



# AUTOMATIC PRESSURE TANNING

by Dan Rinehart

**How does the pressure tanner system work?** “Contact force” is the key concept. The objective of any tanning process is to use osmosis and saturate hide fibers (molecules) with tanning agents. With saturation as the goal, the pressure tanning system increases the percentage of tanning molecules per cubic inch. The result is that the “osmotic interaction” of tanning agents in hide molecules is increased. Osmotic interaction is simply the replacement of organic material within the molecules of a hide with tanning/preserving agents.

**PRESSURE IS THE KEY.** At 30,000 feet on Mount Everest, there are fewer oxygen molecules per square inch than there are at sea level. The reason for this difference in oxygen density is pressure. When oxygen is denser (sea level) in the lungs, more oxygen is available per square inch for saturation of lung tissue. Thus, increased oxygen molecules per square inch of breathing air directly correlates to increased lung absorption of oxygen molecules.

The same is true for tanning a hide. The more pressure within the automatic tanning cylinder, the more tanning molecules are pressed into a given square inch of hide material. Thus, pressure assures thorough penetration throughout the hide in less time. Therefore, through “contact force,” pressure-tanning saturates hide material with the maximum amount of tanning molecules.

In contrast, a water pressure washing system uses “acceleration force,” which accelerates one material through another but does not assist “osmotic interaction.”

**Speaking of time and saturation rates...** The following are the results of a test that we conducted on a vat of cow hides tanned through the conventional pickle- brush-on tanning methods. The test was designed to measure the rate of saturation throughout the thickness of a hide. Here are the results.

HIDE PENETRATION	TIME
Stage 1- 1/16 inch	1 hour
Stage 2- 1/8 inch	5 hours
Stage 3- 1/4 inch	36 hours

Yes, there is a geometric decrease in penetration of tanning agents when tanning a hide utilizing a brush-on tan (gravity) at atmospheric pressure. The same penetration-constraints apply within the pressure tanning system, however, the time it takes to saturate 1/16 inch with the pressure system is greatly reduced.

We tested the same breed and size of cow hides with the pressure tanner system and found the following saturation rate.

HIDE PENETRATION	TIME
Stage 1- 1/16 inch	20-30minutes (70% of the area was 90% tanned.)
Stage 2- 1/8 inch	1 hour
Stage 3- 1/4 inch	6 hours

Yes, the penetration rate geometrically again increased. The results of this study showed us that the thickness of the hide has a huge effect on the saturation rates. With this in mind, we did the same test with the exception of removing the hide from the tan after being pressurized for one hour and fleshing the hide with a Quebec Flesher.

HIDE PENETRATION	TIME
Stage 1- 1/16 inch	20-30minutes (same as before)
Stage 2- 1/8 inch	1 hour (same as before, hide is removed and fleshed)
Stage 3- 1/4 inch	2 hours

Note that with a fleshing machine, after 1 1/2 hours of being in the tan, the penetration rate does not geometrically increase. Instead, the penetration of the third 1/16 inch is exactly the same as the penetration for the previous second 1/16 inch.

The results of this test are the reason why the pressure tanning procedure *always* includes the shaving of the hide within the first 1 to 2 hours of tanning.

**FINDING:** Tanning agent penetration-rates geometrically decrease due to thickness of the hide. That is why it is essential to shave a hide after the initial 1 to 2 hours in a pressure tanner.

**How does the pressure tanning system work?** Utilizing the physics of “contact force” with the pressure tanning system and using proprietary tanning crystals, a more complete osmotic exchange is completed in a shorter time period, resulting in a quicker, more complete tan. Pressure tanning crystals consist of the following three chemicals:

**Aluminum sulfate:** acidic tanning agent, sets hair

**Salt:** pulls natural fluids out of a hide

**Soda ash:** (time released neutralizer) slowly increases pH

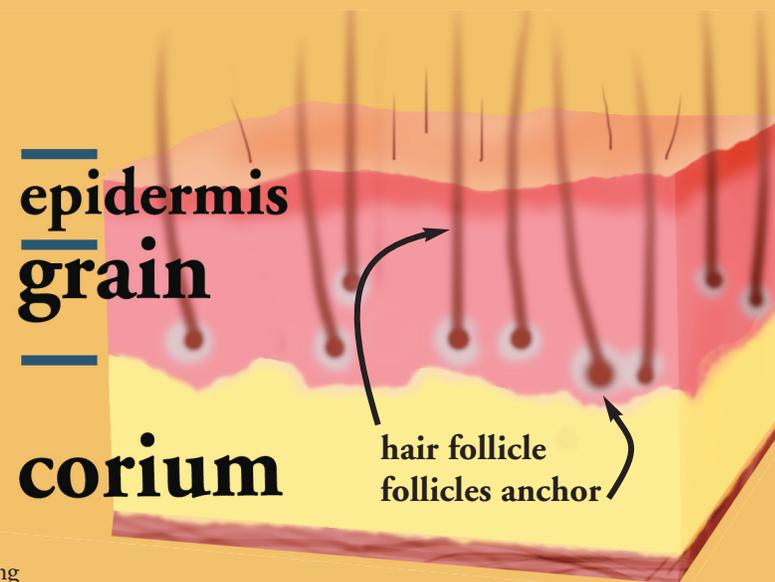
**Aluminum sulfate** is an acidic tanning agent that both opens the hide (lowering pH) and saturates hide fibers (molecules). As aluminum sulfate lowers the pH, the hide is puffed up, creating a more porous hide which more efficiently accepts tanning agents. Once the hide is puffed up, the pressurized aluminum sulfate replaces organic material within each hide molecule with the aluminum sulfate tanning agent. At the same time, the erratically woven hide fibers are coated with aluminum sulfate tanning agents. Note: with the pressure tanning system, “pickling” is automatically in the process.

The structure of a hide is similar to erratically woven fibers. Tanning a hide effectively coats the fibers with a “chemical veneer.” Tanning a hide can be described simply as painting the fibers of a hide with preservatives. Pickling swells the fibers of the hide, making it easier for tanning

agents to penetrate and making it easier to flesh the hide.

**Salt** pulls natural fluids, dirt, and contaminants out of the hide, transferring such fluids from the hide and sending it into the waste fluid. Salt also prevents “acid swell.”

**Soda ash** is a “time-released” neutralizer that slowly increases the pH of the tanning solution. The result is that soda ash neutralizes (closes hide tissue) the hide and “locks-in” the tanning agents. The important (proprietary) characteristic of the soda ash in the pressure tanning crystals is that it is “time-released.” The aluminum sulfate must have adequate time to open, penetrate, and saturate hide molecules and hair fibers/roots. Therefore, the effectiveness of the soda ash must be put on hold for a time period. Once the aluminum sulfate has penetrated the hide molecules (osmosis) and coated the hide fibers, soda ash is released, “locking-in” the tanning agents and securing the hair roots. Note: soda ash neutralizes (increasing pH) the aluminum sulfate much slower than baking soda, allowing more effective saturation of tanning agents in the hide. If pH is *not increased*, the hide will lack “binding,” and hide material will remain open, allowing tanning agents to escape. The result of a hide that lacks proper tanning agents is that it will ultimately dry, shrink, pull, and crack.



**Why is warm water used in the pressure tanning system?** Greater tanning penetration and increased duration of neutralizing (Soda Ash) process occurs with warm water. Optimal water temperature is 105 to 110 degrees (dishwashing temperature). It’s all about decreasing pH. Cold water averages 3.2 pH, while warm water averages 2.5 pH.

Since a lower pH increases hide penetration of tanning agents, warm water instigates a deeper and more complete tan saturation. Warm water also cleans and loosens organic materials such as blood, dirt, fat, etc.

The “bonding” of the tan in the hide occurs as the water temperature cools. As the tanning solution cools, the soda ash slowly increases the pH, locking in the tan to the hide fibers. Using baking soda as a neutralizer “jerks” the pH higher. The jarring neutralizing of baking soda decreases tanning saturation effectiveness. Conversely, as the warm water slowly cools in the pressure tanner, the soda ash slowly neutralizes (increasing pH), thus allowing tanning agents greater opportunity to saturate and bond.

In other words, baking soda “slams the door” on tanning agents, while soda ash “closes the door” over an extended time, allowing greater tan penetration and absorption, resulting in a final “locked” (bonded) tan.

# TANNING

**Pickling.** If you blow up a balloon, dip it in paint, and then deflate the balloon, the deflated balloon will have a very high density of paint per square inch. On the other hand, if you dip a deflated balloon in paint and then inflate it, the inflated balloon will have a very low density of paint per square inch.

Pickling works the same in the pressure tanning process, and here is why it is essential for a deep tan. The pickling process automatically oc-

curs in the pressure tanning process as the aluminum sulfate plumps the hide (similar to the inflated balloon), tanning agents coat the expanded hide fibers (similar to painting the balloon) and finally soda ash neutralizes (deflates) the hide, similar to the high density of paint on the deflated balloon, locking in the high density of tanning agents.

A mammal hide consists of three layers: epidermis layer, grain layer, and corium layer.

**Epidermis:** this is the thinnest of the three layers, much like a thin outer veneer. When a hide starts to deteriorate, this is the first layer to “slip.”

**Grain:** This layer is very similar to the following corium layer, however, it has the tightest fiber-weave of all the layers. The result of being the tightest weave and being sandwiched between two other layers is that it is the last to tan. The catch-22 here is that this is the most important layer to tan because it is within this layer that hair roots are located. Improper tanning of this layer will result in certain hair slippage as the “follicle anchor” will be affected by bacteria, then will disintegrate and release the hair from the hide. Note: the first areas that bacteria attack are the follicle anchors. If follicle anchors are destroyed by bacteria, it is 100 percent certain that the hair follicles will slip from the hide layers.

**Corium:** This is the thickest layer of the 3 layers. This is also the layer that we thin when we flesh a hide from underneath. As described previ-



**Step 1**

Put one gallon of water, per average deer cape, into the pressure tanner.



**Step 2**

Measure one pound of tanning crystals for each gallon of water used.



**Step 3**

Pour and mix in the tanning crystals.



**Step 5**

Apply the tank top and bolt close. This will seal the tank for an airtight fit.



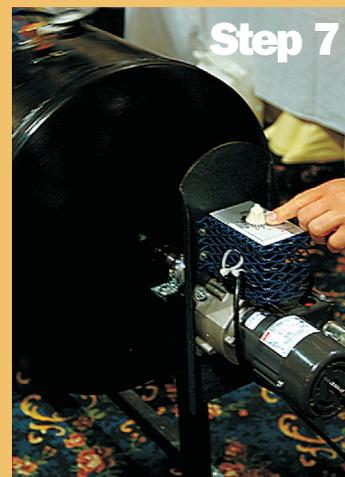
**Step 6**

Pressurize the tank.



**Step 4**

Place the cape(s) into the tank. All meat and fat should be removed before starting the tanning process. The ears, lips, eyes, and nose should be turned and meat removed.



**Step 7**

Set the timer for one hour.



**Step 8a**

After one hour remove the cape, drain and flesh. Here Gerald Tessier demonstrates the new Econo Quebec Flething machine.



The capes, now fleshed, will be returned to the pressure tanner.



Add a third-cup of softening oil and one capful of Scour to the tanning solution. Re-pressurize the tanner and set for three more hours.

ously, it is essential that this layer be thinner if we are to achieve proper chemical saturation and penetration.

**Leveling and what it means for your tan.** "Leveling" is the slow migration of tanning chemicals throughout the depth of a hide during the drying process. After 4 hours of tanning in a pressure tanner, 100 percent of the hide has been penetrated with tanning chemical. After immediate removal of the hide from the pressure tanner, the level of tanning agent differs between layers. Seventy to 80

percent of the tanning agent is in the inside 80 percent of the hide The corium has the highest percentage, followed by the epidermis and finally the grain layer. It is during the mounting and drying process that the percentage of tanning chemical content within each layer "levels" or evens out. It is this natural process of "leveling" (migrating and evening the tanning content) that eliminates shrinkage during the drying process.

Note: fleshing after the second tanning will remove the highly saturated corium layer that initiates "leveling" (through the corium and into the grain layer). The result of the removal of the corium will be a dried grain layer that lacks proper tanning chemical, and the hide will pull, shrink, and crack. If you find that you must flesh the hide after the second tanning, simply submerge the entire hide back into the tanning solution for 10 to 15 minutes (after fleshing, prior to mounting).

**Pressure Tanning Procedure:**

1. Remove the major meat and fat.
2. Turn the ears, lips, eyes, and nose.
3. In the tanner, mix 1 pound tanning crystal and 1 gallon water per average size deer cape.

4. Pressurize tank and set timer for 1 hour, then flesh each hide.
5. Add 1/3 cup of softening oil and 1 capful of Scour to tanning solution, re-pressurize the tanner and set the timer for 3 hours.
6. Remove the hides from the tanner and quickly (2-4 minutes) rinse them in cold water with Dawn dishwashing detergent.
7. Spin-dry each hide in a washing machine. The hide can now be frozen or mounted. The result is a quick, cost-effective, convenient and complete tan, the Automatic Pressure Tanner. ■

DAN RINEHART owns and operates Dan Rinehart Taxidermy School & Supply in Edgerton, Wisconsin. He recently bought the rights to the Automatic Tanner from Steve Rotramel (Taxidermy Arts Supply), who invented the machine in 1997. You may contact Dan at (608) 884-3047.



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