ALBUMINATE OF IRON.

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Synonym.—Ferri Albuminas.

Physical Properties.—Albuminate of iron is an amorphous, reddish-brown, slightly alkaline, chemical preparation which is placed on the market in the form of small scales and irregular lumps. It is irregular in fracture, translucent, and, under the microscope, presents itself as a beautiful reddish-brown body, containing a small amount of granular matter. Many specimens show a spiral marking under the microscope, due to fracture in carrying; a freshly prepared specimen will not present this peculiarity nor any granular matter. When ground in a mortar, it is reduced to a fine, brown powder. Improperly prepared specimens show many pure lemon-yellow, or white scales, which may contain much granular material. It has a glutinous taste, and should not be salty.

A practical study of a freshly prepared, pure preparation shows valuable physical and chemical properties. It is practically insoluble in distilled water, hot or cold; but a small amount may be held in suspension for a short time. It is *insoluble* in all acids, dilute or concentrated, ether or chloroform; readily soluble in all alkaline mixtures, giving a beautiful, clear, reddish-brown solution. It is freely soluble in water which has been rendered slightly alkaline by water of ammonia, caustic potash or soda.

Almost any alkaline solution can be added to a solution of albuminate of iron. Liq. potassii arsenitis will mix with it in all proportions without change. Bichloride of mercury will cause a white precipitate of albuminate of mercury. If sufficient potassii iodidum is added to dissolve the bichloride of mercury, it can be mixed in almost any proportions. Acids and acidulated preparations can not be combined with it, as they always cause a precipitate. If these precipitates are not new chemical compounds, they can be redissolved by rendering the solution alkaline. In all poor preparations, when the solution is heated to the boiling point, an odor similar to glue is given off; but the odor from a good preparation is bland and agreeable.

No precipitate should form when heat is applied to the solution of a fresh preparation; it simply becomes frothy for a short time. Alcohol and alcoholics can be added in all proportions, provided they are first rendered alkaline or neutral in reaction.

Albuminate of iron does not undergo oxidation nor decomposition when exposed to the air. When powdered albuminate of iron is heated in a glass tube, water is given off first, which is strongly alkaline in reaction; next, dark, irritating fumes, which will not support combustion and which smell like burning meat; a dark carbonaceous ring is deposited on the cold portion of the tube, and a dark carbonaceous ash is formed which, if heated strongly in a flame, is soon reduced to a dark white or black oxide of iron, proved by appropriate tests.

Chemistry.—Crudely expressed, albuminate of iron is formed by making a solution of fresh egg-albumen and gradually adding to it a neutral solution of oxychloride of iron. Precipitation will not be complete unless the solution is neutral in reaction. Albuminate of iron is precipitated as a brown, amorphous, flocculent substance; is collected on a linen cloth; thoroughly washed with distilled water, and

dried at a moderately low temperature. When dried, it consists of irregular scales and needles of a beautiful brownish-red color.

The following is the formula given for making liq. ferri albuminas:

"Thirty-five parts of dry egg-albumen are dissolved in one thousand parts of water. The solution is strained and poured into a mixture of one hundred and twenty parts of a solution of oxychloride of iron and one thousand parts of water in a thin stream, with stirring.

"A very accurate neutralization with very dilute soda-lye (five parts of this lye for ninety-five parts of water) may be necessary to completely precipitate the albuminate of iron formed. After the precipitate has all settled and the supernatant fluid has been decanted, it is washed by repeated mixing with water and allowing to settle, until the supernatant fluid, on being acidulated with nitric acid and mixed with a solution of nitrate of silver, opalesces only feebly. The sediment, gathered on a linen straining cloth after the supernatant fluid has been poured off, is poured into a sufficiently large bottle (previously weighed) together with three parts of soda-lye (sp. gr. 1.170) previously diluted with fifty parts of water, and dissolved by shaking. Add to this solution, one hundred and fifty parts of alcohol (sp. gr. 0.830), one hundred parts of cinnamon water, two parts of aromatic tincture and

a sufficient quantity of water to make the total weight of the fluid amount to one thousand parts.

"This solution contains approximately four parts of iron in one thousand parts. It is a reddish-brown fluid of extremely slight alkaline reaction with a weak taste of cinnamon."

Some writers have made assertions that there is no true chemical compound called an "albuminate," but they fail to produce the experimental evidence whereon their conclusions have been based. There is not the least question of a doubt that a chemical reaction takes place when egg-albumen is added to a solution of oxychloride of iron or bichloride of mercury. It is claimed that a mere coagulation takes place resulting in coagulated albumen which carries down with it the salt of mercury or iron in its original state. Let us test the reaction. Take a fresh solution of egg-albmen and cautiously add to it a dilute solution of oxychloride of iron until the iron is just short of an excess; a brown precipitate forms. Carefully filter; add ammonia water to the filtrate, and no precipitate forms, showing an absence of free oxychloride of iron, for it is precipitated by ammonia water. Its presence can not be shown in the filtrate by any other test. Was it precipitated with the albumen in its

natural state? Carefully cleanse the filter (testing the wash water with negative results) and add to part of it water which has been rendered alkaline with ammonia water. It is dissolved completely, giving a reddish-brown solution. If this pre-precipitate had contained oxychloride of iron it would not have dissolved in ammonia water or alkalies. To another part of the precipitate add dilute hydrochloric acid and water; no change is noted at all. If any part of the oxychloride was present in a free state it would be dissolved at once. This gives two of the most important conclusive proofs that a chemical change occurs between the albumen and oxychloride, in which the latter has been decomposed and a new salt formed.

After thoroughly cleansing and drying the remaining part of the precipitate, reduce it to a fine powder. Treat one part of the powder with hydrochloric acid; another part with nitric acid, and another with nitro-muriatic acid. No change occurs in any case after twelve hours, hot or cold. This proves again that iron is not present as a chloride, oxychloride or oxide; for, if suspended in the precipitate, it would have been dissolved. Other experiments are equally conclusive.

Conclusions.—When a neutral solution

of egg-albumen is added to a neutral solution of oxychloride of iron, a chemical change takes place, resulting in the formation of a new salt of iron. This new salt is an organic compound, entirely unlike all other known salts of iron, and, chemically speaking, is termed an albuminate.

There *is* a series of salts called albuminates, but their formulæ, as well as that of albumen, are so complicated and complex that they have never been positively figured. If this salt, obtained as mentioned, is not a chemical albuminate, what is it? and what *chemical tests* will prove any other identity. The presence of free albumen cannot be demonstrated in the solutions or salt of the albuminate.

Physiological Action.—We have already demonstrated the great chemical affinity of the salts of iron for albumen, and it is now proposed to carry its study one step farther as related to internal administration. All therapists teach that the best time to administer the preparations of iron is after meals; and the reason assigned is, the greater activity of the absorbents as well as the presence of the digestive fluids at this time. If given as a chloride, its first action is to combine with the albumens present and form an albu-

minate. If any other preparation of iron is given it is acted upon by the free dilute hydrochloric acid, converted into a chloride, which, in turn, combines with the albumens. The albuminates produced in the stomach are probably precipitated by the acid condition of its contents, but as soon as they pass into the intestines and come into contact with the alkaline fluids they are rendered freely soluble, and taken up by the lacteals, enter the blood as albuminates. It is altogether probable that this chemical change is not confined strictly to the digestive tract, for a certain amount of the other soluble preparations of iron may be taken up by the lacteals and absorbents; but the moment they are mixed with the alkaline chyle, which is very rich in albuminous material, they are converted into soluble albuminates. The blood itself is so rich in albumens, and, being alkaline, iron could not probably exist in it in any other state than as an albuminate.

The salts of iron have much to do with the oxidizing processes of the body, through the blood, and also enter into the composition of hemoglobin and the red blood corpuscles. Just what action albuminate of iron plays in this oxidation is entirely theoretical; but, being an organ-

ized nitrogenous, carbonaceous, oxidized product in itself, it seems to be capable of combining or parting with atoms of oxygen or carbon, in its contact with the tissues, and yet retain its physical characteristics.

When the claim is made that albuminate of iron, being the most easily assimilated salt, because it is ready for absoption without chemical change, should, therefore, be given the preference to all other salts of iron, it is open to objection and criticism. As has been shown, other salts are absorbed and fulfil their special functions as indicated. This much can be said, however, in favor of albuminate of iron and its preparations. It is not astringent; does not "pucker the mouth" nor injure the teeth by prolonged administration; does not constipate, and does not precipitate the digestive ferments in the stomach and intestines. It will remain in the stomach without causing irritation when other preparations cannot be retained; it is readily assimilated and can be given to children without the least trouble and in any dose. It is not toxic in its action and will fulfil every indication for a plain tonic. It cannot be used in place of, nor substituted for, other salts of iron, employed for their astringent action or local effect.

Dr. Sydney Ringer has given the subject of iron considerable study, and claims that it is present in the circulation and body in the form of an albuminate. Other writers corroborate his opinion. These considerations seem perfectly plausible, and a close chemical and chemico-vital examination, such as we have given, will add many points in its favor.

Dose.—Pulv. ferri albuminatis gr. j to xx. Liq. ferri albuminatis f℥ j to iv. Syr. ferri albuminatis cum strychninæ et quininæ (Quininæ, gr. j. Strychninæ sulphas, gr. $^1/_{60}$) f℥ ss to iij.

Therapy.—Briefly summarized, albuminate of iron has found its most suitable applications in my practice, in all forms of anemia and debility where an iron tonic has been indicated. Good results could not always be obtained from tr. ferri chloridi and other astringent preparations, and serious objection was found to its continued administration in the case of children. Convalescence from scarlatina, measles, influenza and diphtheria was very much hastened, and a bright ruddy glow was soon brought to the pallid faces of these children by administration of one drachm of the liq. ferri albuminatis after meals and at bed-time. In most cases it was combined with one to three drops of

liq. potassii arsenitis. Several cases of anemia and irritability of the stomach have yielded to its use in combinations. For two years past the following combination has given me extremely favorable results:

R. Pulv. ferri albuminatis..... gr. ij.
Acidi arseniosi.....
Strychninæ sulphatis.... āā gr. $\frac{1}{60}$
M. Ft., tab. (compressed) no. i.
Sig.: One tablet after meals and at bed-time.

Mr. ——, aged 48, consulted me, complaining of great prostration, nervousness, irritability, inability to do a full day's work, shortness of breath, giddiness, poor appetite, insomnia, constipation and loss of flesh—all the result of an attack of influenza six months before. He was put on a diet of rich milk, cocoa, red meats, baked potatoes, eggs, oysters and all easily assimilated foods, and instructed to abstain from pork, veal, cabbage, turnips and all heavy indigestible articles of diet.

He took three tepid salt-water baths each week,—at bed-time. Bowels were regulated with small doses of cascara sagrada and aloin in pill-form. Improvement was noticed, and one week later he was placed on the above pill, four times daily, as directed. In two months' time he was apparently a new man; had gained twenty pounds in

weight, and could do a full day's work without unusual fatigue.

Another equally typical case was that of a chlorotic, single woman, aged 25, who had amenorrhea, general pains, giddiness, headache, nausea and great pallor. A similar form of treatment was ordered for her, and recovery was perfect in three months. The menstrual periods returned at regular intervals; the nausea, headache and giddiness disappeared, and the color returned to its natural hue.

Many other diseases are promptly benefited by it. You may summarize its therapeutical application by the axiom, that albuminate of iron can be used in any condition where iron is indicated, providing it is not required for its astringent and styptic action.

Bryn Mawr, Penn.

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