

# Wool Dyeing process

# Wool processing is the multi step process

- Wool processing is the multi step process of turning raw wool into finished product.
- **The basic steps**
- Scouring
- Drying
- Carding or Combing
- Spinning
- Felting
- Dyeing

# Scouring

- Scouring, the technical term for washing, is the first step in wool processing. This involves washing the wool in hot soapy water to remove dirt, grease and dry plant matter from the fleece.
- The preferred water temperature for washing wool is 60 degrees C.
- Soaps of various natures have been tried with much success. For those washing wool in their home, Dawn dishwashing soap seems to be a favorite. Use a mild soap, nothing harsh. Commercial processors may use a slight alkaline solution (by adding sodium carbonate) to aid in the scouring process.
- The key is to keep the water temperature and the volume of soap used as low as possible while still being able to wash out the grease and dirt. Wool that is very greasy will require hotter and stronger solutions to remove the grease.

# Scouring

- In the scouring process the wool undergoes several soaks and rinses until the wash water remains clean. It is preferable to let wool soak and avoid agitation.
- Each subsequent wash is a weaker solution of soap or alkaline until the final wash is only water. Between each wash the wool is pressed or squeezed to remove excess water.
- At each wash step the wash water can be retained for subsequent batches of wool until the first wash becomes too dirty for further use.
- At this point the second wash can be used as the first by bringing it up to temperature and adding soap to bring it up to start point. Each subsequent wash would move up the chain so that the last rinse is always being replaced with clean water. This way water and energy to heat it, is being conserved.
- When washing wool on the ranch consideration must be given to the quality of the water. Just as you would not wash your clothes in water that has an excess mineral content (like iron) you do not want to wash your wool in the same type of minerally imbalanced well water.

# Drying

After washing and thorough rinsing the wool is dried. On a commercial scale large mechanical dryers are used. The wool is set on screen tables with hot air circulation. On a individual scale the wool can be placed on a sheet and set in the sun.

# Carding or Combing

- In researching wool processing information there was some confusion between these two terms. Many recent sources do not mention combing at all and older sources talk of it as something entirely different from carding. Nowadays, the terms combing and carding are often used interchangeably and the more common term of carding prevails.
- As far as we can discern, carding is gently spreading washed and dried wool in preparation for further processing.
- Combing is straightening and stretching the fibers to obtain maximum spinning capacity.
- For carding the shorter wools are preferred and for combing the longer wools are preferred. The shorter carded wools are generally the ones that will be processed into clothing.

# Carding

- Carding is a hand or mechanical process. Individuals can purchase hand carders while commercial processors will use mechanical machines. Either way, steel fingers separate and straighten the fibres and then twist them back into one another again thus forming strings of wool. These strings are again twisted into one another to produce longer continuous ropes of wool called rovings.
- Any dry plant material still in the wool will fall out or should get picked out during the carding process.
- At this stage of the wool processing the paths can diverge. Dependent on the quality and type, wool will either be used for the purpose of spinning or will make its way to the felting table.

# Spinning

- Spinning is the process where the wool rovings produced during carding, are turned into yarns. On a commercial wool processing scale the rovings pass through a spinning machine. On an individual scale a spinning wheel or a hand spindle is used. During spinning the wool rovings are gently stretched again. Through a series of twisting and spinning and twisting again the wool is spun into batches of similar quality and strength.
- The spun wool is formed into and stored as skeins of yarn, what you see and buy in the store. These are small bundles of yarn that can now be dyed if warranted.



# Spinning

- During the spinning process other fiber types may be blended with the wool to create various and more unique yarns.
- Once yarn is produced (or purchased) it can be used for weaving or knitting. What's the difference between the two?
- Weaving is taking strings of yarn, setting them at right angles to each other and interlacing them over and then beneath each other thus forming a woven mat.
- Knitting is done by forming loops of yarn and interlocking rows. You are continually forming new loops and passing a string of yarn through it.

# Felting

- Felting can occur after carding and instead of spinning.
- Felting is a feature of wool that enables it to form mats of fabric because the fibers can interlock with each other. How much it can felt is dependent on the fineness or coarseness of the fibers. The finer wools felt better due to the finer crimp which results in more ridges and a tighter lock or joining.
- In the process of felting the wool is subjected to moisture, pressure and gentle beating action. Layers of wool are laid at right angles to one another to establish fibers that run lengthwise and then crosswise and then lengthwise again. The felting machine applies steam moisture and pressure along with a back and forth action to felt the wool. As the fibers shrink they become entangled together and form a strong, durable felted mat of material.
- Wool can be felted to the point where it is impossible to distinguish the fibres in the material or to pull it apart as the fibers have become so entangled and tightly meshed. Felting done to this extent is then called fulling.

# Dyeing

- As wool readily accepts dye colors, dyeing can occur at almost any stage of the wool processing. The two common stages for wool dyeing is right after washing or after spinning wool into skeins of yarn.
- If the dyeing occurs after the wool is washed then it is referred to as stock dyed wool. If the wool is dyed after it is spun into yarn then it is referred to as yarn dyed.
- Many subtle dye colors can be extracted from various plants for a natural dye process. On a large commercial scale the use of chemical dyes is more convenient and thus more common.
- Yet if you want to save a fleece or see it turned into a product for your home or for a friend it is valuable to learn about wool processing. And if you are producing wool it is valuable to learn about the properties and characteristics that make wool such a unique and multifaceted fiber material.

## A new process of wool dyeing

- A process for the level dyeing of wool or of the wool portion of fiber blends by the exhaust dyeing technique in a strongly acidic medium with aqueous liquors of reactive dyes which have in their molecule at least one grouping which, under fixing conditions, reacts with the fiber via the vinylsulfonyl form by nucleophilic addition, which comprises heating the exhaust liquor which contains such dyes of the vinylsulfonyl type, but no acid or acid-donating agents required for fixing the dyes, together with the material to be dyed to the dyeing temperature within the range from 95 to 106.degree. C. as rapidly as possible and in one step, then, on reaching the dyeing temperature and while maintaining appropriate isothermal conditions for dye fixation, adding sulfuric acid to the hot dyebath incrementally within a period of 10 to 45 minutes, and dyeing the wool at pH values between 2 and 3.

# Yarn dyeing

- There are many forms of yarn dyeing. Common forms are -at package form & at hanks form. Wool yarns are mostly dyed at hank form
- The common dyeing process of wool yarn with reactive dyes at hank form is given below in short-**Skein (Hank) Dyeing**  
The yarns are loosely arranged in skeins or coils. These are then hung over a rung and immersed in a dyebath in a large container. In this method, the colour penetration is the best and the yarns retain a softer, loftier feel. It is mostly used for bulky acrylic and wool yarns.
- Both dyes and pigments appear to be colored because they absorb some wavelengths of light preferentially. In contrast with a dye, a pigment generally is insoluble, and has no affinity for the substrate. Some dyes can be precipitated with an inert salt to produce a lake pigment.

## Loose-fibre dyeing processes

- Scoured wool and new synthetic fibre are presented to the dye-house in a «clean» state and usually require no further treatment to remove contaminants before dyeing. If purchased from outside sources, fibrous raw materials normally arrive on site in the press-packed bales used universally by the textile industry to transport raw fibre.
- Within an integrated manufacturing site, for example, one with its own wool scouring facilities, loose fibre may be transferred between the scouring department and blending department or loose fibre dyehouse by pneumatic conveyer or as individual low-density bales from intermediate warehousing.
- Special opening machinery is not usually necessary when dealing with previously scoured wool and with new synthetic fibre. Bales are, therefore, often simply weighed and then brought into the dyehouse, opened at the side of the dyeing machine and the required quantity of (dry) fibre loaded manually into the dyeing vessel. Alternatively, fibre may be wet prior to packing in order to facilitate more even machine loading.

# Dyeing of wool

- Various types of machines are used for dyeing wool and synthetic fibres in loose form. These include conical pan, pear shaped and radial flow machines. Loose fibre is typically packed into these machines manually.
- Dyestuffs are dissolved in hot water before being added to the circulating bath. Typical dyestuffs and chemicals for wool and wool-blends are employed
- In the majority of cases all chemical and dyestuff additions are made manually to the open dyeing machine. Less frequently, or if «pressure» dyeing machinery is being utilised (for synthetic fibres, because wool is normally dyed at atmospheric pressure), pre-dissolved chemicals and dye are introduced to the circulating dye bath from special addition tanks

# Dyeing process

- The dye bath is typically run for 10 - 15 minutes to ensure even penetration of the liquor through the fibre pack before commencing the heating cycle, raising the temperature of the dye liquor to 98 °C at a rate of 1 - 2 °C per minute. On reaching top temperature, dyeing may continue for up to 60 minutes, during which time the dye bath pH may be checked and adjusted by adding further acid to achieve maximum dye uptake. Progress of the dyeing is normally judged by eye and fibre samples are then removed for comparison with a standard.
- A dyeing which is judged to be on shade will be terminated and the machine drained. A dyeing which is not of the required colour may have further additions of one or more dyestuffs, the dye bath being returned to the boil after each addition. Because of the blending operation which follows loose fibre dyeing, it is uncommon for there to be more than one shade addition unless the machine load is the only fibre in a batch.



# Dyeing process

- Dyeing is followed by rinsing with cold water, to remove any surface-bound dyestuff and to cool the dyepack before manual unloading. The machine may be filled with cold water and then run for 10 - 15 minutes before draining. The use of «flood rinsing» in which the dye bath is allowed to refill and then run continuously to drain during the rinsing operation is now much less common due to increases in water charges and effluent disposal costs.
- Liquor from both the dyeing and rinsing process may be recycled for further use. In this case the machine must be fitted with an external holding tank. The dye bath may be recycled if a number of dyeings of the same shade are being performed to make up a bigger dye lot. In this case the dye bath is pumped to the reserve tank and dropped back to the dyeing vessel when required for the next dyeing.

# Dyeing of wool

- There are, however, severe limitations to the use of this process because dye uptake is temperature-dependent and starting the dyeing at too high a temperature can result in an unacceptable rate of strike and unlevel application. The selection of dyestuffs and dyeing conditions which promote maximum uptake of dye are required for the successful operation of this process.
- In such circumstances it is more usual to recycle the rinse liquor, as the temperature of this liquor is lower and more compatible with dyeing start temperatures. Depending on the design of the machine a reserve tank may not be required for the operation of this process, as the fibre carrier can often be removed with the dyeing vessel full. Both these alternatives conserve water, and to a lesser degree, thermal energy