

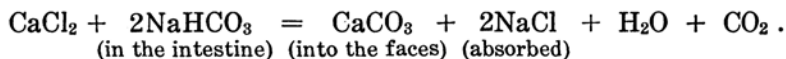
ORGANIC SALTS CONTAINING IRON AND CALCIUM.

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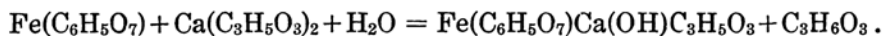
Some years ago the author prepared the complex salts of organic compounds containing heavy metals, such as $[(\text{CH}_3)_3\text{Sn}]_2\text{O}(\text{CH}_3)_3\text{SnX} \cdot \text{H}_2\text{O}$,⁽¹⁾ $[(\text{CH}_3)_3\text{Sn}]_2\text{O} \cdot \text{HX} \cdot \text{H}_2\text{O}$,⁽¹⁾ and $\text{X}(\text{CH}_3)_3\text{NCH}_2\text{CH}_2\text{SAg} \cdot \text{AgX}$.⁽²⁾ At present, however, these compounds are not important from the physiological point of view. Present investigation on the preparation of the complex salts of organic compounds containing iron and calcium has been undertaken chiefly from the physiological as well as pharmaceutical ground.

Iron and calcium, especially the latter, are very important in regard to our daily life. The deficiencies of these elements cause various diseases such as anemia on one hand, and tetany, rickets, and others, on the other. The absorption of these elements by intestinal tract depends upon their solubility.⁽³⁾ Among the organic compounds ferric citrate and calcium lactate are more easily absorbed through the intestinal mucosa than other iron and calcium compounds. However, these compounds are not like the inorganic compounds, they do not cause an acidosis or alkali deficit of the blood. It is presumed that the organic radicals are burned up in the body. On the other hand an inorganic compound, for example calcium chloride, causes acidosis by selective excretion but not selective absorption, according to the following reaction :



Of course the equation affords the end result of the reaction involved in the body. That is, the part of the bicarbonate in the body is replaced by an equivalent amount of the chloride, indicated as NaCl in the equation, which is absorbed consequently causing alkali deficit.

Reaction between Ferric Citrate and Calcium Lactate. It appears that when one molecular proportion of calcium lactate is treated with one molecular proportion of ferric citrate in a solution, a salt-like compound is formed according to the following reaction :



The compound formed is very easily soluble in water compared with iron

(1) T. Harada, this Bulletin, **2** (1927), 105.

(2) This Bulletin, **4** (1929), 171; *ibid.*, **6** (1931), 25.

(3) H. S. Mitchell and L. Schmidt, *J. Biol. Chem.*, **70** (1926), 471; H. S. Mitchell and N. Vaughn, *ibid.*, **75** (1927), 123; A. M. Hjört, *ibid.*, **65** (1925), 783; E. H. Masson, *ibid.*, **47** (1921), 3.

citrate or calcium lactate. It has no definite melting nor decomposition point.

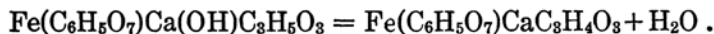
Experimental Part.

When calcium lactate (5 g.) was treated with iron citrate (5 g.) which was previously dissolved into about 20 c.c. of water by aid of heat, the colour of iron citrate was affected. The solution was filtered through filter paper, cooled down to about 50°C., then the compound formed was precipitated with four times by volume of 95% alcohol at about 50°C. Then the alcoholic solution was decanted.

The precipitated compound was a gummy greenish mass. For its purification the above process was repeated. Finally the gummy mass or its thick syrup was dried, or still better, scaled on a glass plate under 60°C. The yield was about 6 g. The salt thus prepared, when dried at 100°C. in open air, usually contains from 8 to 9 per cent. of water. The presence of water as the hydrate is suspected. It is a bright, shining, greenish substance and has no definite melting nor decomposition point. However, it slowly decomposes at above 150°C.

The aqueous solution of the above substance is slightly acidic. It was believed to be a definite compound of a type of a salt according to the following analytical results, and hence the reaction equation was formulated as described above.

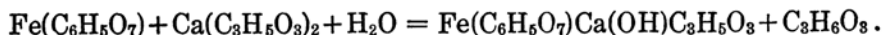
When the substance was heated at above 100°C. in open dry air it probably changed into a lactone form. Thus :



In regard to the definite structure of this compound, the author hopes to report later after further study on its physical properties has been made. (Found : Fe, 15.48, 15.24 ; Ca, 10.25 (Kramer-Tisdall), 10.59 ; lactic acid, 27.12 (Clausen), 24.95. Calc. for $\text{FeCaC}_9\text{H}_9\text{O}_{10}$: Fe, 14.98 ; Ca, 10.75 ; lactic acid, 24.14%.)

Summary.

One molecular proportion of calcium lactate appears to react with one molecular proportion of ferric citrate in aqueous solution, producing a salt-like substance having the formula, $\text{FeCaC}_9\text{H}_{11}\text{O}_{11}$, according to the following reaction :



Yokohama, Kanagawa.