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EVALUATION OF WELL WATER QUALITY IN MAHARAGAMA WITH SPECIAL EMPHASIS ON PRINCIPAL COMPONENT ANALYSIS (PCA)

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Groundwater contamination adversely affects the health of the individuals who consume well water. In the present study groundwater samples were collected from Jambugasmulla, Navinna, Wijerama, Gangodawila South B, and Wattegedara including University of Sri Jayawardhenapura premises to cover five Grama Niladhari (GN) divisions situated in Maharagama. The area is continuously populated and highly urbanized with different anthropogenic activities and groundwater aquifers are very shallow and susceptible for human induced pollution. The purpose of the study was to analyze and compare overall well water quality in Maharagama area using Principal Component Analysis (PCA) with the aid of microbiological and some physico-chemical parameters with reference to SLS drinking water standards. Eighty wells were sampled monthly using simple random sampling method from January 2012 to October 2012 for microbial and physico-chemical parameters by standard analytical methods and the PCA was carried out to evaluate the relative water quality among GN divisions.

According to PCA analysis, both Jambugasmulla and Wijerama showed similar characteristics. They are clustered together with high BOD_5 indicating high organic pollution and the relationship with high total coliform and faecal coliform counts suggesting as unacceptable for drinking purposes. The pH values were also higher than other GN divisions recorded. Wattegedara GN division contained the highest polluted wells with the highest nitrate (77.31ppm), COD (27.40 mg L^{-1}) and salinity (0.0078 mg L^{-1}) with high total coliform (412CFU/100 mL), faecal coliform (250CFU/100 mL) indicating both chemical and microbiological pollution. Navinna GN division had a distinctly high conductivity value (70000 µS cm^{-1}) and located separately among other clusters. Apart from PCA analysis, results showed that both total and fecal coliform counts ranged between 0 to >1100 CFU per 100ml ($p<0.001$), sometimes exceeding more than1100 CFU/100 mL. On average the total nitrate concentration was significantly high ($p<0.001$) and in some locations in the Wattegedra GN division nitrate concentration exceeded by more than 60 mgL^{-1}. Mean ranges of nitrate (0.64-77.31 mg L^{-1}), pH (4.11-7.14), conductivity (114-70000 µS cm^{-1}), BOD_5 (0.03-19.40 mg L^{-1}) and COD (0.14-64.13 mg L^{-1}) were recorded, respectively.

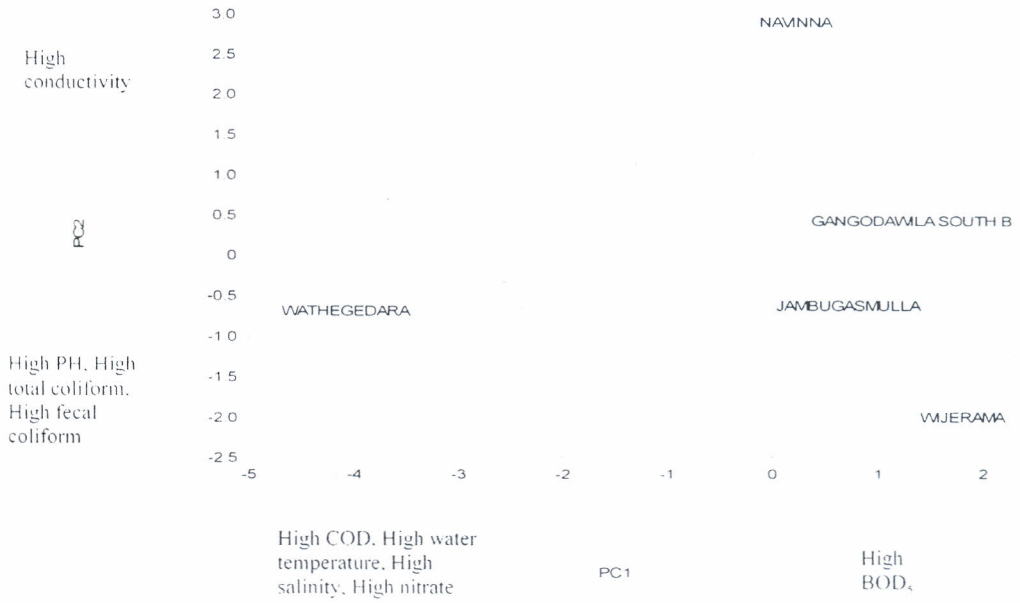

Figure 1. General Situation of the study area (With Comparison of Five GN divisions in Maharagama) using Principal Component Analysis (PCA)

The results of the study showed that overall water quality of the area is deteriorated and all parameters tested were far above the standard given for drinking water quality by SLS. PCA analysis showed that the pollution status of the Jambugasmulla and Wijerama area is more or less similar where Navinna area which has a solid waste dumping site had highest conductivity, nitrate, phosphate and microbial density which far exceeded the drinking water standards. As the study area has a very shallow water table it is very susceptible for pollution making the situation more dangerous. Although people in the area get the water supply from National Water Supply and Drainage Board, many people in this area still use their wells for water consumption. Therefore it is essential to take appropriate actions to safe guard the human population who consumes ground water to avoid water borne illnesses.

Keywords: Groundwater, physico-chemical parameters, PCA

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