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RECOVERY OF CERTAIN METAL SALTS

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My invention relates to various salts, for example nickel chloride hexahydrate, which are produced initially in solution commonly, and which can be recovered from solution in a water-soluble form by crystallization, but when recovered from solution by the customary commercial evaporation procedures, the residue after evaporation contains a considerable percentage of insolubles. For example, nickel chloride hexahydrate obtained by customary evaporation processes, has mixed with it a considerable percentage of basic nickel chloride which is insoluble in water.

Crystallization is, of course, a slow and rather delicate process that is not well adapted for commercial production and is to be avoided when possible.

More specifically, the invention relates to those salts of which the metal is a metal having an atomic weight not less than that of nickel and not greater than that of copper (i. e., is nickel, cobalt or copper), and of which the acid is hydrochloric, formic or sulphuric acid.

I have discovered a procedure whereby the customary evaporation processes (for example, concentration by heat followed by final evaporation and drying on rotating metal drums), can be used to expel the water from solutions of these salts without leaving a percentage of insolubles. The metal salts thus obtained may be contaminated with small amounts of impurities, as will appear hereafter, but these are soluble and they are of such a nature and comprise such a small percentage of the total residue that they are unobjectionable for various uses to which the metal salts are put.

Briefly, I add to a solution of the metal salt, a salt or salts which, under the conditions existing during the evaporation, will cause the association of the dissociated radicals of the metal salt and the water of the solution into only compounds that are water-soluble or vaporous at the evaporating temperature. It is to be understood that herein I use the term "vaporous" as including gaseous. Instead of adding such a salt to the solution directly, I may of course add to the solution a material or materials which, by reaction with the solution or otherwise, will produce such a salt, and thus add the desired salt by indirection.

It will be apparent that the nature or type of the action of the added salt is immaterial, and also that the particular constituents of the initial solution or the particular products of the evaporation with which the added salt reacts is im-

material (if the added salt enters into one or more chemical reactions in any particular instances); thus, the action may be of one or more kinds in the case of one metal salt and of another or other kinds in the case of another metal salt, and different added salts may operate in different ways, all as will be understood. For example, in a particular instance the added salt may be selected with the view to adding, and for its ability to add, such additional radicals to the solution-brine that, by the selective action of radicals, the free radicals then in the solution will associate into only one or more solubles or vaporous compounds. Any such vaporous compound that may be formed (that is to say, a compound that is vaporous at the evaporating temperature) escapes during the evaporating procedure and accordingly does not enter into the solid residue, excepting as it may appear in, say, the residual soluble hydrate form of the metal salt as in the case when water is formed from some of the dissociated radicals that, except for the action brought about by the added salt, would enter into other compounds. Also, any such soluble but residue-contaminating compounds as may be formed need represent only such a small degree of contamination as to be unobjectionable in many instances, as pointed out before. Also, the added salt may be selected for its ability to act as a buffer substance preventing losses of volatile acids like hydrochloric from chlorides and formic acid from formates, or to inhibit any action of small amounts of, say, liberated sulphuric acid on the metal of the surface on which the solution is to be dried. As further examples, the salt to be added to the solution may be selected for its ability to act by inhibiting any catalytic reaction which otherwise would produce an insoluble salt of the metal, or as a catalyst producing only the soluble metal salt desired, or leading to the production of a soluble substance or substances in lieu of an insoluble product otherwise appearing.

In general therefore the form or nature of the action or actions of the added salt is not of primary importance to my invention. As the added salt or salts I employ one or more of the water-soluble alkali salts of organic acids or of the alkaline earth metal salts of such acids, and by preference (for reasons of economy) salts of those organic acids that are not readily volatilized at the evaporation temperatures employed; usually these temperatures are about 110° to 125° C. I have discovered that the quantities of such salts required are small.

As a specific example of my invention, I take a water solution of sufficient nickel sulphate to produce from 120 to 140 grams of the hexahydrate, and to this add about one gram of sodium lactate. This solution may then be concentrated by boiling, and at a suitable degree of concentration that will be understood, the concentrated solution may be deposited on the outside of a rotating heated metal drum on which it is further evaporated until the solute appears as dry flakes which can be scraped off the drum easily as the drum rotates. These flakes comprise nickel sulphate hexahydrate with a small percentage of organic impurity; they are completely soluble in water and are not hygroscopic.

As another specific example, I take a water solution containing nickel chloride sufficient to produce about 120 grams of nickel chloride hexahydrate, and to this add one gram of sodium lactate or potassium lactate. On expelling the water, say by heat in the manner indicated before, a completely soluble product results that contains nickel chloride as a hexahydrate and which maintains its dry form and does not form lumps when kept for a long time.

Again, to a water solution containing sufficient cupric chloride to produce 100 grams of the hydrate, I add about two grams of sodium tartrate, and upon evaporation to apparent dryness, as by hot air blown through the solution or by heating in contact with metal surfaces as before, a completely soluble residue containing water-soluble cupric chloride hydrate is obtained.

Again, the sodium salt of an organic acid like propionic may be added to a solution of nickel sulphate, in generally similar proportions, with similar results, and with various solutions, e. g. chloride solutions, similar results can be obtained by earth-alkali, e. g. calcium, salts of the organic acids.

It will be understood of course that my invention is not limited to the matters of details appearing in the specification above except as appears hereinafter in the claims.

I claim:

1. The method of obtaining the salt of a metal of the group consisting of those metals the atomic weights of which are not less than the

atomic weight of nickel and not greater than the atomic weight of copper and an acid of the group consisting of hydrochloric, formic and sulphuric acids, without substantial admixture of a water-insoluble substance, which method consists in adding, to a solution of the metal salt, a relatively small quantity of one or more substances selected from the group consisting of the water-soluble alkali and alkaline earth metal salts of organic acids, and thereafter obtaining substantially all of the metal salt by evaporating the solution to dryness.

2. The method of claim 1, characterized by the fact that the added substance consists at least in part of a lactate.

3. The method of claim 1, characterized by the fact that the added substance consists at least in part of a propionate.

4. The method of claim 1, characterized by the fact that the added substance consists at least in part of a tartrate.

5. The method of claim 1, characterized by the fact that the metal salt is nickel sulphate and the added substance at least includes a substance selected from the group consisting of sodium lactate and sodium propionate, the proportions, by weight, being sufficient of the metal salt to produce about 130 parts of the hexahydrate thereof, to about one part of said added substance.

6. The method of claim 1, characterized by the fact that the metal salt is nickel chloride and the added substance at least includes a salt of the group consisting of sodium lactate and potassium lactate, the proportions, by weight, being sufficient of the first to produce 120 parts of the hexahydrate thereof, to about one part of the second.

7. The method of claim 1, characterized by the fact that the metal salt is cupric chloride and the added substance at least includes sodium tartrate, the proportions, by weight, being sufficient of the first to produce 100 parts of the hydrate thereof, to about two parts of the second.

8. The method of claim 1, characterized by the fact that the metal salt is a chloride and the added substance at least includes a calcium salt.

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