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Atmospheric chemical composition of bulk precipitation of the vicinity of oil refinery in Sapugaskanda, Sri Lanka

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Rainwater quality is critical because it can be used to forecast air quality. The aim of the current study was to investigate the chemical characteristics of bulk precipitation in Kelaniya, Sapugaskanda, and Siyambalape, an area close to an oil refinery in Gampaha District, one of Sri Lanka's most densely populated and urbanized districts. Wet precipitation samples were analyzed for pH, conductivity, Na^+, K^+, Mg^{2+}, Ca^{2+}, F^-, Cl^-, NO_3^-, SO_4^{2-}, Pb, Cu, Mn, Al, Zn, Ni, Cr, Cd, and Fe for a total of 18 samples between 2020 July and 2020 October. The results obtained were compared with 6 samples taken from a background area situated in Kidelpitiya, Meegoda where the anthropogenic influence is minimum. Volume-weighted average concentrations of the major ionic species present in precipitation samples were in the order of $F^- < K^+ < NO_3^- < Mg^{2+} < Cl^- < SO_4^{2-} < Ca^{2+} < Na^+$. Neutralization of the acidic species would take place due to the presence of $MgCO_3$ and $CaCO_3$. Other than the anthropogenic sources natural sources were also considered. When considering a marine contribution, SO_4^{2-}/Na^+, Ca^{2+}/Na^+, and Mg^{2+}/Na^+ ratios are higher than the reference value suggesting that contribution of sources be possible other than marine. When considering a soil contribution, SO_4^{2-}/Ca^{2+}, NO_3^-/Ca^{2+}, Na^+/Ca^{2+}, and Cl^-/Ca^{2+} ratios are higher than the reference value suggesting that contribution of sources be possible other than soil. It was also found that Al is the most predominant trace element in the area while Fe is the least (All are in metallic forms not in the ionic forms). Investigation of correlation between major ionic species and elements (Ca^{2+}, SO_4^{2-}, Al, Cu, Zn, and NO_3^-) in the wet precipitation samples identified probable anthropogenic sources such as heavy traffic, biomass burning, large-scale constructions, and waste incineration. The highest correlation between Na^+ and Cl^- is probably due to marine contribution. A comparison between the background and the study area was carried out to identify the difference between the chemical compositions of the atmosphere during the given period suggesting that the area has a higher chemical composition of the species interested rather than the background. Also, this study reveals the effect of the Covid-19 pandemic on the reduction of the chemical composition of such species of the atmosphere in the area of interest. This study reveals that the chemical composition in the atmosphere is strongly dependent on both anthropogenic and natural phenomena around the area of study.

Keywords: Bulk precipitation, Ions, Principal component analysis, Chemical elements, Correlation