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# **Chemistry of Tanning**

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Tanning in the taxidermy industry is a very vital purpose for the life of your mount. But what is it and how does it work? Tanning is the process of changing a protein skin into a non protein state. This article is not meant to access each method, but cover the importance of properly handling the skin, understanding the makeup of the skin, and review various factors that contribute to a properly tanned skin. "Before one can learn to tan, it is essential to learn some of the chemistry behind it".

Factors affecting the finished product are proper handling of the skin, *<u>pickling</u>*, <u>degreasing</u>, <u>bating</u>, <u>shaving</u>, <u>staking</u>, and <u>drumming</u>. As these materials and processes have an effect on quality, so do the types of skin, the regions they're from, time of year they're killed, age, and possible diseases. An understanding of the skin is essential before tanning can be achieved. The makeup of the skin is approximately as follows:

Collagen. 30% tannable protein
Elastin. Less than 1% tannable protein (Can be removed by bating)
Keratin. 2-10% makeup of hair or fur
Albumen. Less than 1% non-tannable protein
Globulin. Less than 1% non-tannable protein
Mucous substances. Less than 1 % non-tannable protein
Salts. Less than 1%
Fats (inner). Approximately 2%, does not include surface fat
Water. Over 60%

Approximately; 30% of the total makeup of the skin is tannable substance, the rest must be removed by various methods which include saltwater soak, detergent baths and *pickling*. Each one of these processes helps in the cleansing and degrading of the unwanted protein.



Of these layers, approximately 60% is removed by <u>shaving</u>. The corium is made up of endless interwoven fibers. These must be thinned enough in the shaving process to give the proper stretch to the finished leather.

## Salting

The purpose of curing a raw skin is to take away the environment for bacteria and provide a means of storage prior to tanning. Bacteria action is stopped when the moisture content is reduced to below 15%. It is important that this process is carried out as soon as possible. Even though some of the bacteria are killed by drying, other bacteria and the spores deposited by bacteria only become dormant and will be activated upon <u>re-hydration</u>. Bacteria, indiscriminately attacks the hide substance by secreting enzymes. They in turn re-digest the broken down proteins. This is especially important to control before tanning and when tanning to prevent skin degrading and hair slippage. Once the protein that holds the hair follicle is destroyed, hair slippage is irreversible. Although drying a skin as quickly as possible is important, drying by direct heat or exposure to the sun can cause gelatinization and cause hardening. The water soluble glues and fats become insoluble. This is a problem often encountered when tanning African skins.

The trapping industry most often stretch furs on wire frames and air dried, but the most common method of curing is by salting. Salting not only dehydrates the skin, but it combines with the proteins and separates the fibers. This makes <u>re-hydration</u> much easier but should not be considered a cure all! Halophilic bacteria can live in a salted skin when the moisture content is above 15% and it only



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becomes dormant when below this point. It is therefore important to use a bactericide in the re-hydration process and never use old used salt. Raw skin should never be salted below freezing. Skins salted at 0 –F will only have 20% penetration. It takes approximately 12 hours at room temperature for salt to penetrate the average skin. After 24 hours the salt should be shaken off and the skin re-salted with clean salt! Using old salt over only increases your chances of bacterial contamination due to the bacteria that is in the salt from prior use.

Avoid a salt pile! A salt pile will place your trophy in harm's way! A salt pile is when you salt the skin one time, lay out the skin and start a pile. The next skin is placed on top of the first skin and then also salted and so on and so on. The skin being covered up by the next skin cannot dry out and the moisture, blood and fluids drain off and soak into the skins below. Doing this careless method means the moisture content will stay above 15% resulting in bacteria activity.

Skins containing high concentrations of fat should not be stored any longer than necessary. The fat becomes rancid and hardens in the skin causing grease burn. After long storage, they become almost impossible to re-hydrate and tan.

## **Re-Hydration of Salted Skins**

To re-hydrate dried salted skins soak in a 5% salt solution with a good bactericide/fungicide. Any more salt in the solution will hinder rehydration. Warm water also helps but should never exceed the living body temperature. This can cause irreversible swelling and gelatinization of the protein. Soak the skins only as long as necessary. Prolonged soaking can cause loosening of the hair. Skins that are difficult to re-hydrate can be beamed or <u>drummed</u> in damp-warm saw dust. These procedures break the surface fibers and allow better penetration.#

## **Pickling and Bates**

- 1. They stop bacteria growth when the pH is kept below 2.2
- 2. They degrade the acid soluble proteins
- 3. They swell and open up the fiber to provide more tanning sites
- 4. They firm up and reorient the fiber for better shaving

The purpose of a pickle is to swell the skin and open the pours in the skin to allow the chemicals to absorb better, break down the fibers in the skin for softer leather and aid in shaving the corium. Skins should be left in the pickle for a minimum of 24 hours. The longer the skin is left in the pickle, the softer and stretchier the leather. It is also important to maintain the pH and the correct concentration of acid for the pickle to work properly. When adjusting the pH to maintain the pH level, be sure to remove skins prior to adding acid. Be sure to mix well before returning skins to the solution. Below is a list of some of the acids commonly used in pickling and the characteristics of each:

- Formic acid: Medium strength organic acid. Available in 85 and 90% concentrations. Most common acid used in the fur dressing industry. In liquid form only.
- Acetic acid: Weak organic acid. Available in strengths from 30 to 100%. Same as white vinegar. In liquid form only.
- **Oxalic acid:** Strong organic acid. Used where a bleaching effect is desired. Should not be used for hair-on tanning except for white-haired animals. In powdered form. Poisonous.





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- **Sulfuric acid:** Very strong mineral acid. Available in strengths from 80 to 100%. In liquid form. Very dangerous to handle. Can explode if added to water too quickly.
- Hydrochloric acid: Strong mineral acid. Available in strengths form 32 to 37%. Evaporates easily. Dangerous.
- **Bascal-S:** Weak organic acids. In flake form. 100% concentration. Helps break down non-tannable proteins. Can be used with other acids. Helps relax skins and tightens hair.

**Bates:** Are added in the pickling process. The purpose for bates is to help prepare the skin for tanning. Bates cleans out natural fatty substances and fatty acids. Opens in between the fibers in the skin, makes a softer stretchier leather and aids the pickling to do it's job. A bate is vital to thicker skins such as bison, moose or elk and are essential for African skins with their tighter woven fibers in their epidermis. With out bates many tanneries think the skin will not be as soft and you will have a better chance of <u>drumming</u> after mounted.

## Degreasing

Degreasing, or "scouring" as it's sometimes called, is a very important step in the tanning process. Improper degreasing will result in poor quality tanning and reduce the longevity of the leather. The fatty acids in the natural fats harden and make the skin waterproof. For skins such as deer, antelope, moose or elk, very little degreasing is necessary. There are many types of degreasing agents available which give varying degrees of success. Solvent degreasers such as mineral spirits, perchloroethylene, trichloroethylene, naphthalene and many others work extremely well. They are also used in conjunction with aqueous degreasers. Unfortunately, solvent recovery is very difficult without distilling equipment. With more restrictions on toxic wastes, many tanneries are using biodegradable aqueous degreasers. For the best results, degreasing should be carried out in the *pickle*.

## Shaving

A fleshing machine is a must although excellent results can be obtained by a curriers' knife. Both take experience to be proficient. Shaving should be done after the skin is pickled for at least 24 hours. For maximum results return the skin to the pickle for another 24 hours and then re-shave. A skin that is not shaved properly will lack stretch, will be stiffer and have more shrinkage resulting in greater chance of drumming. The object is to cut enough of the corium to separate the fibers but not to cut into the epidermis layer.

## **Basification**

This is the process of leveling the acid level after pickling. Basification is important to provide for proper penetration and to remove most residual acids in the skin. This process is often referred to as neutralization. The term is not correct because the pH is seldom brought to neutral.

Leveling is accomplished in three steps. Pickles can be a pH range from 2.2 - 3.5 depending on the type of tanning process used. Soda ash is added in the pickle and the pH level is gradually brought up to about 5.6 pH. This leveling is accomplished through out a three day process.





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## Tanning

Bacteria control, proper shaving and reducing moisture are the key factors in producing a proper tan. Some common tans used today are known as EZ-100, Liqua-Tan, Lu-Tan F, Alum.

## **Oils and Fat Liquors**

Tanning oils and fat liquors come in a variety of combination for different uses and effects. They are made from raw marine and animal fats and oils, vegetables oils and synthetic oils. Some are sulfated (reacted with sulfuric acid and neutralized with alkaline), some are sulfated (reacted with sodium bisulfite) and some are emulsified with anionic, non-ionic, or cationic emulsifiers. These are generally termed fat liquors. Fat liquors that are stable in the pickle and tanning baths are usually combinations of sulfated oils, neutral oils, raw oils and emulsifiers. Swabbing oils must penetrate the leather usually without mechanical means and fix to the leather fiber to prevent washing out. Oils with high fatty acid contents should be avoided when tanning for taxidermy. They tend to oxidize and harden darkening the leather and preventing <u>re-hydration</u>. When oiling skins by the swabbing method, the moisture content should be between 15-25%. Too high moisture content, the oil becomes diluted and too low a moisture content, the fibers adhere together causing stiffness.

## Staking

With out staking the skins you will not have a proper tan or finished leather! This is the procedure where the skin fibers are mechanically "broken". The skin should be 75-80% dry before staking or the staking will have little effect. Staking is done either by a commercial staking machine or by hand. There are several methods of hand staking. One is to work the skin over a rounded edged board clamped to a bench, second is to clamp the skin to a bench or beam and work the skin with a hand held staker, and third is to work the skin over a tightly stretched 3/4" hemp rope (care must be taken not to damage the hair or fur.) If the skin fibers are not broken then the leather has a greater chance in drumming and has little stretch for taxidermy purposes. Staking in many tanneries eyes is the final step of tanning. They believe without staking your skins are not tanned.

## **Drumming Machines**

There are two basic methods of drumming. One is to drum the skin in a 6 -8 foot tall drum immediately after <u>staking</u> and the other is to dry the skin completely before drumming. If the skin is completely dried, it is then drummed in damp sawdust to soften the skin. The advantage of this method is that the inner fiber moisture is dried and when the skins are re-drummed in dry sawdust after the wet sawdust, the skins dry softer. Another method of producing even softer leather is to re-oil with solvent oil, when the skin is about 80-85% dry. Then roll up the leather overnight and drum the next day. The solvent oil displaced the moisture and keeps the fibers separated until the leather is completely dry. The sawdust used for drumming should be hardwood such a maple, ash, or beech. Never use hardwoods such as cherry or walnut that can stain the hair and skin, or soft woods with resins. Other drumming materials used are corn cob, corn meal, flour, talc, and clay. Borax can be used for skins such as domestic sheep (sawdust is almost impossible to remove from domestic sheep). The sawdust drum should be at least 6 feet high and 2 feet wide. It should have baffles every 2 feet on the inside with 1x2-inch rounded pegs sticking up from the baffles. The drum should turn 10-15 revolutions per minute depending on the size of the drum. Drumming time varies from 30 minutes to several hours, depending on the type of tan, type and thickness of the skin, and the oil used.



## Caging

The last step is caging which is simply removing the sawdust from the hair or fur. This is accomplished by *drumming* the skin in a 6 -8 foot tall cage and a minimum or 2 feet wide made with 1/4" screening, the same size drum as a tumbler but with 1/4" screen around it to allow the saw dust to fall out.

Taxidermists who say they (home tan, studio tan, or self tan) 99 percent do not tan in the manor explained above. They eliminate a lot of very important steps. Their tanning process normally consists of:

- <u>Salting</u> the skin for 24 hours. Rarely do they dry the skin below 15 percent moisture level resulting with skins with higher chance of damage from bacteria.
- No pre soak or <u>re-hydrating</u> of the skins Eliminating bactericides or fungicides to kill bacteria resulting in putting the skins in the next step with high levels of bacteria and spores.
- They use a *pickling* solution but with no *bates* and then *shave* the thin, rub a tanning oil on the skin and they are done.
- Some may try to neutralize the skin for about 15 20 minutes. This short <u>basification</u> time only neutralizes the surface of the skin and not in the middle of the skin. This will keep acid active in the middle of the skin. Over time this will cause the hair color to fade lighter, shrink, cause ears to crack open, lips to pull apart, stitches to pull apart, drumming, shorten the life expectancy of your mount and possibly attract bugs!
- Taxidermists will call this a tan but in actuality it is only a pickle.



Read entire <u>How to Choose a Taxidermist</u> article.

### About the Author

Ron Schaefer offers full spectrum <u>Taxidermy Services</u>, <u>Bronze Sculptures</u> and <u>Wildlife Drawings</u>. Ron Schaefer, a Master Taxidermist, located in Texas, is founder and artisan for <u>Heads Above The Rest</u>, Inc.® and has been studying the fine art of moving and adjusting skin since 1975. He specializes mainly in life size African and Exotics with his passion being Cats.

Heads Above The Rest, Inc.® is not a large production firm. Ron Schaefer strives for low volume, accepting a limited number of clients each year, enabling him to maintain high quality craftsmanship and customer care. He leads the industry in higher standards and you will see a definite difference when working with Heads Above The Rest, Inc.®.

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