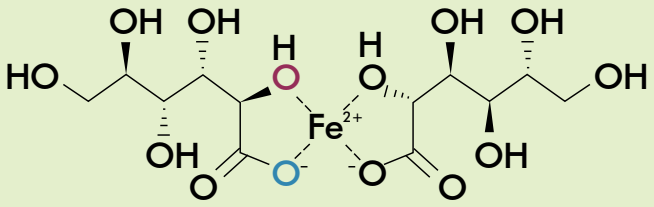
JOST CHEMICAL®

It's in the Details

What is a Chelate?

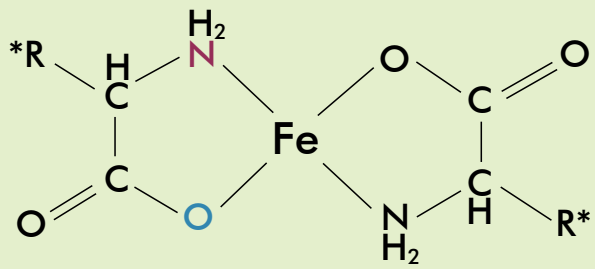
There has been some confusion in the dietary ingredient industry with the term "chelated minerals." Some would have us believe that only metals complexed with amino acids are chelates. In reality, a chelate is any metal that is attached to an anion (negatively charged group) with more than one attachment site. Chelation means that the anion has two or more separate sites to which the metal is bonded. Considering this definition, a relevant example of a chelate is ferrous gluconate. Gluconic acid, $C_6H_{12}O_7$, has two bonding sites: the ionic acid oxygen ($-COO^-$) and the oxygen on the hydroxyl group (-OH). Both sites form bonds with the metal ion Fe^{2+}. The chemical structure shown below for ferrous gluconate shows that the metal ion (Fe^{+2}) is bonded in two places with each anion.

Ferrous Gluconate Chelate



The ferrous gluconate structure is similar to that of amino acid chelates, such as ferrous amino acid chelate, which are bonded in two positions at the acid ($-COO^-$) and amine ($-NH_2$) functional groups (shown below).

Ferrous Amino Acid Chelate



Bioavailability Advantage of Mineral Chelates

Chelated minerals are the preferred choice of many nutritionists because their complex structures better survive passage through the stomach and into the small intestine where absorption into the bloodstream takes place. The reason chelated minerals can survive the onslaught of acid and enzymes in the stomach is because they are bound to ligand anions in multiple locations, as described above. The strength of the multiple bonds between the chelator and metal ion hold the mineral complex together through the acidic environment of the stomach and into the small intestine. With non-chelated mineral salts, stomach acid easily liberates the metal ion. The large macromolecules are more readily

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Did You Know?

Many of the high purity mineral salts manufactured by Jost Chemical are chelates, including:

Citrates	**Ascorbates**	**Fumarates**
Gluconates	**Lactates**	**Malates**

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absorbed through the intestinal wall than free ions, which are typically flushed through the intestine without being absorbed into the bloodstream.[1]

In widely used non-chelated mineral salts such as ferrous sulfate (shown below), once the stomach acid liberates the metal ion, it remains free and mobile in solution and is quickly flushed through the intestine with minimal absorption.

$$FeSO_4 + 2H^+_{(Stomach\ Acid)} \rightarrow H_2SO_4 + Fe^{+2}_{(Free\ ion)}$$

In the chelated mineral example, ferrous gluconate, both the acid $-COO^-$ and the hydroxyl –OH bonds would have to be broken to free the metal ion. Instead, the strong bonds of the complexed metal molecule remain intact through the stomach and into the intestine where the mineral can be absorbed and put to work in the body. It is postulated that this slower, later digestion allows for greater absorption, and thus superior bioavailability of the mineral in the chelated form.[2]

Another related example is the chelated mineral calcium citrate. The strongly bonded calcium citrate shows superior bioavailability when compared to the simple, non-chelated ingredient calcium carbonate.[3]

There is little scientific evidence indicating that amino acid chelates have superior bioavailability to the chelated mineral ascorbates, citrates, fumarates, gluconates, lactates and malates. In fact the European Food Safety Authority has concluded that due to a lack of data supporting the use of the amino acid chelates (other than the pure bisglycinates), their safety cannot be assessed.[4]

The chelated mineral products offered by Jost Chemical provide superior nutritional value to dietary formulators and, unlike the "proteinates" and "amino acid chelates" made with soy & rice protein isolates, can be readily verified for identity, purity and potency by standardized compendial test methods.

[1] *See the discussion on the requirement for good absorbance of complexed metals in the small intestine in the Delano Reports by A. Hashimoto, www.delano.com/Articles/Mineral_forms_compared.html.*

[2] *See Kirchoff, The Treatment of Iron Deficiency Anemia with Iron Chelate Tablets, Therapiewoche, 33/37, 4833-42 (1983) for discussion.*

[3] *J Clin Pharmacol. 2000;40:1237-12; also see the discussion and data from the work of M GADOMSKA-NOWAK at www.pjps.pk/CD-PJPS-21-2-08/Paper-5.pdf.*

[4] *The EFSA Journal (2009) 1077, 3-5.*

Jost Chemical Co produces a broad range of chelated mineral salts in a cGMP-compliant manufacturing facility in St. Louis, Missouri. Most of these products are backed by the USP/FCC and FDA as suitable for use in foods, dietary supplements, and pharmaceuticals.