PRACTICE OF 'BLENDING' FOR THE MANUFACTURE OF VEGETABLE TANNED LEATHER

K. R. V. THAMPURAN, D. GHOSHI & M. SANTAPPA
Central Leather Research Institute, Madras

Received on September 23, 1974.

Vegetable tannins are a group of similar astringent substances, which are complex organic compounds of the aromatic series of high molecular weight. They would normally be insoluble in water but for the presence of lyophilic groups. Tanning takes place because of the reaction of the polyphenolic substances with the reactive groups of collagen. The cross linking of collagen by multivalent tannin molecules confers the necessary structural stability to the tanned hide or skin.

The process of tanning is one of the earliest crafts known to mankind and in all probabilities, vegetable tanning was the earliest form of tanning to be practised. Bark tanning was known more than 12,000 years ago according to the famous German archaeologist Dr. Walter Vonstockar. Vegetable tanning is the most natural method of tanning, requiring minimum control in its operations. The skill associated with this craft was handed down from generation to generation. Vegetable tanning is practised extensively in all parts of India where we have got a primarily village-based economy and the part played by vegetable tannins, in our internal and export economy is considerable.

Vegetable tannins may be broadly classified as hydrolysable tannins and condensed tannins. The former on hydrolysis with acids, alkalis or enzymes, yield glucose and gallic or ellagic acids. The phenolic residues are linked to sugar radicals through oxygen atoms. They are usually quite acidic, contain fairly large amount of sugars and are better buffered. They deposit bloom due to the action of enzymes. Condensed tannins are not hydrolysable and by condensation yield 'phlobaphenes' in acid medium. Here the phenolic radicals are linked to each other via carbon atoms. They contain very little acids or sugars and are very sensitive to pH.

In the actual practice of vegetable tanning, for the manufacture of a variety of leathers, the major share of which forms heavy leather tanning, a mixture of tanning materials is used. This judicious admixture is known as "blending" in tanners' parlance. The object of blending is manifold and may be summarised as follows:

(i) Tanning materials of high T/N. T. ratio, for eg. quebracho, are very astringent. By blending with mellow tanning materials, the astringency can be adjusted to the optimum requirement of tannage, as otherwise a harsh leather will result. There will be overtannage on the grain and the tanning as a whole will not be uniform through the cross section of the pelt.
(ii) Catechol tanning materials have normally a higher pH. While this factor is conducive to penetration of tannins into the pelt, there will not be sufficient fixation at higher pH levels. To avoid this defect, catechol tanning materials like wattle or quebracho are usually blended with pyrogallol materials like chestnut or myrobalan.

(iii) Materials like myrobalan, hydrolyse giving copious deposition of bloom. This aids in giving weight and solidity to the leather, in sole leather manufacture. Hence with most of the sole leather tanning procedures, blending with myrobalan is a very common practice. In western countries, chestnut, oak bark and valonea are used mostly, though myrobalan is also used occasionally.

(iv) Vegetable tannins are complex organic substances and hence each tanning material has a distinctive peculiarity. Each material imparts its particular characteristics like colour, feel, fullness, smoothness of the grain, tearing strength etc. So when the manufacturer aims at specific requirements in the final leather, he will have to blend two or three tanning materials to achieve his object.

(v) During the actual tanning procedure, factors like molecular weight, particle size, acid-salt ratio, surface tension, viscosity, etc. of the materials used, exert pronounced influence on the tannage. Hence blending assumes very great importance in as much as to achieve the desired objectives, two or three materials will have to be blended. Especially for rapid tanning of hides, tanning mixtures of low viscosity, medium astringency and low salt content are required.

(vi) Sometimes, blending is resorted to, for reasons of economy. It is not un-

common to use cheaper materials within reasonable proportion to effect a saving in the costlier tan materials. For instance, for E.I. kips, it was a usual practice to mix konnum with avaram. Similarly, mixtures of two or three materials have been traditionally in use, in the villages of India for vegetable tanning.

In western countries, the vegetable tanning materials used predominantly are wattle, quebracho and chestnut while oak, valonea, sumac, algarobilla etc. are used to some extent. In recent times, tannage with wattle alone has become quite common. Blending with syntans or pretanning syntans are also practised. The most common blends are quebracho-chestnut, wattle-myrobalan and quebracho-myrobalan. For rapid tanning, suitable blends from wattle, quebracho, chestnut and oakwood extracts with or without syntans are used. Certain usual blends are given below:

1. Quebracho extract 75% Myrobalan 25% on tannin basis
2. Wattle 75% Myrobalan 25%
3. Wattle extract 40% Quebracho extract 20% Chestnut 20% Syntan 20%
4. Chestnut extract 50% Sweetened chestnut 30% Quebracho extract 20% on material basis
5. Oakwood extract 60% Syntans 40%
6. Oakwood extract 45% Willow bark extract 45% Syntans 40% on material basis
7. Sulphited quebracho 20% Wattle extract 10% Chestnut 5% Syntan 40% on material basis

LEATHER SCIENCE, VOL. 22, 1975.
The blends used above are mainly for sole and heavy leathers. For skins, blends of sumac, gambier, algarobilla etc. are used. However, it may be mentioned that the manufacture of vegetable tanned skins is negligible in foreign countries, since they depend mainly on imports from developing countries.

In India, the most common blends are wattle-myrobalan and babul-myrobalan. Probably one of the earliest blends was avaram-konnam used for E.I. kips. From the literature available on vegetable tanning many formulae for blending are found and some of the interesting mixtures are quoted below:

1. Babul bark 1 part
   Goran bark 1 part
   Myrobalan nuts 1 part
   (on tannin basis)

2. Wattle bark 4 parts
   Myrobalan nuts 1 part
   (on material basis)

This mixture can be used in the leach battery also.

In sole leather tanneries of Kanpur, one part of babul and one part of myrobalan are leached together and the liquor is strengthened with one part of wattle extract.

In Calcutta tanneries, the blend commonly used is

- Wattle extract 3 parts
- Myrobalan extract 1 part

3. For quick drum tanning of V. T. sole:
   Quebracho extract 75%
   Myrobalan extract 25%
   (on tannin basis)

4. For bag tanning:
   Babul bark 10 parts
   Myrobalan nuts 1 part
   (on material basis)

In Punjab, sometimes babul alone is used for bag tanning.

5. For heavy leathers:
   Goran 2 parts
   Babul 1 part
   Myrobalan 1 part
   (on tannin basis)

   Goran 1 part
   Babul 2 parts
   Myrobalan 1 part
   (on material basis)

In recent researches at Central Leather Research Institute; modified mangrove extract and modified cutch extract along with babul and myrobalan have been successfully utilised for sole leather tanning as follows:

1. Mod. mangrove extract 1 part
   Babul bark 1 part
   Myrobalan nuts 1 part
   (on tannin basis)

2. Mod. cutch extract 1 part
   Babul bark 1 part
   Myrobalan nuts 1 part
   (on tannin basis)

In some of the earliest records, the following blends are found.1 The blends 1-7 are mainly used for tanning cow hides, while the mixtures 8-10 are for E.I. skins and kips.

1. Dhawa leaves 25%
   Dhawa twig bark 25%
   Anola bark 25%
   Mahurain 25%
   (Bahamia Vahlii)

2. Avaram bark 50%
   Konnam bark 50% for E.I. kip

3. Babul bark 60%
   Dhawa leaves 20%
   Ghat bor nuts 20%

4. Ghat bor 25%
   Karaunda leaves 25%
   Sali bark 15%
   Anola twig bark 10%

5. Karaunda leaves 1 part
   Babul bark 1 part
   Ghat bor 1 part
   (on material basis)

6. Dhawa twig bark 10%
   Dhawa leaves 20%
   Goran bark 25%
   Ghat bor 25%
   Karaunda leaves 20%

(continued on page 58)
7. Goran bark
Sundri bark
Dhawa twig bark
Ghat bark

8. Wattle mixtures for half tan or E.I.:
Avaram bark
Wattle bark
Dhawa leaves

9. Wattle bark
Dhawa leaves
Sumac

10. Avaram bark
Gothar fruit

There are many other blends used in the
villages of India depending upon the local
availability. Mixtures of sam, ad, arjun,
karada and many other locally available
materials, common and uncommon, are
blended with babul and myrobalan success-
fully.

Recently a process was developed for the
manufacture of sole leather using a blend
of wattle extract and tamarind seed bark.

In the context of “blending”, it will be
appropriate to highlight the work done in
CIRI during the last two decades. For
the purpose of substituting wattle bark and
promoting the use of relatively less
known tanning materials, considerable work
has been done and several blends or tanning
mixtures have been formulated by the
research workers from time to time. Kedlaya et al. have given exhaustive data on various indigenous tan materials and
blends in the “Assessment of Indian
tanning materials.”

Rao et al. in their attempts to find
substitutes for wattle bark, formulated the
following blends:

1) Goran bark and dhawa
leaves, 1 : 1

2) Karada bark and dhawa
leaves, 1 : 1

There is a tannin mixture used for
E.I. skin and kips.

Selvarangan et al. used a blend
of Konnambark and dhawa leaves in the following proportions:

3) Konnambark and dhawa leaves, 3 : 1

- for E.I. skin and kips.

Selvarangan et al. used a blend
of iron and wood of Malabar (Hopea pavel-
flora) in the following blends:

Process No. I. Two barks

1st bark:

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Konnambark</td>
<td>37.5%</td>
</tr>
<tr>
<td>Myrobalan nuts</td>
<td>17.5%</td>
</tr>
<tr>
<td>Wattle extract</td>
<td>25%</td>
</tr>
</tbody>
</table>

Process No. II Single bark

- Same as above

For E.I. tanned goat, sheep and cow
hides, Krishnan et al. used a blend
of Konnambark, babul, wattle bark and wattle
extract in suitable proportions to yield 100
leather on fleshed weight. Rajabhat et al.
formulated two blends of karada and
Konnambark, and babul and karada for tanning
E.I. kips.

While investigating the possibilities of
new blends for E.I. tanning, Varma et al.
found the following blends for tanning cow
hides:

<table>
<thead>
<tr>
<th>Blend</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peltophorum bark</td>
<td>6 : 1</td>
</tr>
<tr>
<td>Myrobalan nuts</td>
<td></td>
</tr>
</tbody>
</table>
| Peltophorum bark + Myro-
  balan nuts             | 3 : 3 : 1   |
| Peltophorum bark + Pithe-
  colobium bark           | 1 : 1      |
| Peltophorum bark + Pithe-
  colobium bark + Myrobalan
  nuts                    | 3 : 3 : 1   |

For sole leather tanning, Ganeshan and
Vijayaramayya have successfully tried a
blend of babul and myrobalan, suitably

LEATHER SCIENCE, VOL. 22, 1975.
strengthened with wattle extract. For bag
tanned sole leather, Sovani and Ganeshan9
have tried Aain bark and myrobalan nuts
in the ratio 2 : 1. Sovani et al. 4 have also
tried Ghat bar and myrobalan (3 : 1) for
tanning cow hides. Mathiah et al. 5 have
used a blend of wattle extract and myro-
balan extract in the ratio 3 : 1 for sole
leather, while almost the same recipe is
used by Mahadevan and Venkatachalam9
for cycle saddle leather.

For rapid E.I. tanning 2 of hides and
skins, a blend of avaram and wattle extract
has been used, the quantities being avaram
bark 100% and mimosa 40% on expected
yield. For book binding 2 leather a
workable blend is formulated with myro-
balan and wattle (3 : 1) with a suitable
buffer solution.

Recently an improved method of E.I.
tanning 3 using a blend of avaram and
konnam has been developed. The tanning
materials used are as follows:

1st bark :
Avaram 35% on pelt weight
Konnam 35% on pelt weight

2nd bark :
Same as above

Projects on blended extracts may theoreti-
cally appear to be very sound and viable
but there have been man handicaps which
are yet to be completely eliminated. No
doubt, we have blended extracts like Wasub
and Wasub super in the market now and
blends with cashew testa are on the
way. In fact, Procter 7 was a very strong
advocate of blended extracts and Puran
Singh 8 gave vehement support to his
theory. The latter went as far as to
postulate that in tropical countries like
India, blended extracts will prove the real

answer. But in spite of vigorous efforts
during the last several decades, the proposi-
tion of blended extracts has not caught the
fancy of the tanners. One reason might be
that the tanner would find it easier to make
a blend suited to his requirement from the
individual materials instead of a ready
made blend whose composition he is not
sure about. Another reason may be that
the blended extracts do not necessarily keep
in tact the inherent qualities of the
constituents.

REFERENCES
1. Wilson, Modern Practice in Leather Manufactu-
re, Reinhold Publishing Corp., U.S., p. 222
Chemists 31, 220 (1942).
3. Hefield, H., J. Am. Leather Chemists Assoc.,
60, 473 (1965)
 Trades Chemists, 47, 245 (1963)
5. Handbook of Tanning, Prof. Das, B. M.,
p. 106.
7. Vegetable tanning materials of India, Edwards,
M. V., p. 161.
8. Chandra Bose G. B. & Koteswara Rao, C.,
Tanner, 28, p. 27 (1974).
9. The vegetable tanning materials of India and
Burma, Edwards, M. V., p. 36.
10. The vegetable tanning materials of India and
Burma, Edwards, M. V., p. 36.
11. Kedlaya, K. J., Selvarangan, R. &
Nayudamma, Y., Leath. Sci., 10, 305 (1963)
12. Rao, J. B., Nayudamma, Y. & Das, B. M.,
Symposium on E.I. tanning industry, p. 153 (1955)
13. Selvarangan, R., Patel, I. M. S. &
Nayudamma, Y., E.I. tanning and dressing of
leathers, CLRI Publication, p. 27 (1965).
Nayudamma, Y., E.I. tanning and dressing of
leathers, CLRI Publication, p. 27 (1965)
15. Rajabather, K., E.I. tanning and dressing of leathers, CLRI Publication, p. 23 (1965)