whereas *A. campestris* eggs will do so only at considerably higher temperatures. It was originally thought that temperature alone was responsible for the delay in hatch of *A. campestris* in the field. However, it may be that temperature is only a limiting factor in the action of a hatching stimulus from decaying organic matter.

It is possible that an infusion of bacteria and molds growing on decaying mosquito bodies will stimulate eggs of other species of *Aedes* to hatch. Many references in the literature suggest that microorganisms often play a part in the hatching of *Aedes* eggs (*5*). Bacteria and molds are now being isolated from decomposing mosquitoes, and further experiments on the effect of these microorganisms and extracts from them are in progress.

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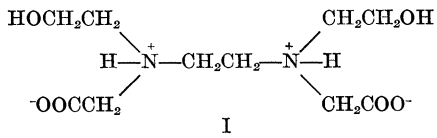
New Chelating Agents for Trivalent Iron

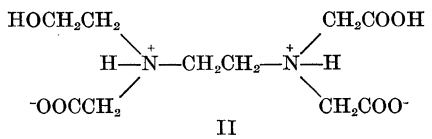
Stanley Chaberek, Jr., and F. C. Bersworth

Bersworth Chemical Company, Framingham, Massachusetts

There have been developed in these laboratories two metal ion chelating agents that show promise as iron carriers for the treatment of iron chlorosis in plants (*1*). These compounds are N,N′-dihydroxyethylethylenediaminediacetic and N-hydroxyethylethylenediaminetriacetic acids.[1] The amino acids, having the structures I and II, are new compounds which have been prepared and



I



II

purified by methods to be reported subsequently (*2*).

[1] F. C. Bersworth, patents pending.

The acid dissociation constants and the interactions of the various acid species with ferric ions were determined for both I and II by potentiometric measurements of pH in a manner similar to that described for N,N-dihydroxyethylglycine (*3*). The reactions investigated and the corresponding equilibrium constants may be summarized as follows.

N,N′-Dihydroxyethylethylenediaminediacetic Acid (I)

$H_2A(OH)_2 \rightleftarrows HA(OH)_2^- + H^+$	$pK_1 = 4.7$
$HA(OH)_2^- \rightleftarrows A(OH)_2^{-2} + H^+$	$pK_2 = 8.6$
$Fe^{+3} + A(OH)_2^{-2} \rightleftarrows FeA(OH)_2^+$	$\log K_1 \leqq 15$
$FeA(OH)_2^+ \rightleftarrows FeAO(OH) + H^+$	$pK_2 = 2.2$
$FeAO(OH) \rightleftarrows FeAO_2^- + H^+$	$pK_3 = 5.5$

N-Hydroxyethylethylenediaminetriacetic Acid (II)

$H_3A(OH) \rightleftarrows H_2A(OH)^- + H^+$	$pK_1 = 2.6$
$H_2A(OH)^- \rightleftarrows HA(OH)^{-2} + H^+$	$pK_2 = 5.1$
$HA(OH)^{-2} \rightleftarrows A(OH)^{-3} + H^+$	$pK_3 = 8.3$
$Fe^{+3} + A(OH)^{-3} \rightleftarrows FeA(OH)$	$\log K_1 \leqq 21$
$FeA(OH) \rightleftarrows FeAO^- + H^+$	$pK_2 = 3.8$

The most important property of these chelating agents is their ability to form 1:1 ferric chelates of sufficient strength so that the complexed trivalent iron is stabilized against hydrolysis even in strong alkaline solutions. Thus, while the ferric ethylenediaminetetraacetate complex is decomposed in alkaline medium to ferric hydroxide, the corresponding ferric chelates of these hydroxyethyl derivatives are completely stable against hydroxide precipitation. The resistance of these ferric complexes to hydrolytic decomposition results from the fact that 1:1 chelate formation is accompanied by the simultaneous ionization of the weakly acidic ethanolic protons of the hydroxyethyl groups.

Both amino acids function as hexadentate chelating agents in the presence of ferric ions. The hexacoordinated ferric ion is bound to the ligand through the two nitrogen and four oxygen atoms.

The development of N,N′-dihydroxyethylethylenediaminediacetic and N-hydroxyethylethylenediaminetriacetic acids makes possible the study and treatment of chlorosis conditions in calcareous soils as well as other studies in alkaline medium. Further investigation of the properties of these chelating agents is in progress and will be reported soon.

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