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# Residue from Sequestrene 138 Fe EDDHA Clogs Filters: Alternatives for Chelated Iron in Liquid Fertilizer Systems

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# Residue from Sequestrene 138 Fe EDDHA clogs filters: Alternatives for chelated iron in liquid fertilizer systems

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**Background**

Ferric iron rapidly precipitates as FeOH and becomes biologically unavailable, so chelated iron is commonly used in liquid fertilization systems to keep it in solution. Chelates are ligands that encapsulate metal ions and shield them from precipitation. The most common chelating agents in agriculture are:

EDDHA (ethylenediamine-N,N'-bis(2-hydroxyphenylacetic acid),
DTPA (diethylenetriaminepentaacetic acid)
EDTA (ethylenediaminetetraacetic acid)
and for monocots in deep-flow hydroponics:
HEDTA (also called HEEDTA) (Bugbee, 2004)

Commercial versions of these chelates are sold complexed with iron and are ready to apply.

The binding affinity of EDDHA, DTPA, and EDTA varies with pH (Figure 1).

The binding strength of EDTA is reduced above pH 6.2 (orange line) and DTPA is reduced above 7.0 (green line). For this reason, EDDHA is widely used in soils or media above a pH of about 7.5.
HEDTA is a weaker chelate that helps provide iron for monocots in hydroponics (Bugbee, 2004).

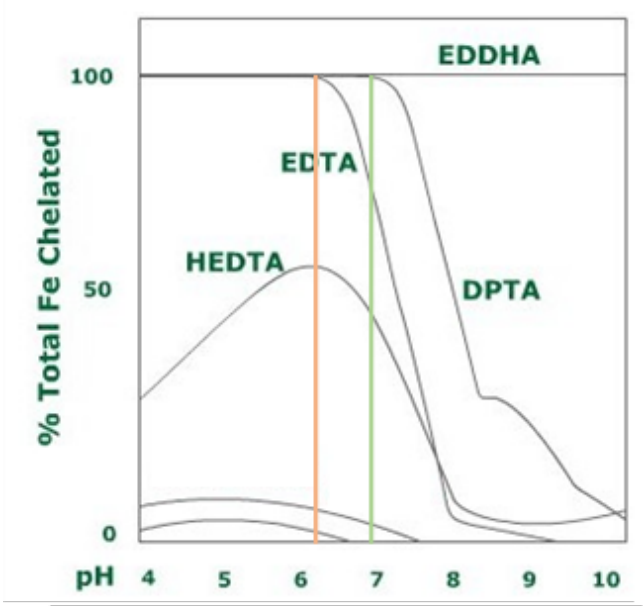


Figure 1. Fraction of iron bound in chelate for EDDHA, EDTA, and DPTA from pH 4 to pH 10.

We found that Sequestrene 138 Fe-EDDHA (Ciba-Geigy; now BASF) resulted in a sediment at the bottom of fertilizer concentrate tanks, which are typically mixed at 100x the final fertilizer concentration. This sediment repeatedly plugged downstream filters.

The objective of this study was to determine factors associated with this sediment and explore alternative approaches to providing chelated Fe in liquid fertilizer systems.

**Methods and Results**

The fertilizer concentrate was replicated in four, 1 liter beakers. The beakers were partially filled with deionized water and 57 g of Peter's 21-5-20 general purpose fertilizer, 0.9 grams of $KH_2PO_4$, and 1 mL of 400 µM $CuCl_2$ were added to each beaker. The solutions were then brought to 1 L with deionized water. Sequestrene 330 Fe chelated iron was added the concentrated stock solution at 0.4 g per L while Sequestrene 138 Fe was added at 0.4 and 0.8 g/L. These concentrations are required to achieve 4 mg per liter after a 1 to 100 dilution through a proportioner.

The beakers were placed on a magnetic stir plate for 10 minutes and left at room temperature over night to allow any undissolved material to settle. The next day, the sediment was visually compared among treatments.

An unidentified sediment occurred from the Sequestrene 138 Fe (Figure 2).

A second, new bag was purchased and it resulted in the same sediment formation.

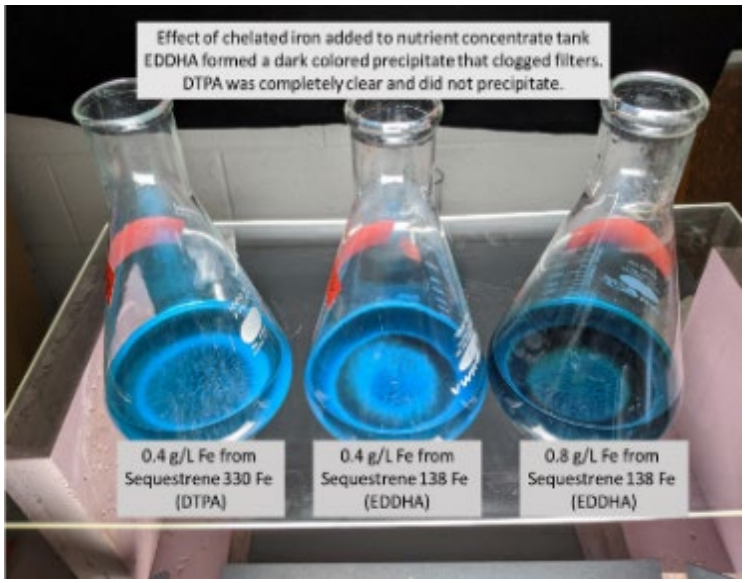


*Figure 2. Stock fertilizer concentrate mixed in 1 L beakers with 0.4g/L Fe-DTPA, 0.4g/L Fe-EDDHA, and 0.8 g/L Fe-EDDHA (left to right). Photo taken one day after mixing.*

*Note the sediment on the bottom of the EDDHA*

In a second study three chelates were evaluated at a concentration of 0.4 g/L:

1) Haifa Micro Fe-EDDHA
2) Nouryon Rexolin Q40 Fe-EDDHA
3) Nouryon Rexolin X60 Fe-HBED (an exceptionally powerful chelate)
4) Miller Ferriplus Fe-EDDHA (solution not shown) (Figure 3).

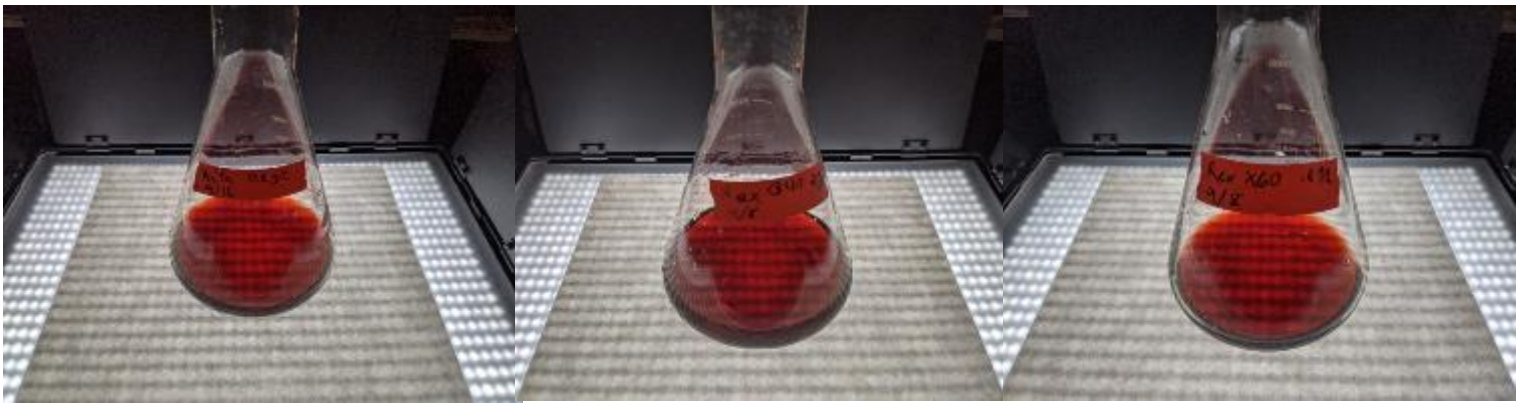

Figure 3. From Left to Right: Haifa Group Micro Fe-EDDHA, Nouryon Rexolin Q40 Fe-EDDHA, and Nouryon Rexolin X60 Fe-HBED. All solutions contained 0.4 grams per liter of product dissolved in deionized water.

**Conclusions**

Sequestrene 138 Fe-EDDHA appears to have impurities that plug filters and clog drip emitters. All other chelating products were clear and without sediment.

In applications where EDDHA is necessary, we recommend alternative products such as Miller Ferriplus (readily available in the USA), Haifa Micro, or Nouryon Rexolin Q40.

**Literature Cited**

Bugbee, B. 2004. Nutrient Management in Recirculating Hydroponic Culture. *In:* Proceedings of the South Pacific Soilless Culture Conference. M. Nichols, (ed.). Acta Hort 648: 99-112.