

ALIEN PROPERTY CUSTODIAN

WASHING, DETERGENT AND SOFTENING AGENTS

Ferdinand Bornemann and Hans Huber, Wiesbaden, Germany; vested in the Alien Property Custodian

No Drawing. Application filed May 26, 1939

This invention relates to washing, detergent and softening agents.

It is known to use phosphates as washing and detergent agents and also for softening water. When ortho- and pyrophosphates are employed in this manner, the calcium or magnesium salts in the water are precipitated and the resulting softened water is utilized as boiler feed or for washing and cleansing purposes. Another method of rendering innocuous the calcium and magnesium salts present in water consists in treating the water with water-soluble metaphosphates, which have the property of retaining the calcium and magnesium salts in solution, or of redissolving calcium or magnesium soaps that have been thrown down by the previous employment of soaps.

It has now transpired in accordance with the present invention that the calcium and magnesium salts contained in water can be retained in solution, or redissolved, by adding alkali metal polyphosphates thereto. As is well known, orthophosphoric acid has a ratio of H_2O to P_2O_5 of 3 to 1. Pyrophosphates have a ratio of H_2O to P_2O_5 of 2 to 1, and metaphosphates of 1 to 1. Polyphosphoric acids have a ratio of H_2O to P_2O_5 between 2 to 1 and 1 to 1, representing always a ratio of two integers within this range. For example, tripolyphosphoric acid has a ratio of 5 to 3. Waters softened with polyphosphates in this manner are primarily suitable for washing and cleansing purposes, but may also serve for dissolving calcareous incrustations in boilers. They may be used either alone or in association with the known washing agents or detergents.

The aforesaid alkali metal polyphosphates can be produced in a great variety of ways, for example by heating sodium sesquiphosphate, which is advantageously prepared, in solution or in the solid state, by mixing mono- and disodium phosphates, or from trisodium phosphate and a corresponding amount of phosphoric acid, or again from phosphoric acid and sodium carbonate. Moreover, alkali metal polyphosphates can be produced by calcining trisodium pyrophosphate. Speaking generally, suitable polyphosphates can be produced by calcining phosphatic salts (pyrophosphates included), or mixtures of such phosphatic salts as furnish substantially neutral products.

The term "neutral", as here used, means that the salts do not contain an ionizable hydrogen radical.

It has also transpired that it is not essential to employ pure originating materials for the

production of the alkali metal polyphosphates, but that, on the contrary, the commercial salts in general use are suitable for that purpose. Thus, for example, the known double-salt of sodium fluoride and trisodium phosphate, may replace pure trisodium phosphate as originating material.

It is true that polyphosphates, especially those of sodium, have already been described in the literature—see Gmelin's "Handbuch der anorganischen Chemie", 8th Edition, 1928, chapter "Sodium", pp. 924/925. However, the literary reference to these polyphosphates relate to the production of well-defined substances which can be crystallized from the melt or from the water. In the process of the present invention on the contrary, no attempt is to be made at the production of such pure polyphosphates. On the contrary, the mixtures of polyphosphates, such as are generally obtained by the present process can be employed as washing, detergent and softening agents without their action being impaired. That there is no need to employ pure polyphosphates as washing, detergent and softening agents is also evident from the fact that commercial phosphoric acids (such as those containing fluorine) or their salts may be used as the originating materials.

The alkali metal polyphosphates produced in accordance with the present invention have pH values of about 9.0 to 9.5, and therefore, do not exert any such corrosive action as, for example, trisodium phosphate. They are, moreover, all soluble in water, and do not require, in their preparation, any such special measures for insuring the attainment of water-soluble products, as is the case with the likewise neutral known metaphosphates, of which only one special group is completely soluble in water. It may also be mentioned that temperatures of at least $500^{\circ}C$ and over are needed in the production of the metaphosphates, whereas temperatures of only about $300-500^{\circ}C$ are required for the calcination of neutral or approximately neutral pyrophosphates, or phosphate mixtures, according to this invention.

The polyphosphates have a further advantage over metaphosphates in that they are non-hygroscopic. They are also effective in repressing calcium ionizations over the large range of pH values from 8.0 to 10.5.

Likewise, the normal pH of the polyphosphates is in the most desirable range from the standpoint of such repression. There is on this account no need to adjust its alkalinity, as is nec-

essary with the metaphosphates which have a normal pH of about 6.5.

We have discovered that the calcium and magnesium salts contained in water can be maintained in solution or, if the calcium and magnesium have been precipitated in the water by the previous employment of soap, can be redissolved, by the addition to the water of the treating agent according to this invention, i. e. an alkali metal salt of tripolyphosphoric acid, preferably sodium tripolyphosphate ($\text{Na}_5\text{P}_3\text{O}_{10}$), or a mixture containing such a salt as an essential ingredient thereof.

A preferred polyphosphate is the sodium salt, $\text{Na}_5\text{P}_3\text{O}_{10}$, of tripolyphosphoric acid, $\text{H}_5\text{P}_3\text{O}_{10}$.

The sodium tripolyphosphate, or other alkali metal tripolyphosphate, employed according to this invention may be produced in a variety of ways. Thus, on cooling a fused mixture of 100 parts of anhydrous sodium pyrophosphate ($\text{Na}_4\text{P}_2\text{O}_7$), with 50 parts of sodium metaphosphate (NaPO_3) which has been kept at a bright red-heat for about half an hour, a crystalline mass of sodium tripolyphosphate may be obtained. This method which, per se, forms no part of the present invention and was known to the prior art, involves the drawback that three heating steps are really involved therein. The pyrophosphate must first be made from disodium

phosphate, the metaphosphate from monosodium phosphate, and the tripolyphosphate from the mixture of pyrophosphate and metaphosphate, each step involving a heating treatment.

5 A preferred method of forming the tripolyphosphate according to the present invention is by a process involving only a single heating step. The principle of this preferred method is to start with a phosphate containing a ratio of alkali
10 (Na_2O , for instance) to P_2O_5 less than that of pyrophosphate and greater than that of metaphosphate, and to make the tripolyphosphate by a single heating operation. This method is disclosed, as applied to a series of polyphosphates,
15 in our aforementioned earlier-filed application, where the initial material is subjected to a calcination treatment at a temperature of about 300-500° C.

The material is employed in water softening use in the same manner as the metaphosphates.
20 Its calcium ion repressive power is of the same order, but under some conditions of pH is very much greater.

This application is a continuation-in-part of
25 our copending application Serial No. 746,774 filed October 4, 1934.

FERDINAND BORNEMANN.
HANS HUBER.