Patented Oct. 23, 1923. 1,471,987

UNITED STATES PATENT OFFICE.

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MUCIN-DISSOLVING AGENT.

No Drawing. Application filed May 26, 1922. Serial No. 563,921.

To all whom it may concern:

Be it known that I, CLARENCE C. VOGT, a citizen of the United States, residing at Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Mucin-Dissolving Agent, of which the following is a full, clear, and exact description.

The present invention relates to dissolving mucinous secretions adhering to various surfaces of the body, such as the teeth, mucous membranes, etc.

Mucin is secreted in various glands and from various surfaces of the body. As secreted it is held in solution by the alkaline character of the secretion. For example, the saliva contains mucin which is held in solution, the saliva being slightly but sufficiently alkaline for this purpose. The mucin, however, is deposited from the saliva upon the surfaces of the teeth in the form of thin films or plaques. The saliva is not sufficiently alkaline to re-dissolve the mucin plaques. The mucin plaques apparently act as a natural protection to the tooth structure against the action of fruit acids, etc. When the mucin plaques are naturally periodically removed, as on the lingual surfaces, which are polished by the motion of the tongue, or other surfaces which are polished by the excursion of the food or by the tongue or the lips, they cause no tendency to caries or dental decay. When, however, the mucin plaques remain undisturbed, as on the interproximal surfaces, or on some of the buccal surfaces, they furnish the foundation for tartar deposits and harbor the lactic acid secreting micro organisms, which, according to the usually accepted theory, are the cause of the break down of the tooth enamel and the beginning of decay cavities. It is, therefore, highly desirable to periodically remove the mucin plaques artificially, particularly from the more inaccessible tooth surfaces which are not naturally cleansed and which are difficult, if not impossible, to clean completely with a brush.

It is also highly desirable to remove adhering mucin from other surfaces of the body. For example, an infected area of mucous membrane is usually coated with an accumulation of secretion containing mucin. The catarrhal discharge from the nasal membranes, for example, contains mucin. It is highly desirable to wash out these catarrhal discharges from the nasal tissues, thus effectually cleansing the infected areas. The washing solution, to be really effective, should dissolve the accumulated secretions and thoroughly cleanse the tissue.

It is also desirable to thoroughly cleanse infected areas in other parts of the body, such for example as the vaginal or urethral membranes.

I have discovered that the objects above indicated as desirable, may be readily attained by washing away the mucinous coatings with a suitable alkaline solution. The alkaline solution must have a sufficiently high hydroxyl ion concentration to readily dissolve the mucinous coating. Its alkalinity must be considerably higher than that of the original secretion in which the mucin was held in solution. For example, while the saliva is rendered alkaline by the presence of disodium phosphate and bicarbonate of soda, it is not sufficiently alkaline to re-dissolve the mucin plaques once they are deposited upon the teeth. I have found that these mucinous plaques, however, may be re-dissolved by a solution having a sufficiently high hydroxyl ion concentration.

Mucin is a glyco-proteid. Under acid conditions it is precipitated or coagulated as an acid mucinate. The precipitated or coagulated acid mucinate will, however, react with alkalis or alkali salts of sufficient alkalinity to form alkali mucinates which are water soluble.

I have found that for practical results the solution for re-dissolving precipitated mucin should have an alkalinity of not less than a p_H value of approximately 9.5, or, in other words, should have a minimum of approximately 3.2×10^{-5} normal hydroxyl ion concentration. A compound of an alkali metal should be employed because of the greater solubility of the alkali mucinates. The mucinates of the polyvalent metals are much less soluble than the mucinates of the monovalent alkali metals. While various compounds of alkali metals which yield the necessary hydroxyl ion concentration will

under suitable conditions dissolve mucin, I prefer to use the alkali compounds which resemble the principal inorganic constituents of the saliva or blood stream, and at the same time yield the necessary hydroxyl ion concentration. I have found that the normal or tertiary phosphates of the alkali metals, such, for example, as tri-sodium phosphate or tri-potassium phosphate, act as efficient solvents for mucin. The tri-sodium phosphate resembles chemically the di-sodium phosphate of the saliva, but has a sufficiently greater alkalinity to re-dissolve the mucinous plaques precipitated from saliva.

The mucin dissolving solution should be substantially free from calcium compounds or compounds of other polyvalent metals which will react to form less soluble mucinates in a manner analogous to the action which such compounds have in forming insoluble soaps, as, for example, the action of lime in forming insoluble lime soaps.

The solution should be sufficiently dilute. If the solution is too concentrated it will not properly dissolve the mucin because of the well known "salting out" effect. "Salting out" by increasing the concentration of various solutions, is employed in many chemical processes to precipitate out substances soluble in more dilute solutions. Therefore, too concentrated solutions, even of the alkali compound, should be avoided.

The solution should also be substantially free from coagulants of mucin or albumens, such, for example, as alcohol, which would, of course, by coagulating the mucin, prevent its dissolving in the alkaline solution. Moreover, the body secretions, such, for example, as the saliva and the nasal secretions contain albumens and other proteins in addition to mucin, and these should not be coagulated.

The solution should be non-irritating to the tissues which are subjected to it. The alkaline compound should be of a non-irritating nature. Also, the solution should not have too great a p_H value. It should in general not have a p_H value of over about 12.5, as this is unnecessarily strong to dissolve mucin, and, if exceeded, might attack or irritate the teeth or other tissues.

The alkaline compound should also preferably be fairly stable in water solution.

While the alkali hydroxids or alkali salts of weak acids which will yield the necessary hydroxyl concentration may be employed, I prefer to use the normal or tertiary phosphates of the alkali metals. By the term "alkali metals" I mean sodium potassium and closely related elements. The substance which I have generally employed is tri-sodium phosphate dissolved in water, preferably to form a solution in the neighborhood of about one-half of one per cent of the hydrated salt containing the usual water of crystallization. This gives the necessary hydroxyl ion concentration to dissolve the mucin within the practical time limits of the use of a mucin solvent such as a dentifrice, without irritating the tissues. Tri-sodium phosphate resembles generally the phosphates in the saliva and blood stream, and has a minimum disturbing effect on the tissues. Tri-sodium phosphate is, however, more alkaline than the di-sodium phosphate present in the saliva and blood stream, and is capable of dissolving deposited mucin; whereas the alkaline body secretions, although capable of holding mucin in solution, do not re-dissolve the mucin once it is precipitated. This is in apparent accord with the usual chemical law that a more active chemical agent is necessary to re-dissolve a precipitate than is required to hold the precipitated substance in solution before precipitation.

A solution of tri-sodium phosphate has less solvent action on the tri-calcium phosphate constituting the tooth structure than does ordinary soft drinking water, so that the solution may be used with impunity as a dentifrice. The phosphates are particularly adapted for dentifrice use since the tooth structure is essentially tri-calcium phosphate, and the sodium or potassium phosphates have little, if any, solvent effect on tri-calcium phosphate.

The tri-sodium phosphate in dilute solution is hydrolyzed, yielding the necessary concentration of hydroxyl ions. It is, of course, immaterial how this hydroxyl ion concentration is attained,—whether by dissolving the tri-sodium phosphate salt or by mixing acid phosphates or phosphoric acid with an alkali hydroxide.

I also prefer to add to the solution of the tri-basic phosphate, not over about one per cent of an alkali metal chlorid, preferably sodium chlorid. This makes a substantially physiologically normal salt solution.

The solution as usually prepared and used contains one-half of one per cent of the hydrated tri-sodium phosphate salt, one-half of one per cent of sodium chlorid and one-tenth of one per cent potassium chlorid. This yields the necessary hydroxl ion concentration and at the same time contains the sodium chlorid and potassium chlorid in about the same proportions as the blood stream. This solution has substantially the same osmotic pressure as the blood stream, and is consequently entirely non-irritant even to sensitive tissues.

In using the solution for hospital purposes, it may be used as simply a dilute solution of the salt or salts above specified. When put up for sale as a dentifrice or nasal douche, I prefer to add a small quantity of mild aromatic antiseptics, such as menthol,

thymol, eucalyptol, and essential oils. These mask the disagreeable taste of the tri-sodium phosphate and add certain germicidal qualities. Such antiseptics also preserve the solution in a sterile condition.

The solution may be sold in dilute form ready for use or may be sold in a concentrated form, either as a concentrated solution to be diluted or as a powder to be dissolved by the user. It may also be sold in the form of a tooth paste or powder combined with an abrasive or polishing material which is chemically inert and which will not act as a mucin precipitant or coagulant. If put up in the form of a paste or powder, the alkali compound should be combined with a sufficiently large quantity of inert matter so that when applied to the teeth with a brush a solution will be formed sufficiently dilute to avoid any appreciable "salting out" action.

While the mucin dissolving medicinal agent herein disclosed and claimed is particularly applicable to dental purposes and to be used as a dentifrice for removing the mucin plaques from the teeth, it is to be understood that the invention is not so limited but may be employed for general physiological purposes where it is desirable to dissolve or wash away mucinous coatings. Neither is the invention limited to the specific chemical substances or their proportions as set forth in the preferred embodiment, but may be otherwise embodied within the scope of the following claims.

I claim:

1. A mucin dissolving medicinal agent for removing mucinous secretions adhering to surfaces of the body, containing a compound of an alkali metal yielding in water solution an alkalinity not less than a p_H value of approximately 9.5, substantially as described.

2. A mucin dissolving medicinal agent for removing mucinous secretions adhering to surfaces of the body, containing a compound of an alkali metal yielding in water solution an alkalinity not less than a p_H value of approximately 9.5 nor more than a p_H value of approximately 12.5, substantially as described.

3. A mucin dissolving medicinal agent for removing mucinous secretions adhering to surfaces of the body, containing a compound of an alkali metal which is non-irritating to mucous membranes and substantially stable in water solution, and which yields in water solution an alkalinity not less than a p_H value of approximately 9.5, said agent being substantially free from mucin precipitants or coagulants, substantially as described.

4. A mucin dissolving medicinal agent for removing mucinous secretions adhering to surfaces of the body, containing a normal or tertiary phosphate of an alkali metal, substantially as described.

5. A mucin dissolving medicinal agent for removing mucinous secretions adhering to surfaces of the body, containing tri-sodium phosphate and sodium chlorid in dilute water solution of such concentration as to form an approximately normal physiological salt solution, said solution being substantially free from mucin precipitants or coagulants, substantially as described.

6. A dentifrice containing a compound of an alkali metal which does not attack the tooth structure and which yields in water solution as applied to the teeth an alkalinity not less than a p_H value of approximately 9.5, substantially as described.

7. A dentifrice consisting of a dilute water solution of an alkali metal which is non-irritating to the oral tissues, does not attack the tooth structure, and is substantially stable in water solution, said solution having an alkalinity of not less than a p_H value of approximately 9.5 and substantially free from mucin precipitants or coagulants substantially as described.

8. A dentifrice containing a normal or tertiary phosphate of an alkali metal and substantially free from mucin precipitants or coagulants, substantially as described.

In testimony whereof I have hereunto set my hand.

CLARENCE C. VOGT.