total nitrogen and total phosphorous values, Jayanthi tank, Sagama tank, Kondawatuwanana tank and Unnachchi tank classified to be Oligotrophic and Nachchadoowa tank, Kala tank, Nallachchiya tank, Thuruwila tank, Tissa tank and Nuwara tank to be Eutrophic status. Thus, the results of the study indicate there is a direct positive variation between geosmin, cyanobacteria and total phosphorous.

Keywords: Geosmin, Cyanobacteria, N:P ratio, Solid-phase micro extraction, Gas Chromatography-Mass Spectrometry