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METHOD OF MAKING HIDE GLUE

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This invention relates to a method of making animal glue. More particularly, this invention relates to an economical method of making high-grade animal glue from cured pork hides.

In the glue industry, it is known that the quality of glue is dependent upon the amount of inorganic salts dissolved in the glue. Thus, high-grade glues usually have a low salt content, and glues which contain relatively large amounts of salt are usually poor in quality. The presence of salt in glue is accompanied by a lowering of adhesive qualities, such as jell strength and viscosity.

It follows that in manufacturing glue it is important to remove the salt from glue raw materials prior to isolation of glue from these materials. Otherwise, the salt will be retained and concentrated in the final glue product and will interfere with its adhesive properties.

With respect to many glue raw materials, e. g. cow hides, bones, sinews, etc., the problem of salt removal is not difficult, but in the case of cured pork hides, it is especially difficult to remove salt by methods heretofore known.

A brief description of the manufacture of bacon rind glue by the lime-sulfurous acid method will serve to illustrate the problem of salt removal. In accordance with this method, a batch of bacon rinds is placed in a wash-mill and washed in cold water until the wash water is substantially salt free as indicated by test. During the washing step the rinds are agitated and kneaded in order to afford the fullest extraction of salt from the rinds. However, the extraction is only incomplete, and even though chemical analysis of the wash water shows a low concentration of salt (e. g. 100 parts per million), substantial amounts of salt remain in the bacon rinds. Next, the rinds are steeped in a saturated lime solution and held there for about sixteen hours. The lime stock is then washed and neutralized with sulfurous acid and finally cooked to extract the glue content.

The bacon glue product of the above method is entirely unacceptable particularly as to appearance and test strength. This glue, which is milky in appearance, has a viscosity of 90 to 100 millipoises and a jell strength of the order of 350 grams. In contrast to this, a high-grade hide glue would have a clear light amber color, a viscosity of about 200 millipoises, and a 500-gram jell strength.

The failure of present methods to provide a high-grade pork hide glue may be attributed to some extent to the inadequacy of the above-mentioned water-treatment step, and while it would

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be very important to industry to have an economical method for making high-grade glue from cured pork hides, such a method has heretofore not been available.

It is an object of this invention to provide an efficient, economical method for making high-grade glue from cured pork hides. It is a further object of this invention to provide a method whereby the salt contained in cured pork hides may be substantially removed without adversely affecting the glue-bearing factors. Other specific objects and advantages will appear as the details of the invention are set out.

We have discovered that we may obtain high-grade glue from cured pork hides by a method which involves the steps of physically conditioning the hides in water maintained at a temperature of about 110° to 120° F., treating the hides in chemicals, and extracting glue from the chemically-treated hides. Further, we have found that the salt content of cured pork hides may be safely and effectively removed by conditioning the hides in water at a temperature of about 110° to 120° F.

The success of our method in providing high-quality pork hide glue is due in large part to the highly effective salt-removal action of water controlled within the temperature range of about 110° to 120° F. The remarkable superiority of water at this temperature as compared with water at 40° to 60° F. was altogether unexpected. As a specific example of this unusual result, we have found that water at 110° to 120° F. is 150 percent as effective as cold water (40° to 60° F.) in the case of the removal of sodium chloride from bacon rinds. This could not have been predicted in view of the fact that the known solubility of sodium chloride in water increases by only 3.6 percent in the temperature range from 40° to 120° F.

In the preferred practice of our invention we charge a suitable wash-mill with a quantity of cured pork hides and sufficient cold water to cover the hides. The mill is conveniently provided with means for stirring and kneading the glue raw materials, and this stirring means is allowed to mix and knead the hides continually throughout the physical and chemical conditioning steps referred to above.

In the physical conditioning step, the temperature of the water is raised gradually to 110° to 120° F. by adding a substantial quantity of fresh warm water having a temperature of 115° to 120° F., whereupon a like quantity of water overflows from the wash-mill. This water conditioning step is continued in this manner until the concen-

tration of salt in the effluent water is about 100 parts per million.

After a sufficiently low salt level has been established, the hides are treated with chemicals. In this step the hides are steeped for about 4 hours in an aqueous solution of a suitable acid such as oxalic, the purpose being to cause the hides to take up water and to make them more susceptible to glue extraction.

Following acid treatment the acid liquor is drained off, and the hides are neutralized with water or a suitable basic material such as lime. The neutralized hides are then subjected to glue extraction in accordance with conventional methods.

Pork glue produced by the above preferred method is practically indistinguishable from high-grade hide glue. For example, our bacon rind glue product has an amber color and excellent adhesive qualities such as 500-gram jell strength and 250-millipoise viscosity.

An outstanding advantage of our process is that it is rapid. On the average, our process requires only about 24 hours or less prior to glue extraction. On the other hand, the lime-sulfurous acid method requires 3 days or more prior to glue extraction.

Our method is applicable to cured pork hides in general, and in particular to raw bacon rinds, salted hog- and pig-skins and the like. These hide materials may be used in any convenient form, preferably in the form of small slabs.

The term "cured" as used herein is meant to refer to a salted condition as produced by treating in a brine solution, dusting with dry salt, etc. Moreover, it will be understood that the use of the word "salt" includes inorganic salts generally, especially sodium chloride, lime, sodium nitrite, etc.

The salt extraction step is followed by chemical conditioning of the pork hides in an acid medium. For this purpose we may use any suitable acid. We have found, for example, that oxalic, sulfurous, phosphoric, formic, hydrochloric, citric, and other acids are suitable. In so far as we are able to tell, there is no difference in the jell strength of glues prepared with different acids. However, the use of oxalic acid is preferred, because it may be handled easily without risk of injury to operating personnel. Moreover, oxalic acid treatment imparts a uniformly excellent appearance to the final glue product.

In our preferred form of chemical conditioning, the strength of the acid solution may vary somewhat as, for example, between 0.25 to 0.75% acid (on a weight basis with respect to the solution). The optimum percentage appears to be about 0.25. It is probable that the use of lower dilutions will result in a lower jell strength glue. When higher acid strengths are used, an undesirable amount of salt of neutralization is ultimately developed in the pork hides, and this is attended by a loss in desired adhesive quality.

The preferred length of time for acid treatment is about 4 hours but this may be exceeded without loss in desirable product characteristics.

As the result of acid treatment, the pork hides take up considerable amounts of water. For example, a 100% weight gain is not unusual. Although this effect is only imperfectly understood at present, it can be said that glue may be extracted much more quickly from this "hydrated" glue stock than from glue stock which has not been hydrated by acidification.

Following acid treatment, the pork hides may be neutralized prior to glue extraction. We have found that it is not necessary to completely neutralize the acidified stock in order to obtain a high jell strength glue in the glue extraction step. However, the glue trade favors a neutral glue, i. e., a glue which has been extracted at about pH 7. The neutralization of acidified pork hides may be accomplished with water or with any suitable alkaline material such as lime, borax, soda ash, sodium hydroxide, ammonium hydroxide, soda lime, and other like materials. These alkaline materials may be conveniently introduced in aqueous solution or suspension.

During physical and chemical conditioning, the pork hides are advantageously mixed and kneaded in the presence of the wash water and chemicals. This mechanical action, which desirably hastens the extraction of salt and the take-up of water, may be achieved by any suitable means. We have found that a simple roller, such as described below, is satisfactory.

Following the acid treatment or (as is the preferred practice) after neutralization of the pork hides, the glue may be extracted by conventional procedures. We prefer to heat the pork hides to 170° F. and upward to the atmospheric boiling point of the glue solution. In the first extraction run, the stock is heated in the range from about 170° to 175° F. and the glue is extracted after 4 hours heat treatment. The next batch is extracted after a 6 hour run in the range from about 175° to 185° F. Further extractions, each for 6 hours, are carried out at progressively higher 10-degree intervals until the boiling point is reached.

The following specific examples will serve to illustrate the practice of our invention:

Example I

A cylindrical wooden vessel, or wash-mill, having an acid-resistant bottom and an upright center post, was used for the conditioning of the pork hides. Coupled to the center post was an electrically-driven roller, shaped like a truncated cone. This roller was adapted to revolve about the center post at 7–8 R. P. M. and to provide both a mixing and kneading action.

First, the wash-mill was charged with 5 tons of bacon rinds and 5000 gallons of cold water. Following this, warm water, at 115° to 120° F., was added continuously beneath the surface of the cold water at the rate of approximately 50 gallons per minute, and a like stream of water was allowed to overflow the mill. The rinds were then rolled and extracted with a continuous supply of fresh warm water (115° to 120° F.) until the wash water was substantially free of salt and other impurities.

Following removal of the impurities, the warm water was drained from the mill and replaced by cold water to which 225 pounds of oxalic acid were added. The acid solution was then mixed over the rinds for 4½ hours with the revolving roller.

After the acid treatment, the rinds were neutralized. This was accomplished by draining the oxalic acid solution and rinsing the rinds continuously with fresh cold water, cone rolling for 2 hours. Next, 20 gallons of aqua ammonia (25% NH_3) were added to the mill and the cone was rolled for about 6 hours. The excess ammonium hydroxide was then removed by draining the mill and washing the rinds continuously with fresh cold water, cone rolling for 2 hours.

Finally, the bacon rinds were removed and subjected to glue extraction between about 170° F. and the atmospheric boiling point of the glue solution.

Example II

A batch of fifty pounds of bacon rinds was loaded into a wash mill having a cone roller. This batch was washed continuously with warm water (110° to 120° F.) until the salt concentration of the water was less than 100 p. p. m.

After cooling to about 70° F., oxalic acid was introduced so as to give a 0.25 percent solution. The acid solution was mixed with the rinds for 4 hours, and was then removed. The batch was washed with a continuous flow of cold water until it was neutralized considerably. During all of these operations the mixing cone was rolled continuously.

Glue was extracted from the conditioned stock in the temperature range from 170° F. to the boiling point. The jell strength and viscosity of the glue obtained in the first run extraction were 535 grams and 406 millipoises, respectively. The all-run average of these values (weighted for amount obtained in each run) was 331 grams and 168 millipoises.

Example III

Fifty pounds of bacon rinds were loaded into a wash-mill provided with mixing means. The rinds were washed continuously with warm water (100° to 120° F.) until the sodium chloride concentration of the water was less than 100 p. p. m.

The rinds were cooled to room temperature and soaked in a 0.25 percent sulfurous acid solution for 4 hours. Excess acidity was then removed, and the rinds were neutralized by a continuous cold water wash. Mixing was continued throughout all of these operations.

Glue was extracted stepwise in intervals between 170° F. and the boiling point of the glue solution. First run and average jell strength were 523 and 318 grams, respectively. First run and average viscosity were 376 and 162 millipoises, respectively.

Example IV

Fifty pounds of bacon rinds were washed continuously with warm water (100° to 120° F.) in a wash-mill having a cone-roller for mixing and kneading the contents.

Washing was continued until the salt content of the wash water was less than 100 p. p. m. The rinds were cooled and then soaked in a 0.25 percent phosphoric acid solution for 4 hours.

Next, the excess phosphoric acid solution was drained off, and the rinds were neutralized in a continuous cold water bath. The mixing cone was rolled during the above operations.

The neutralized rinds were subjected to glue extraction from about 170° F. to the boiling point of the glue stock liquor. Respective values for first run and average jell strength were 523 and 331 grams; like values for viscosity were 352 and 171 millipoises.

Example V

Twenty pounds of bacon rinds were batch-washed with warm water (100° to 120° F.) until substantially freed of salt. The rinds were cooled to 70° F. and steeped in a 0.75 percent formic acid solution for 12 hours to cause the rinds to take up water.

The excess formic acid was drained off and the rinds were washed with cold water and neutralized by soaking in a saturated lime solution.

Excess alkalinity was removed by washing with cold water and, as in the above operations, glue was extracted in steps from the neutralized stock from 170° F. to the boiling point of the glue stock solution. The first run and average values for jell strength and viscosity were 514 and 317 grams, and 238 and 140 millipoises, respectively.

Example VI

Approximately 13,000 pounds of bacon rinds were batch-washed five times with warm water (110° to 120° F.), each time for two hours, followed by cooling to room temperature. After this, the rinds were soaked in a hydrochloric acid solution maintained at a pH of approximately 2.4 for a period of 18 hours. The excess acid was removed by batch washing with cold water.

Neutralization was accomplished by soaking the rinds in 0.5 percent (approximately) borax solution, and the excess alkalinity was removed by batch washing with cold water. During the above operations the batch was mixed whenever possible.

Glue was extracted between about 160° F. to the boiling point. Jell strength: first run, 461 g.; all-run average 305 g. Viscosity: first run, 258 m.; all-run average, 107 mp.

Example VII

Approximately 10,000 pounds of bacon rinds were washed both continuously and batchwise with warm water (110° to 120° F.) until the salt content of the washings was less than 100 p. p. m. The rinds were cooled and then soaked in a 0.5 percent oxalic acid solution for 4 hours and washed with cold water for 2 hours.

The rinds were neutralized in a saturated lime solution and washed with cold water for 2 hours.

Glue was extracted between 170° F. and the boiling point. The first run and average jell strength of this glue were 520 and 350 grams, respectively. Corresponding values for viscosity were 176 and 104 millipoises.

Example VIII

This example was similar to Example VII except that the water wash was continuous only, 0.25 percent oxalic acid was used as the acidifying agent, and the alkalizing agent was 0.25 percent sodium carbonate.

The jell strength of the glue product was 548 grams, first run, and 353 grams, average of runs. The viscosity was 397 millipoises, first run, and 167 millipoises, average.

While in the foregoing specification, we have set forth certain details and specific steps, it will be understood that variations therein may be made by those skilled in the art without departing from the spirit of our invention.

We claim:

1. The method of manufacturing glue from bacon rinds, which comprises extracting salt from said rinds with water maintained at a temperature of about 110° to 120° F., separating the extracted rinds from the water, soaking the separated rinds in acid solution for a time sufficient to permit substantial hydrolysis of said rinds, separating the acid-soaked rinds from the acid solution, and extracting glue from the rinds.

2. The method of manufacturing glue from bacon rinds, which comprises extracting salt from said rinds with water maintained at a temperature of about 110° to 120° F., separating the extracted rinds from the water, soaking the separated rinds in oxalic acid solution until the

rinds are substantially hydrolyzed, neutralizing the acid-soaked rinds, and extracting glue from the neutralized rinds.

3. The method of manufacturing glue from pork hides cured with salt, which comprises extracting salt from said hides with water at a temperature of about 110° to 120° F., separating the extracted hides from the water, soaking the separated hides in acid solution until substantial amounts of water are taken up by said hides, neutralizing the acid-soaked hides, and extracting glue from the neutralized hides.

4. The method of manufacturing glue from cured pork hides, which comprises extracting salt from said hides with water at a temperature of about 110° to 115° F., separating the extracted hides from the water, soaking the separated hides in acid solution for a time sufficient to permit substantal hydrolysis of said hides, neutralizing the acidified hides, and heating the neutralized hides with water to at least 170° F.

5. In a process for manufacturing glue from pork hides containing salt, the step of extracting said hides with water at about 110° to 120° F. to remove said salt.

6. In a process for manufacturing glue from cured pork hides, the steps of extracting said hides with water at about 110° to 120° F., separating the hides from the water, and prior to neutralization, soaking the separated hides in an acid solution until the hides are substantially hydrolyzed.

7. In a process for manufacturing glue from bacon rinds cured with salt, the step of extracting said rinds with water at about 110° to 120° F. to remove salt from the rinds.

8. In a process for manufacturing glue from salt-cured bacon rinds, the steps of extracting said rinds with water at about 110° to 120° F., separating the rinds from the water, and prior to neutralization, soaking the separated rinds in oxalic acid solution until the hides take up substantial amounts of water.

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