Influence of Crustal Sources and Necessity of Direct Measurements of Bicarbonate in Rain Water: An Indian Perspective

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It has been observed that rainwater composition is influence by crustal sources in India. Results reported from most Indian continental sites show remarkably high concentrations of calcium as compared to other sites of the world. Higher calcium concentrations are contributed by $CaCO_3$ present in soil dust in atmosphere which contributes bicarbonate (HCO_3^-) ions in rain water. Due to this reason, rain water is noticed alkaline in India. Normal practice of chemical analysis of rain water includes the determination of Na^+, K^+, Ca^{++}, Mg^{++}, NH_4^+, F^-, Cl^-, NO_3^-, SO_4^{--} ions and pH. Usually, HCO_3^- is calculated based on pH. The present study shows that calculated HCO_3^- concentrations are underestimated which affect ion balance and QA/QC in analysis. In this study, direct measurements of HCO_3^- have been attempted to eliminate the error in ion balance. The results show a significant improvement of ion balance by inclusion of measured HCO_3^- concentrations. In the study, sulphuric acid titration method was followed to determine HCO_3^- concentratons in rain water. A total of 166 samples of rain water were collected at Hudegadde, a rural site in south-west India. Out of 164 samples, 18 samples (11%) had HCO_3^- concentrations >100 µeq/l and 4 out of 18 samples (22%) had HCO_3^- concentration >200 µeq/l which was very high corresponding to their highs pH values. Correlation coefficient (r^2) of Ca^{++} in case of calculated HCO_3^- was 0.35 which was improved to 0.43 while considering measured concentrations. This approach reduced the relative difference between anion sum and cation sum and improved the ion balance suggesting that without HCO_3^- measurements in rain water, chemical analysis of rain water should be treated incomplete in Indian perspective.

Key words: Alkaline pH; buffering; bicarbonate; ion balance; rural site; calcium and pH.