Introduction

Carbonate or bicarbonate concentration in a sample may be a function of carbon dioxide. As carbon dioxide comes into contact with aqueous solution, it is converted into carbonic acid, $\text{H}_2\text{CO}_3$, which is in turn converted into bicarbonate, $\text{HCO}_3^-$, or carbonate, $\text{CO}_3^{2-}$ depending on the pH. At pH levels above 6.3, carbonic acid is converted into bicarbonate. At pH levels above 10.3, carbonic acid or bicarbonate, is converted into carbonate. Therefore, the analysis of either carbonate or bicarbonate is dependent upon the pH of the mobile phase.

Samples may either have carbonate by nature or they may absorb CO$_2$ from the atmosphere to give the sample some form of carbonate. When analyzing carbonate or bicarbonate in a sample, it is important to realize that depending on the sample pH, the carbonate/bicarbonate concentration may change slightly due to CO$_2$ absorption from the atmosphere.

Ion Chromatography is an excellent method for the quantification of carbonate/bicarbonate. Only single-column IC (SCIC) method can be used for carbonate/bicarbonate analysis. Samples such as different types of beverages, soils, and food can be analyzed easily using this method.

Results and Discussion

As mentioned earlier, depending on the pH of the mobile phase, carbonate/bicarbonate will elute and can be analyzed only as one component. It is not possible to separate bicarbonate from carbonate. The best method for analyzing carbonate/bicarbonate is using the Allsep Anion column with 4mM p-Hydroxybenzoic acid, pH 7.5 mobile phase. Under this condition, carbonate/bicarbonate is analyzed as bicarbonate. Figure 1 shows a standard chromatogram of bicarbonate along with other anions. Under this condition, bicarbonate is well separated from fluoride and chloride.

Figure 2 shows a chromatogram of a cola sample. The sample was eluted with 3mM p-HBA, pH 7.5. This mobile phase was used with the cola sample to give a better separation of carbonate from the void. Dilution of the cola with deionized water was the only sample preparation required.

Conclusion

Ion chromatography is a reliable and simple method to determine carbonate/bicarbonate. The Allsep Anion column separates bicarbonate from other weakly retained anions such as chloride and fluoride.