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BLEACHING FATTY ACID COMPOUNDS WITH CHLORITE AND ALDEHYDE

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This invention relates to an improved process for effecting color improvement or bleaching of fatty acid compounds. Such fatty acid compounds are oils, fats, fatty acids, waxes and soaps.

In accordance with the process of my present invention, the material to be bleached is subjected to the simultaneous action of a chlorite and an aldehyde in the presence of water. Advantageously, the material being treated is admixed in liquid form with the chlorite and aldehyde in aqueous solution. The pH of the solution during the bleaching operation is generally maintained at not less than about 7, though in some instances, as subsequently noted herein, mildly acid solutions may be employed.

Various methods have heretofore been proposed for the bleaching of fatty acid compounds. Many of such methods have involved the use of acids and other strong chemicals which have a tendency to injure the material being bleached or require very careful, critical control to avoid such injury.

Many of these previously-proposed bleaching methods, especially those involving the use of strong acid solutions, tend to char or cause an undesirable reaction between the fatty acid compounds and the acid constituents of the solution and are not applicable to the treatment of many materials of this type, particularly soaps and other alkaline reacting materials.

I have discovered that fatty acid compounds can economically be bleached to an exceptionally high degree, without substantial degradation or danger of deleteriously affecting their desired characteristics, by subjecting them to the action of a chlorite in an alkaline, substantially neutral or only mildly acid aqueous solution, in the presence of an aldehyde as hereinafter more fully described.

The function of the aldehyde in my improved bleaching process appears to be that of activating the chlorite rather than a direct action upon the fatty acid compound itself. Thus activated, the chlorites, or reaction products thereof, are enabled to effect the bleaching of the fatty acid compound, even in an alkaline or substantially neutral environment.

Chlorites useful in my process are those sufficiently soluble in water to provide an adequate concentration to effect the desired bleaching. When the bleaching requirement is relatively low, less soluble chlorites may be used. However, for most purposes, I prefer the chlorites of the alkali and alkaline earth metals such as sodium chlorite, NaClO_2 , and calcium chlorite, $\text{Ca}(\text{ClO}_2)_2$.

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Various aldehydes may be used, including the aliphatic aldehydes, aromatic aldehydes, other carbocyclic aldehydes and heterocyclic aldehydes. For example, I have found formaldehyde, acetaldehyde, paraformaldehyde, furfural, benzaldehyde, and 5 and 6 carbon atom aldose sugars and inverted sugars to be particularly useful. All of these compounds are characterized by the CHO group. In addition to those highly soluble in water, the relatively insoluble aldehydes have been found to function satisfactorily in most instances.

Temperatures and concentrations are not usually critical and may be varied over a wide range. Increasing the temperature has generally been found to increase the rate of bleaching. Also, the ratio of chlorite to aldehyde may be widely varied. However, a molar ratio of chlorite to aldehyde of about 1:1 has been found generally useful.

The optimum operating conditions, with respect to temperature, concentration and ratio of chlorite to aldehyde, are to a considerable extent interdependent and also will vary somewhat with the particular material being bleached, the degree of bleaching required, the length of the period of the treatment and, to some extent, with the particular chlorite and aldehyde employed.

The temperature best suited for a particular operation will, to a considerable extent, depend upon the nature of the material being treated. Ordinary room temperature may frequently be employed with advantage but higher temperatures are usually desirable when treating fatty acid compounds normally solid where it is desired to effect the melting or solution thereof. Temperatures at which the material being treated becomes unstable or at which the material is deleteriously affected, are to be avoided.

It has previously been proposed to bleach cellulosic materials, for instance, by treatment with a chlorite activated by an acid environment, or activated by the introduction of chlorine gas, or a hypochlorite. Many fatty acid compounds, as previously noted, are destroyed or deleteriously affected by strongly acid solutions and, where chlorine is introduced or liberated during the reaction, there is a tendency for the chlorine to combine with the fatty acid compound.

An advantage of my present process is that the fatty acid compounds may be effectively bleached without the introduction of acid or other chlorite-activating agents which might deleteriously affect the material being bleached.

The hydrogen ion concentration of my improved bleaching solution may vary over a con-

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siderable range. A mildly acid condition may be used where desired, providing the fatty acid compound being bleached is of such a nature as not to be injured thereby, or where the compound has an acid reaction, for instance, a fatty acid. However, it is preferred to carry out the process at a pH within the range of about 5 to about 11.

Generally satisfactory results are obtained in bleaching non-acidic fatty acid compounds where the pH is maintained at about 7 or higher, for instance within the range of about 7 to about 11. Solutions having a pH somewhat lower than 7 may be used in the treatment of acid materials, such as fatty acids, and various other fatty acid compounds not injured by the acid condition. A buffer salt may, with advantage, be used to maintain the solution at the desired pH.

Alkali metal phosphates such as the monosodium and di-sodium orthophosphates have been found to be particularly advantageous buffers for the purpose of the present invention, though other buffers may be used with advantage. I have found that, by buffering the solution to a pH of about 7 by the presence of such phosphates, the consumption of chlorite in the bleaching operation is materially reduced. In some instances, a saving of 50% of chlorite has been effected by the use of these phosphates in conjunction with the other constituents of my bleaching solution previously noted.

My invention is applicable to the treatment of either natural or synthetic fatty acid compounds, including saponifiable oils and waxes, such as beeswax, carnauba wax, candelilla wax, corn oil, soybean oil and oleic acid, or commercial red oil. It is especially applicable to the bleaching of soaps and similar alkaline-reacting materials.

The bleaching of such fatty acid compounds is with advantage effected by treating the material while in a liquid condition, i. e., either molten or in aqueous solution or suspension, depending upon the characteristics of the particular material treated.

For example, such materials either molten or in aqueous solution, may be admixed with the chlorite in the presence of water, and the aldehyde thereafter added, or the material to be treated may be admixed with the aldehyde in the presence of water and the chlorite added to this mixture. The resultant mixture is maintained at a temperature usually ranging from room temperature to about 100° C. for a period of time sufficient to effect the desired bleaching and is thereafter cooled and separated.

In the bleaching of soap, for instance, the soap may be melted by heating in water, the soap solution admixed with an aqueous chlorite solution and the desired amount of aldehyde thereafter added gradually or as a series of small portions, during agitation.

In the treatment of wax or the like, which is solid at normal temperatures, the material is with advantage melted and an aqueous solution of the chlorite and the aldehyde admixed therewith or the chlorite and aldehyde may be added separately.

My invention and its application will be further illustrated by the following specific examples:

Example I

An aqueous solution was prepared by admixing 50 c. c. of pH 7 sodium phosphate buffer solution, 50 c. c. of an aqueous sodium chlorite

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solution containing 10 grams of available chlorine and 100 c. c. of a dilute aqueous formalin solution containing 2.2 grams of HCHO. 100 grams of soybean oil was then admixed with the resultant solution and allowed to stand for 2 hours, at the end of which time much of the original yellow color of the oil had been removed and, upon separation from the solution, a superior product was obtained. During the admixing of the oil with the solution and during the following 2 hour period a pH of about 7 and a temperature of about 25° C. were maintained.

Example II

Beeswax was not only bleached but the texture thereof was made smoother by the following treatment: To 50 grams of beeswax melted in a water bath there was added 50 c. c. of an aqueous pH 7 sodium phosphate buffer solution, 100 c. c. of an aqueous sodium chlorite solution containing 5 grams of available chlorine as chlorite and 1.9 c. c. of furfural. After admixing the solution and the melted beeswax, the admixture was permitted to stand for 1 hour at a temperature of 60° C. Thereafter, the wax was separated and allowed to solidify. The resultant product was found to have a much lighter color than the original wax.

Example III

Cocoabutter was saponified by treatment with caustic soda and 200 grams of the resulting soap was melted with 200 grams of water. 1 gram of sodium chlorite dissolved in an equal weight of water was then added and admixed with the soap solution. This was followed by the addition of 10 c. c. of aqueous formaldehyde solution prepared by dissolving 0.53 gram of 36% formalin in 100 c. c. of water. The addition of 10 c. c. of this aqueous formaldehyde solution was repeated at 10 minute intervals until a total of 100 c. c. of the solution had been added. During this period, the pH of the solution was approximately 9.3, no buffer being used, and the mixture was kept hot (about 100° C.) by the passage of steam therethrough. Thereafter, the bleached soap was cooled and separated. Its color was very white.

Example IV

A further batch of the cocoabutter soap was bleached, as described in Example III, except that a reduced amount of formaldehyde was used. In this operation the formaldehyde solution was prepared by dissolving 0.4 gram of 30% formalin in 100 c. c. of water. The color of the bleached soap was found to be even superior to that resulting in Example III.

Example V

A still further batch of cocoabutter soap was bleached, as described in Example III, except that the 10 c. c. portions of the formaldehyde solutions were added at 15 minute intervals. Results comparable with those of Example III were obtained, indicating that the time factor is not critical.

Example VI

200 grams of yellow laundry soap was melted with an equal weight of water containing 0.48 gram of 36% formalin. At 15 minute intervals, 10 c. c. portions of an aqueous solution of commercial sodium chlorite, each containing 0.1 gram of chlorite, were added until a total of 100 c. c. of the chlorite solution had been added. During this period, the pH of the solution was about 9.3, no

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buffer being used. A temperature of about 100° C. was maintained during this period, and thereafter until all of the available chlorine had disappeared, by the passage of steam through the solution. Thereafter, the soap was salted out and was found to be of a very good white color.

Example VII

For the purposes of illustrating the advantages derived from the use of the aldehyde in my process, results of the following experiments are presented:

To 500 grams of the yellow laundry soap of Example VI, maintained at its melting point, about 100° C., there was added and admixed therewith 2.5 grams of sodium chlorite in 3 c. c. of water. After being maintained at this temperature for about 2 hours, the soap was only slightly bleached. The mixture was then allowed to cool and stand for 2 days at the end of which time all available chlorine had been exhausted. The color of the soap was thereby somewhat improved though it still exhibited a slightly yellow cast. It will be observed that no aldehyde was used in this operation.

To 500 grams of the same soap, maintained at its melting point, there was added 2.5 grams of sodium chlorite and 0.932 gram of 36.6% formalin solution. After stirring the mixture for 20 minutes, all available chlorine had disappeared and the soap was well bleached. After removing a 100 gram sample of the soap, an additional 1.25 grams of sodium chlorite and 0.466 gram of formalin was added. After 15 minutes of stirring, the available chlorine had disappeared and still further bleaching of the soap obtained. During these tests, the pH of the soap solution was about 9.3, no buffer being used.

Example VIII

To 50 parts of red oil (oleic acid), heated in a boiling water bath to a temperature of about 100° C., and agitated by the passage of steam therethrough, there was added 0.5 part of available chlorine as sodium chlorite dissolved in 10 parts of water. A solution of 0.25 part of 36% formalin in 10 parts of water was prepared and 1 part of this solution was added at 5 minute intervals until the total had been added. A few minutes after the final addition, all available chlorine had reacted. The fatty acid was then separated and was found to be a well bleached product.

By my improved process, a high degree of bleaching may thus be accomplished with economy in time and chemicals while avoiding deleteriously affecting the materials being treated and the necessity of critical control of time, temperature and concentration heretofore required to avoid injuring the material.

Where the process is carried out under acid conditions, as previously described, it is possible that the activation of the chlorite is, in part, effected by the acid environment. However, the use of aldehyde, in accordance with my present invention, has the effect of materially accelerating the bleaching action of the chlorite, even in such acid environment, and is particularly desir-

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able where strongly acid solutions are to be avoided.

The present application is in part a continuation of my co-pending application Serial No. 472,052, filed January 11, 1943.

I claim:

1. In the bleaching of material comprising fatty acid compounds, the improvement which comprises admixing the material to be bleached with a water soluble chlorite in the presence of water and an aldehyde at a pH not less than about 7.

2. In the bleaching of material comprising fatty acid compounds, the improvement which comprises admixing the material to be bleached with a water soluble chlorite in the presence of water and an aldehyde, and maintaining the hydrogen ion concentration of the mixture at a pH not less than about 7 by the presence of an alkali metal phosphate buffer.

3. In the bleaching of fatty acids, the improvement which comprises subjecting the fatty acid to be bleached to the action of and in admixture with an aqueous solution of a chlorite having a pH not less than about 7 in the presence of an aldehyde.

4. In the bleaching of soap, the improvement which comprises subjecting the soap to the action of and in admixture with an aqueous solution of a chlorite in the presence of an aldehyde.

5. In the bleaching of non-acidic material comprising fatty acid compounds, the improvement which comprises subjecting the material to be bleached to the action of and in admixture with an aqueous solution of a chlorite at a pH within the range of about 7 to about 11 in the presence of an aldehyde.

6. In the bleaching of fatty acids, the improvement which comprises subjecting the fatty acid to the action of and in admixture with an aqueous solution of a chlorite at a pH not less than about 7 in the presence of an aldehyde, the molar ratio of chlorite to aldehyde being about 1:1.

7. In the bleaching of soap, the improvement which comprises subjecting the soap to the action of an aqueous solution of a chlorite at a pH within the range of about 7 to about 11 in the presence of an aldehyde.

8. In the bleaching of soap, the improvement which comprises subjecting the soap to the action of an aqueous solution of a chlorite at a pH not less than about 7 in the presence of an aldehyde, the molar ratio of chlorite to aldehyde being about 1:1.

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