



# Hibrix™ Chelator Technology

## **Hibrix Chelator Technology for Stabilizing Nutrient Hydroxides In Chelate-Soluble Form**

The one half of Hibrix Chelator Technology, achieves re-use of the chelator as it is not absorbed into the plant – being repelled immediately, the cation load is pulsed through the plant skin barrier.

The other half of the Hibrix Chelator Technology is to ensure that on the return journey of the barren chelator, there are more cations to capture and shuttle back to the plant.

This is where the stabilization of nutrient hydroxides, in chelate-soluble form comes in.

It is possible to form colloidal hydroxides sufficiently fine that they do not initially settle out and form a layer which is poorly exposed to chelate in solution. However with Brownian motion they eventually collide with each other, and aggregate until they are of sufficient size to settle out.

Furthermore, the fully hydroxylated precipitates are generally not the most thermodynamically stable, and through the effects of thermal vibration they tend to lose water and form more stable crystalline forms.

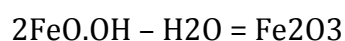
Formation of such crystalline forms is very undesirable – they can “cement” together and create hardened sediments difficult to deal with.

As an example, ferric hydroxide can lose one H<sub>2</sub>O to form Goethite:



Goethite is significantly more difficult to dissolved than ferric hydroxide.

In further stabilization, two adjacent Goethite molecules can lose further H<sub>2</sub>O to form Haematite:



Haematite is extremely difficult to resolve.

Hibrix Chelator Technology applies saccharides to stabilise the fully hydroxylated precipitates as micro-colloids, preferably containing only some tens of cations, or no more than hundreds.

There are three parts to this technology.

The first part of this Hibrix Chelator Technology for stabilising cation hydroxide micro-colloids relates to this management of micro-colloid size.

The management of micro-colloid size is an extremely difficult and complex area because one is dealing with interface physical chemistry where paths of the reactions, and physical conditions such as temperature and local shear intensity, levels of supersaturation, surfactants etc play a large role.

Ultra-fast precipitation under very high shear conditions, with attention to other key factors such as component concentrations and pH ensure achievement of the objective.

This degree of complexity in such multiphase (heterogenous) reactions is completely unlike normal homogenous (single phase) preparative chemistry such as the simple chelation of iron by mixing a dissolved salt such as iron sulphate with a solution of chelate such as sodium EDTA.

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It is instructive to note at this point, that it is merely for shorthand that ferrous hydroxide is written  $Fe(OH)_2$ ; it is actually tri-axially complexed, water taking up the further 4 positions (X,Y and two Z) :  $Fe(OH)_2 \cdot 4H_2O$ .

Now the iron aggregates initially as a thin, diaphanous two-dimensional matrix, the hydroxyls spacing equally between the Fe centres in the X and Y dimensions.

The second part of the Hibrix Chelator Technology for stabilising cation hydroxide micro-colloids relates to the stabilising of these layers so that they do NOT give up water with continued thermal vibration, and remain in the most chelate-accessible form.

the thin, diaphanous two-dimensional matrix films are provided with polyol groups as they form, which displace a proportion of water molecules at the Z-axis positions; which leads to stabilised layering of the lattices with the polyols acting as a displaceable glue (i.e. their relatively weak bonds can be broken, and edge Fe's surrendered to returning chelate).

The third part of the Hibrix Chelator Technology for stabilising cation hydroxide micro-colloids relates to the stabilising of the formed micro-colloids so that they do not aggregate with Brownian kinetics.

Essentially, they must be dispersed by an appropriate surfactant.