United States Patent Office 2,805,914 Patented Sept. 10, 1957

2,805,914

ALPHA-HYDROXY-ADIPALDEHYDE TREATMENT OF CHICKEN FEATHERS TO ENHANCE FILLING POWER, WATER REPELLANCY, ETC.

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No Drawing. Application June 9, 1954, Serial No. 435,658

9 Claims. (Cl. 8—94.10)

This invention relates to a method of treating land fowl feathers, especially chicken feathers, to increase their "filling power" and resiliency, and to impart permanent curliness and water repellency, thereby making such feathers an acceptable substitute for the standard waterfowl feathers and down mixture now in wide use for sleeping bags, etc. A further object is to make handling of chicken feathers easier, not only with respect to the elimination of malodorous products normally found on chicken feathers but also easier and less expensive handling in the factory, as will be explained. A further object is to employ a single chemical which will kill bacteria, insects and other organisms on the feathers, and will eliminate bad odors and also will react with any blood left on the feathers. An additional object is to facilitate drying the treated feathers by employing a chemical which apparently prevents hydrolyzing of the keratin of the feathers.

In explanation of the expression "filling power," reference may be made to the report entitled "A Proposed Method for Measuring the Filling Power of Down and Feathers," by Henry A. Sinski, publication No. TD103037, The Office of Technical Services, Department of Commerce, and to the article by N. B. Edelman in Textile Research, Journal, vol. 17, p. 199 (April 1947) entitled "Investigation of methods for determining the filling power of feathers." See also the Sinski et al. Patent No. 2,706,910 dated April 26, 1955.

The term "feathers" as used herein includes cleaned and soiled whole land fowl feathers, crushed (commercial "curled") land fowl feathers, land fowl feather fibers, stripped land fowl feathers, and mixtures of these, but not waterfowl feathers or down.

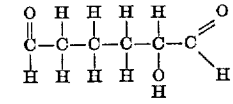
This application is a companion to our pending application Serial No. 411,594 filed February 19, 1954, entitled "Method of Enhancing Filling Power, Stabilizing Curl, etc. in Land Fowl Feathers by Applying Glyoxal and Products Produced Therefrom."

In the preferred procedure of the present invention, the feathers, if not known to be entirely free of blood, are soaked for about ten minutes at about 110°–125° F. in a solution of a haemolytic agent or blood solubilizer. One such agent is "Haemo-Sol," sold by Polychem Corporation, 501 Fifth Avenue, New York 17, N. Y. Another commercial blood solubilizer which might be used is sold under the name "Coagusol." The strength of the solution should be about 1 oz. of the agent to 10 gallons of water. After the soaking, the solution is drained off the feathers and the feathers are then laundered or dry cleaned to remove dirt and some of the natural oil or wax. In laundering, preferably a detergent such as Tergitol NPX is used (0.25% water solution at 110°–125° F.). Other detergents that have been found to be satisfactory are sold under the trademarks or names "Sted," "Glim," "Triton," "Sterox" and "Monsanto MXP." In general, the non-ionic type of detergents should be used to minimize any chemical action on the protein of the feathers. Laundering with the

usual degree of agitation continues for about twenty minutes, then the solution is separated from the feathers by centrifuging or wringing. In lieu of laundering, dry cleaning with any one of a number of well known dry cleaning solutions (e. g. trichlorethylene) may be resorted to, but washing is preferred because it is less expensive. Either the laundering or the dry cleaning may take place in the same vessel or container that is used during the soaking (blood solubilizing) step. Of course if the feathers as initially received are perfectly clean, the soaking and washing or dry cleaning may be omitted.

If the feathers are from immature chickens, the damp feathers from the described laundering or dry cleaning operation are placed in a 1% water solution of trisodium phosphate $Na_3PO_4 \cdot 12H_2O$ at 110–120° F. for about ten minutes. If feathers from nature chickens are being processed, the phosphate treatment period is increased to about thirty minutes. Feathers from nature chickens are, on the average, much less curly and much more difficult to curl than feathers from young chickens, hence the longer period of phosphate treatment. It should also be explained that curling feathers or enhancing their curl will increase the bulk value or filling power of the final feather product. Other suitably buffered alkaline solutions may be used in lieu of the trisodium phosphate solution mentioned above, but in all cases the time of the treatment must be much less for immature feathers to avoid excessive degradation. This mild alkaline treatment of the feathers is believed to alter the stability of the feathers by modification of the cystine linkages of the keratin. It is believed that the higher concentration of cystine linkages in mature feathers enables them to resist the action of the alkaline solution for a longer period.

The drained and rinsed product from the curling step just described, with a pH of 6–7, is then immersed in a solution of 1% alpha-hydroxyadipaldehyde



plus 0.1% of technical aluminum sulphate $Al_2(SO_4)_3$ as a catalyst. The pH should be between 2 and 4, which insures a good penetration of the feather body. The temperature should be between 105° and 120° F. for best results, and the time of the treatment should be about 30 minutes. Aluminum sulphate has the ability to lower the pH of the alpha-hydroxyadipaldehyde solution. In lieu of aluminum sulphate, we may use 0.05% chromium fluoride ($Cr_3F.4H_2O$) which has the desirable property of preventing bacterial degradation of the feathers.

After the adipaldehyde treatment, but before curing, the feathers are rinsed and partly dried by centrifugal wringing. The rinsing is important to remove any impurities left after treatment. The drying need not proceed at once: the damp feathers may be left in open containers for days without further attention. This is a very important operating advantage as it permits a factory using our process to shut down for a holiday or a weekend without the necessity of going on with the process. With some other processes, the feathers would be ruined unless work continued after soaking.

The final step is drying and fluffing, which takes place at about 140°–180° F. in a closed chamber with a beater such as is disclosed in Patent No. 2,739,391 dated March 27, 1956. The beating fluffs and highly charges the feathers and makes them exceptionally well suited for a filling material. The feathers are removed from the closed chamber by suction and are packaged or baled for future use.

The treated, dried feathers are very soft, permanently curly and water repellent. Their filling power is 6.0+, or about the same as the standard waterfowl down and feather mixture required by Army specifications.

What we claim is:

1. A method of treating clean land fowl feathers to enhance their filling power, impart water repellency and resiliency and other desirable characteristics which comprises soaking said feathers in a water solution of about 1% alpha-hydroxy-adipaldehyde plus an effective amount of an acidic catalytic agent to give a pH of between 2 and 4, the temperature being between 105° F. and 120° F., the time of the treatment being about half an hour, then rinsing said feathers and drying them.

2. A method of treating clean land fowl feathers which comprises imparting a curl to said feathers by soaking them in a curl inducing alkaline solution for between ten minutes and half an hour, depending on the maturity of said feathers, the temperature of the solution being about 110°–120° F., then rinsing said feathers to bring down the pH to 6 or 7, then setting the curl in said feathers by immersing them in a 1% solution of alpha-hydroxy-adipaldehyde plus an effective amount of aluminum sulphate as a catalyst, the pH being between 2 and 4, rinsing said feathers and drying and fluffing them at elevated temperatures.

3. The invention defined in claim 2, wherein the alkaline solution for imparting a curl to said feathers is a 1% solution of trisodium phosphate.

4. A method of treating clean land fowl feathers which comprises soaking said feathers in a water solution of about 1% alpha-hydroxy-adipaldehyde plus .05% chromium fluoride as a catalyst, at a pH of between 2 and 4 and a temperature of between 105° F. and 120° F., for about half an hour, then rinsing, drying and fluffing said feathers.

5. The invention defined in claim 4, wherein said clean land fowl feathers are first curled by soaking in a 1% water solution of trisodium phosphate at 110°–120° F. for between ten and thirty minutes depending on the maturity of said feathers, then rinsing said feathers to bring down the pH to 6 or 7, then setting the curl in said feathers by immersing them in the aforesaid alpha-hydroxy-adipaldehyde solution.

6. The product of the method defined in claim 1.

7. The product of the method defined in claim 2.

8. The product of the method defined in claim 4.

9. The product of the method defined in claim 5.

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