E2-08 Chemical speciation to study the fertilizing action of dolomite

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In the environment and in many other areas, measurement of the total amount of a substance present is not sufficient and speciation, i.e. the oxidation state, concentration and composition of each species present, is required. Computing and analytical methods have led to an increased understanding of the speciation underlying many chemical reactions.

Dolomite has been used in plantations to rectify magnesium and calcium deficiencies in the soil and to reduce the high soil acidity.

This work was aimed to study computer aided chemical speciation using experimentally analysed total amount of components present in dolomite to check the suitability as a supplement of essential metals. (Equilibrium simulation program, MINTEQA2 was used to perform calculations).

Analysis of the total components was carried out as follows:

Calcium, magnesium chloride and nitrate	:	Titrimetry
Iron, aluminium and phosphate	:	Spectrophotometry
Carbonate, sulphate and silicate	:	Gravimetry

Experimental analysis showed that calcium (26.90%), magnesium (5.30%), iron (0.07%), aluminium (0.005%), carbonate (47.69%), sulphate (5.76%), phosphate (0.02%), chloride (5.61%), nitrate (2.48%) and silicates (0.51%) are present in the sample.

Computer simulations by varying the pH of the system gave the following observations:

- Most of the calcium is present as Ca^{2+} up to pH 8 and precipitation starts at pH 6 as hydrapatite.
- Total magnesium present in the sample is in the dissolved form (Mg^{2+}) up to pH 9 and completely precipitated as $Mg(OH)_2$ above pH 11.
- Iron is completely dissolved up to pH 7 as Fe^{2+} and precipitated as FeO above pH 8.
- Precipitation of aluminium occurs as $Al(OH)_3$ at pH5<pH10. Al^{3+} is the dissolved species up to pH 5.
- Solubility of silicates is very high at pH 7-12. Below pH 7 all the silicates are present as silicic acid

As all these components are dissolved more than 99% at pH 4, which is the soil pH of tea cultivation, dolomite can be added directly to the soil.