

# For a natural look

**SETA Technical Team**

*Seta S/A was the pioneer in Brazil in the production of acacia tannins with the start of its activities in 1941, in the city of Estância Velha / RS. Today, the company produces and markets mimosa wattle extracts worldwide, not only to produce leathers, but also for other uses such as water and wastewater treatment, animal nutrition, adhesives and dispersants. Another important factor regarding the production of these extracts is the fact that reforested trees are legumes and return to the soil some important nutrients, recovering areas for future acacia plantations or even other plant crops.*

**V**egetable tanning is one of the oldest known processes for producing leather, all the way back to the times when our ancestors began to use and wear the skins of animals. It is thought that the discovery was by chance, when some hard sun-dried skins were left in pools of water and plant materials that changed the feel of the skins and made them rot free.

Fast forward some millennia and the process must have become more sophisticated, by which time various barks and plants were found to have the ability to tan hides and skins. The leathers produced must have been of some quality — in 2008, archeologists in Armenia discovered a 5,500-year-old pair of the oldest known footwear in an impressive state of conservation. The

story of Ötzi the Iceman, who now has a museum devoted to his life and death, about BC 3345-3300, is well documented and even his leather shoes indicate that he must have had access to an early cobbler. Clearly, vegetable tannins have made a lasting impact on our history, although it must be conceded that other products such as aluminium and oils were used in tanning — but they were easily washed out from skins. Vegetable tanning was predominant until the development of chrome tanning.

Notwithstanding the benefits of chrome tanning for large scale and fast production, with physical characteristics that offer greater flexibility and elasticity, vegetable tanning remains an essential element in the tanning industry. Even

with chrome, there is a need for the retanning and fatliquoring of these same hides with other products to provide different characteristics for each article. Some of these include synthetic tannins, oils and vegetable extracts. In certain articles, large amounts of vegetable tannins are used to "give back" a more natural appearance to the chrome-tanned leather.

*SETA headquarters located in Brazil, on the outskirts of Novo Hamburgo.*  
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Although present in most plants, vegetable tannin extracts are only commercially viable from certain species. The best known and used are extracted from quebracho, chestnut and mimosa, the latter having the greatest global commercial volume due to its versatility. Each extract has its own characteristics but, historically, every country in the world enjoyed the extracts available locally. Presently, with globalisation, tanneries can choose to use these extracts in combination in the same tanning process, depending on the desired characteristics.

### Mimosa and sustainability

Mimosa, also known as wattle, is extracted from the bark of the acacia tree, a species only found in latitudes lower than the 30th Parallel South, which passes through the state of Rio Grande do Sul in Brazil, South Africa and Australia. Among the extracts cited, only the mimosa wattle is 100% produced from controlled reforestation and with international environmental certification.

Sustainability is based on a very simple principle: everything we need for our survival and well-being depends, directly or indirectly, on our natural environment. To seek sustainability, it is necessary to create and maintain the conditions in which humans and nature can exist in harmony, so that future generations can also enjoy what we have today. The leather industries have worked intensively on their production processes to reduce their environmental impact, seeking a cleaner manufacture. In this context, vegetable tanning is even more important in this industry.

### Tannins and how they are used

Tannins are polyphenol compounds and are present naturally in the barks, stems, roots, leaves and fruits of most species. The tannin action of the polyphenols depends on the molecular mass and the hydroxyl groups (-OH). There are two types of tannins found in nature, hydrolysable tannins (pyrogallol) and condensates (catechol).

Examples of hydrolysable tannins are those extracted from chestnut wood and mirabolán fruits. The main condensed tannins are extracted from quebracho wood and mimosa bark.

The tannins are extracted with hot water, forming a liquor with low concentration and then concentrated by evaporating the excess water from the



*Tannin content analysis being carried out at SETA's Quality Control laboratory.*

liquor. Although this liquor can already be used in the tanning process, most of the commercialised extracts go through the atomisation process so that they can be used in powder form, facilitating transportation and handling.

### Tanning process

In the stages prior to the vegetable tanning, the hides follow the usual sequence of soaking, unhairing and liming, where the hairs are removed and the lime can open the fibres, and splitting to the required thickness.

Before starting the tanning, the skins need to go through the process of deliming, and pickling for pH adjustment so that the skins are able to receive the tanning extracts. Contrary to chrome tanning, where the pickle is made by reducing the pH to around 3.0 to start the tanning, in vegetable tanning this pH should be between 3.8 to 4.5. The reason for starting vegetable tanning in this higher pH range is because the vegetable tannin is fixed in pH ranges lower than 3.8, and above this pH the tannin can penetrate the entire thickness of the skin before the fixation process, with the reduction of the pH and the aid of acids.

Originally, the vegetable tanning was done in a static process, in a series of pits with different tannin concentrations, and which took months without a mechanical action for the tannins to

penetrate the hides. Presently, some tanneries specialising in vegetable tanning still use the pit system for certain articles, combining this system with the finalisation of tanning with the use of more vegetable extracts in drums, a system known as pit and drum or mixed system. There is also a third option, a more modern process known as a rapid system, where only drums are used, speeding up significantly the vegetable tanning process.

With the skins at an ideal pH of 3.8 to 4.5, tanning can be started, choosing to use pretanning agents before putting the skins in contact with the vegetable extracts.

In any of the three types of process, the vegetable tanning comprises two stages:

1. Diffusion - penetration/crossing of the extracts in the skin structure.
2. Fixation of extracts in leather fibres.

In both stages there are important factors that affect the process.

In the diffusion stage, the factors are:

- a) **Concentration of the tannin solution** – ideally, both in the static and in the rapid process, the skin is progressively put in contact with the extracts, starting with a low concentration of tannins and gradually increasing until



SETA main production facility in Brazil.

reaching a higher concentration, which provides the desired penetration. Low concentration of tannins aids penetration and too much tannin can provide a surface tanning, which impairs penetration throughout the skin.

- b) **Time** – the longer the contact time of the vegetable extract with the skin, the greater its penetration. Static process varies from weeks to months, and in the rapid process from a few hours up to two or three days, depending on the thickness of the skins and other conditions.
- c) **Temperature** – tanning should occur at ambient temperature, between 20-30°C. Higher temperatures cause an increase in particle size, causing a superficial fixation of the tannins, and impairing the penetration.
- d) **pH** – the pH of 3.8 to 4.5 provides optimum penetration of the extracts. A lower pH may delay penetration, causing the fixation of extracts on the surface of the leather, making it difficult to penetrate.
- e) **Neutral salts** – a bath of tannins with high amounts of salts can delay the penetration of the tannins in the skin, damaging the tanning.
- f) **Particle size** – the most astringent tannins have a larger particle size, making penetration difficult. Therefore, the use of these more astringent tannins is opted after the less astringent tannins that penetrate faster.
- g) **Mechanical effect** – the higher the mechanical effect, the faster the tannins cross the skins, hence the

reason why the static tanning in pits takes a longer time. However, in the case of drums, a lower speed is chosen, around 4rpm, to avoid damaging the skins in the contact between the skins and the drum. Another factor is to avoid larger rotations that provoke an exaggerated increase of the temperature inside the drum damaging the tanning and the skins.

In the fixing stage, the factors are:

- a) **Concentration of tannin solution** – low concentrations of tannin cause less fixation and vice versa.
- b) **Time** – the longer the tanning time, the greater the fixation of the tannins in the skins.
- c) **Temperature** – the increase in temperature helps in fixing the tannins, but care must be taken not to exceed 40°C to avoid the oxidation and darkening of the surface of the hides. In pits, one can choose heated baths at the end of the tanning, increasing the fixation.
- d) **pH** – below pH 3.8 there is a greater fixation of the tannins. Therefore, at the end of the tanning, the point at which the tannins have fully and completely penetrated the skins, acidic products are used to cause the tannins to be fixed on the skins.
- e) **Neutral salt** – baths with many salts cause a lesser fixation of the tannins in the skins.
- f) **Particle size** – the larger the particle size, the greater the tannin fixation on the skin. The pH and temperature help increase the particle size of the

tannin, causing the fixation. Also, more astringent tannins have the largest particle size and have higher fixing power.

After the tannin has penetrated, acid fixation can last for 2 hours or even overnight, depending on the characteristics of the article. Heavier articles such as sole leather may require a longer fixation time. After this time, it is advisable to perform a quick wash with clean water to remove the unfixed superficial tannin from the surface of the hides and then pile the hides for 2 days, as the tannins continue to fix in the skin's structure.

Thereafter, the samming operations are performed to eliminate the unfixed tannin between the fibres of the hides and the shaving operation for thickness control. After these, the leathers go through the process of retanning, dyeing, when necessary, and fatliquoring. After the fatliquoring, the leathers are ready to dry. First, they go through the setting machine and they can then be dried normally, hung in drying rooms. Another way may be direct drying on toggling frames. The use of drying or vacuum drying machines can also be used to accelerate the drying process, depending on the article, but care must be taken not to migrate the tannins which can lead to the grain cracking.

In this context, vegetable tannins are of fundamental importance in the leather sector. In addition to the products being environmentally sustainable, the production process can be 100% safe if the necessary care is taken since vegetable tannin is easily degraded in the environment. ☺