A METHOD OF PROCESSING FRESH BUTCHER-HOGSKINS

A method for processing fresh butcher-hogskins to leather is described. The procedure followed was essentially a process that was developed on brined skins and described in a previous publication, with modification. Sodium hydroxide (0.25 percent) was added in the relime step and a nonionic surfactant (0.5 percent) was added in the delime and bate step. The blue stock was then split, shaved, degreased, vegetable retanned and fat liquored. By following the procedures described, an acceptable leather with a clear grain and no grease stains was obtained. Either the added alkali or the added surfactant alone, also gave acceptable leather, but the use of both appeared to result in the cleanest grain.

The study demonstrates that the pigskin process developed earlier at this Center on brined skins which uses short floats, lowered amounts of water and chemicals and shortened process time can be modified to handle fresh butcher-hogskins. The importance of using fresh pigskins is that it gives additional significant savings of water and handling time when compared to the use of salt cured stock. It also provides the opportunity to maximize by-product recovery and to eliminate the dissolved solids pollution resulting from salt curing at the curing plant and tannery.

Introduction

In 1981, the world supply of pigskins was reported to be 779 $\times$ 10^6 head and only 5 percent of these skins were recovered (1). The Pigskin Council of America (PCA) stated that recently 80 $\times$ 10^6 hogs were slaughtered in the United States and about 5 $\times$ 10^6 were skinned for potential leather making purposes. Many of these will be rendered for gelatin or sold to tanners abroad with only a minority of the skins tanned in this country. World population will double in the next 20 years and will far outstrip any growth in the availability of cowhides for leather. A demand will then be created for pigskins, which are probably the largest untapped source of leather making raw material in the world (2). Mr. Wolff of the PCA stated that pigskin leather can and will reduce the critical supply and price problems of the leather industry and substantially improve the economics for hog producers. Pigskin tanners will also benefit from this use of pigskin not only in United States sales but in an international supply of semi-processed stock (3). Since the best quality raw skins come from the United States (6-month old pen raised butcher hogs) (1), it would seem probable that the related industries in this country could become a major beneficiary of any increased demand for pigskins.

Our laboratory has started a program in pigskin research and has begun to publish some of our initial results (4-6). One of our objectives is to develop the appropriate technologies for holding pigskins and for processing them to leather that will result in the maximum recovery of leather and nonleather making raw materials in the best possible condition for both

domestic and foreign use. To accomplish this it is necessary to emphasize the processing of fresh pigskins whenever it is possible.

This paper reports on the preliminary results that were obtained in a study of the processing of fresh butcher-hogskins and the processing modifications that were made to obtain a satisfactory crusted pigskin leather.

Materials and Methods

Rawstock. Fresh, pulled butcher-hogskins were obtained from a local slaughterhouse and put into process within about 5 hr after removal from the animal. The skins were double fleshed, first from head to butt and then from butt to head on a 72-in. double roll mechanical flesher.

Process. The fresh skins were initially taken to the blue by following a process developed at this Center on brined pigskins and described in a previous publication (6). A stainless steel lined drum was used for processing. The blue stock was split and shaved to approximately 3.5 ounces at a nearby commercial tannery. The modifications to the above process, the retan and fat liquor procedures, and the degreasing method are described below.

Relime Modification

Float	150 percent @ 85°F
NaOH	0.25 percent
Triton X114†	0.3 percent
Lime	4.0 percent

Run 20 min/hr for 12 hr

Drain float

Batch wash (3 ×)

Float	150 percent
Temperature	90°F

Run continuously for 10 min

Drain floats

Delime and Bate Modifications

Float	150 percent @ 100°F
Triton X114	0.5 percent
NH_4Cl	4 percent
1500 EU Bate	1 percent

Run continuously for 1 hr

Drain float

Batch Wash (2 ×)

Float	125 percent @ 90°F

Run continuously for 15 min

Drain float

Retan and Fat Liquor

Add 150 percent float @ 110°F

0.5 percent NH_4HCO_3 (to pH ≅ 6.0)

Run 30 min, dump float

Wash continuously for 10 min @ 120°F

Add 150 percent float @ 120°F

10 percent bisulfited quebracho (50 percent solution)

2 percent fat liquor 0-270 (Diamond Shamrock)

4 percent solvent fat liquor X-76-31 (Reilly Whitman, Inc.)

Run 45 min

Cool down float with cold water, then dump

Horse skins overnight

Dry in toggle, wet in, stake, toggle.

Degreasing of Blue Stock After Splitting and Shaving. It was found necessary to degrease the blue stock as follows before retanning and fat liquoring in order to obtain a satisfactory crust leather free from grease stains.

Wash continuously for 10 min @ 120°F.

Add 300 percent float @ 120°F

1 percent Triton X114

Run 45 min

Set overnight, then dump float A.M.

Wash continuously for 20 min @ 120°F

Physical Testing. The experimental leathers were tested for tensile strength (7) and double hole stitch tear (8). Samples of the leather were also subjected to a 3 min boil to evaluate their resistance to shrink under these conditions.

Results and Discussion

Conversion of Fresh Pigskins To Retan Crust Leather. Fresh butcher-hogskins were processed to the blue by following a process developed on brined pigskin and described in a previuos publication (6). The blue stock was split and shaved and then vegetable retanned and fat liquored following the procedure described in the Material and Methods section. This same retan and fat liquor were used throughout this study. When the retanned crust leather was air dried, pronounced grease stains appeared in the neck and flank regions.

It was next decided to determine if degreasing this split, shaved, blue stock before further processing would correct the problem of grease stains. The degreasing procedure followed is described in the Materials and Methods section. Degreasing the blue stock before further processing did result in less intense grease stains than when no degreasing was done, but the airdried retanned crust stock was still unsatisfactory. These results indicated that a further investigation of our processing method was necessary to determine if changes or modification could be made to solve this problem with fresh butcher-hogskins.

Investigation of Processing Modifications. A decision was made to add a small amount of NaOH to the relime step and a concentration of 0.25 percent was selected arbitrarily as a start. The rationale was that the increased surface alkalinity might effect breakdown of cellular structure or membrane in the outer skin surfaces by causing a more rapid and greater surface swelling than lime alone. Additionally, even small amounts of alkali are reported to materially decrease the calcium ion solubility (9), and decreased calcium ions and increased sodium ions should act favorably towards solubilizing surface fatty acids. These factors plus the surfactant already present in the relime step could effect increased removal and suspension of surface fat and fatty acids in this step and also in the delime and bate step.

It was decided to also add 0.5 percent Triton X114 to the delime and bate steps. The skin volume drops significantly in going from the relime to this step, and this rapid contraction or falling of the skin volume could free more of the fatty substances in the skin for suspension and removal by the surfactant. The proteolytic enzymes in the bate might also act to break down skin structure which could release fatty material for easier removal.

In the first experiment, six fresh butcher-hogskins were processed through to the blue using the above modifications to the process. These modifications did not result in any obvious changes in processing characteristics that could be determined by observation or pH's of the various treatment floats. The blue stock was split and shaved and then degreased. Following retan and fat liquor, the crust leather was dried. The grain was clear and there were no grease stains which indicated that the process modifications were effective.

At this point an experiment was set up to determine if the processing changes made could eliminate the need for degreasing the blue stock before the retan and fat liquor step. Therefore, split, shaved blue stock, which had been made from fresh butcher-hogskins put through the modified process and not degreased in the blue, were retanned and fat liquored. The retan crust leather after air drying did show grease stains on the grain surface in the neck and flank areas. The results, however, were an improvement over the crust stock from fresh skins that had been put through the unmodified process and also had not been degreased in the blue.

It was of interest now to determine whether just the alkali addition to the relime or the surfactant addition to the delime and bate would suffice. In this series of experiments six fresh butcher-hogskins were used for each test. After conversion to the blue each group was then degreased before retanning and fat liquoring. All the retan crusted stock from both experiments air dried with no grease stains, which indicated that either of the additions alone was effective.

The use of both the alkali and surfactant, however, seemed to give a clearer grain but much more experience data will be needed to confirm this. At the moment considering the skin variability such as breed, time of year, feed used, and possible processing variables it is suggested that both processing modifications be used with this retan fat liquor system to give best results.

Physical Tests on Retanned Crust Leather From Fresh and Brined Skins. Table I shows the tensile and double hole stitch test values that were obtained on our experimental crust retan leather. In comparing the leathers produced by the various modified processes, there appears to be no obvious differences in test values. When these leathers as a group were compared to leather produced from brined stock carried through the unmodified process, and then degreased in the blue (Table II), there again appears to be no difference.

The leathers were sampled and tested for shrink temperatures and in all cases gave a 3 min boil. Based on this test, again the leather appeared to be similar.

It was necessary to use whole skins for an adequate evaluation of our experimental ap-

TABLE I

PHYSICAL TEST DATA ON CRUST RETAN LEATHER MADE FROM FRESH PIGSKIN AND MODIFIED PIGSKIN PROCESS

Side no.	Elongation and Tensile Strength: Direction	Thickness in.	Elongation percent	Tensile[a] p.s.i.	Stitch Tear/Double Hole: Stitch Tear[a] lb/in.
	(Alkali in relime and surfactant in delime and bate)				
1	par.	0.0500	26.00	2810	560
	per.	0.0510	24.88	2110	
2	par.	0.0540	26.88	2580	607
	per.	0.0535	25.00	1830	
3	par.	0.0515	27.13	2620	599
	per.	0.0515	28.25	1740	
	(Alkali in relime)				
4	par.	0.0500	31.63	2900	607
	per.	0.0510	35.50	1660	
5	par.	0.0480	27.75	2740	594
	per.	0.0460	36.88	1940	
6	par.	0.0485	38.38	2440	606
	per.		35.50	1540	
	(Suractant in delime, bate)				
7	par.	0.0410	24.75	2510	557
	per.	0.0410	21.63	1940	
8	par.	0.0470	26.63	2560	554
	per.	0.0465	18.00	2700	
9	par.	0.0455	23.25	3080	539
	per.	0.0485	39.13	1760	

[a]Average of two values.

TABLE II

PHYSICAL TEST DATA ON CRUST RETAN LEATHER MADE FROM BRINED PIGSKIN AND UNMODIFIED PIGSKIN PROCESS

Side no.	Elongation and Tensile Strength: Direction	Thickness mm	Elongation percent	Tensile[a] p.s.i.	Stitch Tear/Double Hole: Stitch Tear[a] lb/in.
	(Brined commercially)				
1	par.	0.0540	37.50	2460	795
	per.	0.0564	34.88	2940	
2	par.	0.0656	56.88	1985	555
	per.	0.0680	42.25	1625	
	(Brined at our lab)				
3	par.	0.0574	46.25	3125	680
	per.	0.0573	33.63	3085	
4	par.	0.0601	52.50	2060	620
	per.	0.0601	30.50	2150	

[a]Average of two values.

proach. To carry through an experimental run to a product that could be evaluated could take at least 2 months and this was a practical constraint on the experimental data we could generate and the variables we could test. The removal of fatty tissue from the flank and neck areas of the fresh pigskin during fleshing is difficult since these areas are substantially thinner than the rest of the skin (10) and the fresh skin is soft and compressible. This could be a con-

tributing factor to possible later problems of grease stains appearing in the neck and flank regions using the unmodified process on the fresh skins.

There is much more that needs to be done. Other retan and fat liquor systems will need to be tested individually in terms of their response to this process and other beamhouse procedures. The effects of the process modifications we have proposed need to be rationalized, and their effects on fat removal from the skin and on the composition of the processing effluents should be determined. Our results will need to be corroborated on large scale commercial runs. In addition, the effects of our process modifications on brined skins should be evaluated.

The process described in this report is only one of many possible approaches to try and improve the processing of pigskins. Growing interest in the inherent economic potential of this raw material will be the incentive for the additional research and development which is needed.

Summary and Conclusion

These preliminary studies have demonstrated a method of processing fresh butcher-hogskins to a satisfactory vegetable retan crust leather. This was accomplished by modifying a process previously developed at this laboratory on brined pigskins. These modifications require an addition of 0.25 percent NaOH to the relime step and an additional 0.5 percent Triton X114 to the delime and bate step. It has been shown that either of these additions, e.g., the added alkali or the added surfactant alone, will give an acceptable crust retan leather with a clear grain but the use of both additions is recommended at the moment since they appear to give a cleaner grain, and their use does not appear to be prohibitive in terms of additional time or expense. It is necessary to degrease the split and shaved blue stock before the vegetable retan and fat liquor step. However, a degreasing was also needed when brined stock was put through the unmodified process and this retan and fatliquor were used. Much more experimental work is necessary to study and optimize the process, and to corroborate these results in a larger scale or a commercial scale run. It is important to note that other retannages and/or fatliquors may respond differently than those that were used in this study.

This method of processing fresh butcher hogskins maintains all the advantages of the process developed earlier at this Center on brined pigskins which uses short floats, lowered amounts of water and chemicals, and shortened process time. In addition, the use of fresh pigskins reduces further the use of water and handling time when compared to brined skins and eliminates the high dissolved solids pollution due to salt curing at the curing plant and tannery. Finally, it provides the opportunity to maximize and upgrade the by-products recovered.

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