Abstract No: 337 ***Natural Sciences***

A PORTABLE PAPER-BASED TOOL FOR THE DETERMINATION OF ALKALINITY

M.I.N. Fernando and M.N. Kaumal*

Department of Chemistry, Faculty of Science, University of Colombo, Sri Lanka
**mnkaumal@sci.cmb.ac.lk*

Water can be contaminated with different acids and bases and this can alter the neutral pH of natural water. In the presence of bases such as carbonate, bicarbonate and hydroxide ions pH of the natural water can be increased. Estimation of alkalinity is a method to determine the total bases available in natural water samples. Alkalinity can be considered as an important parameter in the determination of water quality. Titrimetric method-based techniques are the accepted approach for the determination of alkalinity in aqueous samples. Time taken to transport the water samples from the point of collection to the laboratory can alter the original level of alkalinity in the samples. A simpler on-site method for the determination of alkalinity can provide accurate results and reduce the analysis cost.

We are reporting a semi-quantitative on-site method which is capable of determining alkalinity. This paper-based tool can be used to determine whether the alkalinity of a water sample is greater than a predetermined threshold value, and the threshold value can be set as the maximum permitted level of alkalinity. With the use of this method, only the samples with alkalinity greater than the threshold value have to be directed to a testing laboratory to estimate the exact level of alkalinity. This approach can reduce the number of laboratory tests and time taken for the analysis. A three dimensional paper-based microfluidic system was developed for the determination of total alkalinity using methyl orange and phenolphthalein indicators. A custom made iron mould was used to create microchannels on the chromatographic paper. Three layers of chromatographic papers were used to develop this three dimensional (3-D) tool. The first layer was used to introduce the sample. The second paper layer was soaked with a known amount of a strong acid. The third layer was treated with methyl orange or phenolphthalein, based on the requirement. The sample (5 µL) which is introduced on to the first layer will travel to the third layer passing the acid-containing second layer. Depending on the amount of acid in the second layer and the level of alkalinity in the sample, pH of the sample eluting to the third layer will vary. Final color of the indicator can be used to determine whether the alkalinity is greater than the predetermined threshold value.

False negative and false positive rates calculated for the selected samples were used to determine the sensitivity and selectivity of the device. Based on the threshold value, amount of acid in the second layer can be adjusted. Samples were tested using standard titrimetric methods to validate the results. This method produced satisfactory results for a series of samples with the alkalinity in the range of 370 to 430 mg/L at a threshold alkalinity level of 400 mg/L.