3. An Overview of Wool Scouring

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Learning objectives

On completion of this topic you should be able to:

- Describe the nature of the main contaminants of raw wool
- Outline the changes that have occurred in woolscouring from its beginnings in the mid 19th century
- Describe the developments that have occurred in wool scouring in the past 50 years
- List the objectives and key functions of wool scouring

Key terms and concepts

Wool contamination, entanglement, washing, scouring, cleaning, bowls, squeeze rollers, harrows, blending, detergent, chemical treatments, drying, automation, effluent, packaging, sampling

Introduction to the topic

This topic provides an overview of the wool scouring process, placing it in an historical context and presenting the principal objectives and functions of the modern industry. Wool scouring is the only operation, other than carbonising, which is unique to the early stage processing of wool fibre. Synthetic fibres are not contaminated to any significant extent, and are not scoured.

During the growth of the wool fibre it becomes coated with grease (more correctly called wool wax), sweat salts (suint) and contaminated with dirt, dust, dung and vegetable matter of various kinds. For wool to be a useful textile fibre it is essential that all of these extraneous materials be removed, and wool scouring plays an essential part in this. While wool scouring had very humble origins and was very inefficient and labour intensive up to nearly 50 years ago, today's industry is technically advanced and makes wide use of sophisticated technologies to minimise costs and achieve the level of quality demanded by the customer. Australia and New Zealand have led the world in innovative scouring developments and the implementation of low cost, efficient scouring of wool.

While wool scouring in simple terms is the washing and drying of wool, in reality there are a considerable number of other operations involved – opening, blending, mechanical cleaning, baling, sampling and testing. On request, various types of chemical treatments may be carried out in conjunction with the scouring process.

Today's industry is efficient in terms of energy, water and labour resources and is also environmentally responsible. The days are long gone when scour effluent could be discharged into a nearby stream, river or at the sea shore. Modern practices ensure that wool scouring makes minimal impact on the environment.

The book by Stewart (1988) provides the most comprehensive coverage of modern wool scouring. Other useful sources of basic information are the book by Teasdale (1995) and the articles by Stewart and Jamieson (1987) and Christoe (1987). The review paper by Wood (1982) outlines the major innovations in wool scouring technologies since the 1950s. Robinson (1991) has authored an IWS Technical Information Letter, "A Basic Guide to Raw Wool Scouring", which is quite informative.

Informative web sites include the major manufacturing of scouring machinery ANDAR and CSIRO Textile and Fibre Technology. Basic information on wool scouring is also available on the Techhistory site – Wool Scouring and Cleaning the Clip (see Topic 3 Useful Weblinks on CD).

The most informative book on the interesting history of wool scouring in New Zealand has been authored by Julie Bremner (1985). The history of the Blackall wool scour in Australia is available on a web site.

3.1 Contaminants of greasy wool

Wool is perceived to be a clean, green, natural fibre. However, raw or 'greasy' wool is contaminated with natural impurities, the type and level depending on the breed of sheep, and the conditions under which the wool is grown. These impurities, which may be up to 40% (or more) by weight, must be washed off before the wool can be used as a textile fibre. The main contaminants are woolgrease, suint and dirt. Woolgrease is technically speaking a wax, produced by the sebaceous glands in the skin of the sheep, while suint is produced by the sudiferous (sweat) glands. Wool wax exists as a solid or semi solid with a melting point around $43^{o}C$ in a stable film around the fibre.

For comparison, Table 3.1 shows typical contaminant levels in the major Australian and New Zealand breeds.

Topic 2, Fleece Weight and its Component Traits (Sheep Production Wool 412/512) Table 2.2 contains information on the contribution of within and between-fleece variation in non-fibre components. Figure 2.1 in the same topic illustrates the across fleece variation in non-fibre components.

Table 3.1 Contamination levels in Australian and New Zealand wools. Source: Hart (1995).

Type of wool	New Zealand Romney			Australian Merino		
	Minimum	Average	Maximum	Minimum	Average	Maximum
Grease (%)	2	6	9	10	15	25
Suint (%)	2	8	12	2	6	12
Dirt (%)	3	8	13	6	20	45

The amount of woolgrease (or wax) present on the wool depends mostly on the sheep breed, with merinos recording the highest amounts. Crossbred wools, which dominate the New Zealand clip, have substantially less wax.

Suint is mainly potassium salts of organic acids. In wool scouring liquors, at alkaline pH levels suint has detergent properties. The amount of suint also depends on the breed type, with crossbreds tending to have more than merino.

Wide differences in the types and levels of wool contaminants help to explain why different machinery and processes have proved necessary in woolscouring. For example, the large amount of fine dirt on some of the fine wools from Western Australia is very difficult to remove and thus low scouring throughputs are often necessary. On the other hand, a high yielding coarse wool from New Zealand represents the other extreme of being very easy to scour.

Raw wool may also be contaminated with vegetable matter (VM). If the level of VM contamination is high the wool may have to be carbonised to remove it. A major proportion of the wools requiring carbonising are from Australia and South Africa.

As two of the most important contaminants, grease and suint, are soluble in non-polar and polar solvents respectively, any scouring system must take these differences in solubility behaviour into account. For example, aqueous systems dissolve the suint, but must emulsify the grease and suspend the dirt. On the other hand, solvent scouring systems will dissolve the grease but must be modified to remove the suint and dirt as well. Aqueous systems are the older approach and are dominant in wool scouring around the world today, but solvent scouring has been tried as an alternative to aqueous methods, in order to minimise entanglement.

While as much of these contaminants as possible is removed as wool grease or sludge, a significant proportion of the contaminants removed from the wool is discharged from the wool scour as an aqueous effluent. The organic effluent load from a typical wool scour is similar to that of the sewerage from a town of 30,000 people.

The term ‘scouring’ is generally used to describe a process that removes contaminants from raw wool, and includes all steps associated with the process – blending, opening, washing, drying, packaging – and the steps involved in ‘cleaning up’ the effluent produced. Scouring is a critically important step in wool processing. It must be carried out using technology that enables the wool to attain its optimum performance in subsequent processing.

Due to the nature of the wool fibre and its propensity to felt, wool scourers are faced with a contradiction – they must deliver a product free of scourable contaminants while minimising the level of fibre entanglement. Generally cleanliness and freedom from entanglement are opposing outcomes, (i.e. the cleaner the fibres become the more entangled they are likely to be after scouring). Both characteristics significantly affect later operations.

Given the importance of wool to the economies of Australia and New Zealand, efficient wool scouring is vital. However, only 12% of Australian wool was scoured before export (with a further 8% being exported as top) in 2003 while in New Zealand almost 90% of its wool production was exported in scoured form in 2003. The principle reason for the difference is that many topmakers (who use mostly Australian wool) prefer to control the blending and scouring of their raw material, whereas the majority of woollen carpet yarn spinners (who use a considerable quantity of New Zealand wool) are content to receive fully specified scoured wool blends ready for processing.

3.2 Historical overview of scouring methods in Australasia

Woolscouring in Australia and New Zealand began in the 19th century. Washing before shearing had been a traditional process in Britain for centuries, but a major factor leading to its introduction in Australasia was the knowledge that ‘colonial wools’ sold on the London market were discounted because of their dusty appearance compared with German, Spanish and English wools. In an attempt to reduce the amount of dust and dirt in the wool prior to export, farmers would dam creeks and drive mobs of sheep through the water. While the sheep stood in pens in the creek their fleeces were manipulated by hand. The wool would then be wrung out by hand to remove as much water as possible. This practice of ‘brook-washing’ was not particularly successful, because the grease in the wool would retain particles of dirt, and cold water could not remove the grease. Another reason for the eventual demise of brook-washing in Australia was the difficulty of finding sufficient water to cleanse the sheep and dust-free paddocks in which to dry them. The practice had virtually disappeared by the 1890s.

Figure 3.1 shows a typical sheep washing site in the South Island of New Zealand in 1876. The pens for holding the sheep in the stream are clearly visible.

Figure 3.1 New Zealand sheep washing site in 1876. Source: Barraud (1822-1897).

In New Zealand some South Island sheep stations washed the sheep in hot soapy water then rinsed them in a nearby stream, but this practice caused many sheep to die from pneumonia before they could be shorn. Washing wool on the sheep's back was a very labour-intensive practice that could only continue in Europe where there were smaller flocks and ready supplies of cheap labour.

Here is an excerpt from The Textile Educator (1888):

'Now it is the job of the wet-chuckers-in to keep the men at the wells supplied with sheep just as the dry-chuckers-in feed the men at the trough. But the berth of the wet-chucker-in is certainly no sinecure, whatever that of his dry confrere may be. The wet sheep are heavy, frightened and stubborn, and often so exhausted that they have to be hauled laboriously out of the hot-water trough by the scruff of the neck'.

The earliest method of wool scouring involved treading of the fleece in running water, together with the addition of some detergent. The commonest of the latter was fullers earth, with alternatives being 'lees' (or urine) and soft soap. Before long the practice grew of scouring the wool in tubs containing hot soapy water after shearing, and drying it in the open. The wool looked better and lower freight costs were a bonus. The difference between cold-water washing and scouring in hot soapy water was considerable and by the mid 1870s, teams of men followed the shearing gangs to scour the wool on a contract basis.

In New Zealand it is reported (Bremner 1985) that the wool lay in the sun on hessian sheets for three hours in summer to four days in winter to dry. Sun dried was claimed to have a bloom that was the hallmark of 'colonial scoureds' on the London market. Paddock hands needed to be vigilant, the wool could bleach to perfection or become yellow with two much sun, and had to be turned every two hours. In time a variety of drying rooms or sheds supplemented paddock drying, with the wind being able to blow through wire netting walls.

Over time, the scouring process gradually became mechanised and commercial wool scours were established in convenient locations around Australia and New Zealand. Wool scouring had become the first step in the wool processing industry. Scouring trains comprising two or more bowls with wringers between each bowl were invented in the 1850s. These systems were the forerunners of the modern scouring line, but were not widely used initially. Instead, colonial scourers favoured the manual method of 'pot stick scouring' which used a cauldron for the hot soak and a pitch fork to transfer the wool to a shallow circular tank with a constant stream of water. This 'self-acting wool washer', called a Williams box was invented by an Otago woolclasser Frederick Williams in 1884 for the cold rinse. It was designed to prevent the roping of wool caused by washing in am oblong wooden tub. It is reported that one man, armed with a pitch fork could wash 14 bales of wool per day in a pair of Williams boxes.

The hand box method was another early technique of wool scouring. The equipment consisted of a series of square boxes arranged in a row with drainage boards between each one. Inside each box was a perforated basket which allowed free circulation of water on all sides. Water was fed into the box from overhead tanks, heated by steam injection and then soap was added. The wool was then moved to the rinsing boxes and then dried by a centrifuge spin dryer before being spread on sheets in the sun.

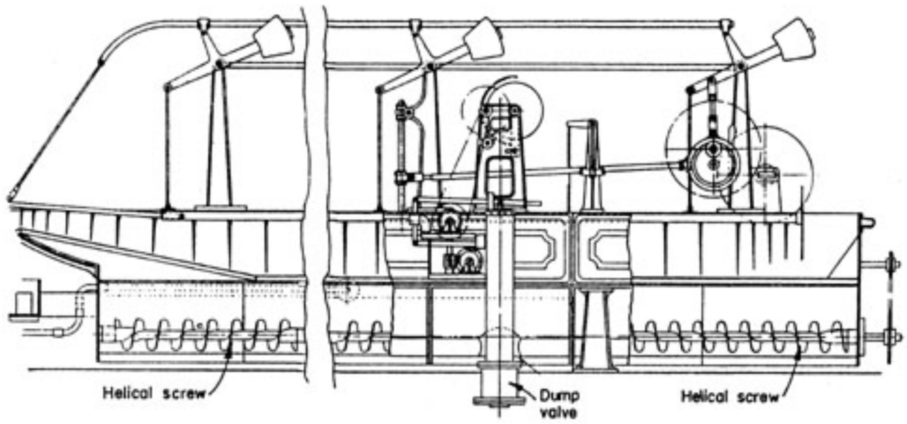
Because of the fear that the desirable appearance of sun-dried wool could be lost by mechanical drying there was little mechanisation in wool drying prior to World War 2. Until then the practice of centrifuging and paddock drying was retained.

The eventual move the full mechanisation in the scouring industry was driven by the fact that, in the 1920s wool that was scoured mechanically in Bradford was considered by the wool trade to be superior to the scoured wool deliveries arriving from Australasia.

The early mechanical scours were relatively simple. In a typical scouring line, the wool was immersed in the scouring liquor and moved through a series of bowls (typically about 8000 litres each) by long-tyned rakes. Greasy wool was delivered by a feed hopper to the first bowl, which contained a soap and soda liquor at a temperature hot enough to melt the grease. The wool progressed through this bowl by mechanical action, arriving at the delivery end after 1-2 minutes. At this point it was mechanically lifted to a pair of squeeze rollers and from there the wool was fed to the second bowl which contained a soap solution similar to the first bowl. Subsequent bowls provided water rinses and after the fourth (or fifth) bowl the wool was transported to a dryer. The liquor flowed in the opposite direction to the flow of wool (counterflow), compensating for the abstraction of water by the scoured wool as well as for the liquor carried away with the effluent.

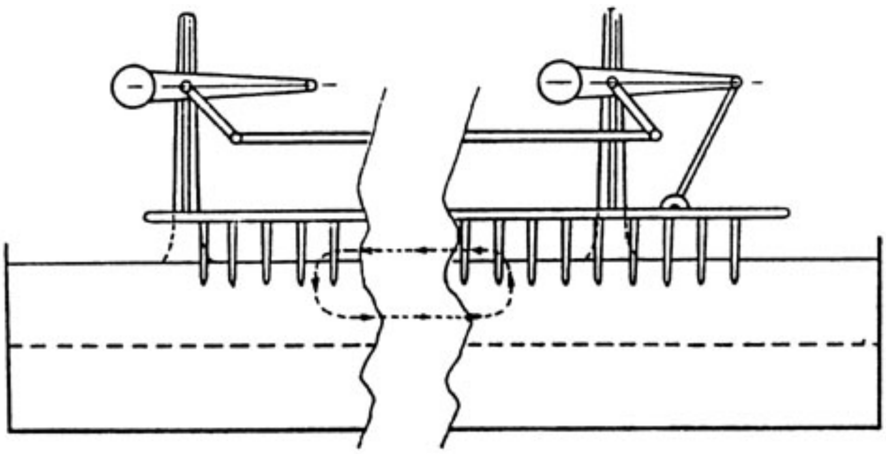
An early self-cleaning scouring bowl is shown in Figure 3.2.

Figure 3.2 Self-cleaning scouring bowl. Source: Wood, 2006.



Each bowl, which was made of cast iron, was fitted with a perforated false bottom and separate squeeze rollers. After the machine has been filled with the scouring liquor and raised to the required temperature the wool is fed into the first compartment on a short brattice. It is conveyed over a false bottom by the reciprocating movement of a harrow. The forks, attached to the harrow, move as a group and are operated by a combination of cams and cranks so that the wool is advanced about 30cm during each forward movement. The forks are then lifted out to move backwards to the original position, ready to repeat the cycle. The action of the harrows is shown in Figure 3.3.

Figure 3.3 Harrow motion in a scouring bowl. Source: Wood, 2006.



The solid dirt is detached in the first bowl and falls through the perforations to the false bottom into a trough, from which the dirt is continuously removed. In a channel at the base of the bowl is a shaft that is fitted with spiral fins rotates. By this action the sludge is brought to a central point where it is discharged automatically through outlet valves.

Scouring was found to not only improve the appearance of the wool and reduced the weight to be shipped. It also gave the opportunity for enterprising local merchants to recognise cheap lines of farmers' wools that could be sorted, amalgamated, scoured and exported at a good profit.

Wool scouring plants were one of the earliest polluting industries in Australia and New Zealand. Untreated wastewater from scouring brings a number of environmental issues, including a detergent loading, high nutrient content and very high Biological Oxygen Demand (BOD). The early scouring plants had only the objective of washing wool and wastewater disposal was not considered a problem.

The treatment of wastewater to alleviate the effects on the aquatic environment became a priority in the 20th century, as pressure was placed on the industry to improve its reputation. The old industry views have now been replaced by the notion that all by-products from the scouring industry have value, and significant economic and environmental benefits can accrue through intelligent use of the by-products. A CSIRO paper, "From Filth to Tilth", which is available as a downloadable document from www.csiro.tft.au, outlines modern approaches to wool scouring that are environmentally sustainable.

In the past, wool scouring was run as a semi-continuous or batch wise operation. The bowls had to be dropped every 8-12 hours because the accumulation of contaminants in the bowls prevented the wool from being adequately scoured. Once the scouring liquors were dropped, the bowls were filled again, heated the process chemicals added and scouring recommenced. This mode of operation was very wasteful of time, chemicals and energy. In the second half of the 20th century considerable research effort in Australia and New Zealand was devoted to improving the efficiency and effectiveness of wool scouring. Amongst the numerous developments were important changes in the design of scouring bowls associated equipment, for example:

- Reduction in the length and volume of the bowls in order to save water, energy and space
- Incorporation of a steep hopper-bottomed design for each bowl in order to remove dirt more easily and uniformly from the bottom of the bowl
- Increased use of stainless steel in manufacturing for longer life and less corrosion
- Heat exchange systems to conserve energy.

Other important innovations have been the full automatic control of the entire wool scouring operation, including:

- Weighbelt feeding to maintain a constant delivery rate to the scour
- Computer control of bowl liquors, temperatures etc.
- Detergent additions controlled using variable speed metering pumps
- Online sensing of dryer conditions and wool regain to ensure consistent dryer performance
- Sophisticated systems for dealing with wool scour effluent in an effective and environmentally responsible manner.

Wool scouring has progressed a long way along the road to becoming a fully scientifically-based process. The theory and mechanisms of contaminant removal are better understood, the conditions of operation needed to achieve optimum performance are better understood, the process is more capable of being controlled automatically, the scouring equipment is better designed to meet current industry needs, and the effects of poor scouring on subsequent processing performance are currently being realised. The result is that the wool scouring industries of Australasia are now the most technically advanced and efficient in the world.

3.3 The objectives of wool scouring

The principal objectives of modern wool scouring are to remove all wool contaminants at maximum efficiency, with efficient energy utilisation and with minimum impact on the environment. Quality control objectives for the scoured product are:

- To produce clean wool of consistently good colour, without causing excessive entanglement
- Achieving a specified moisture regain by efficient drying
- Achieving an acceptably low residual grease and dirt content
- To achieve a correct wool pH level (appropriate for subsequent dyeing).

The factors that are important in achieving a clean, bright scoured product are:

- Degree of opening given before scouring
- Number of bowls in scouring line
- Detergent and builders used
- Water quality
- Time of immersion in the bowls
- Temperature of scouring bowls
- Amount of mechanical action used
- Efficiency of the squeeze presses.

A wool scour also performs a number of other key functions:

- Blending auction lots together on instructions from the owner of the wool
- Removing as much dust and dirt as possible prior to, and after, scouring
- Carrying out optional chemical treatments as requested by the client
- Product differentiation – converting wool from a commodity fibre into added-value premium products
- Sampling the scoured wool for testing
- Extraction of wool grease from the scour effluent.

The critical importance of scouring as the first step in processing wool has always been appreciated, although the incentives to the development of new or improved scouring systems have changed over the years.

Freedom from entanglement was once considered to be the principal objective, providing of course that grease and dirt removal was satisfactory. Entanglement or in the extreme case, felting, results in excessive fibre breakage in subsequent yarn-making processes such as carding, with two undesirable effects. Firstly, it reduces the mean fibre length in top and yarn, producing products of inferior quality, and secondly the processing yields, as measured by the combing tear in the worsted system, are reduced. Entanglement is most undesirable in the worsted processing system and is less critical in woollen processing.

More recently, the cleanliness of the scoured product has become more important to the industry, largely influenced by the development of high speed machinery. Another important consideration today is concern for the environment, which has changed the attitude of wool scourers in many countries. This is because the pollution load associated with the conventional aqueous scouring of greasy wool is extremely high. Today, reduction in pollution has become more important to wool scouring than freedom from entanglement; adequate dirt removal and subsequent liquor handling to ensure minimal pollution of the environment are important factors.

Fibre damage in wool scouring

Wool is a relatively weak fibre, compared to other staple fibres. During scouring wool experiences various conditions which can lead to fibre damage and loss of strength. Three possible sources of fibre damage in wool scouring are mechanical damage, pH and temperature.

Mechanical damage will be fairly minimal since the actions of the moving parts in scouring tend to be relatively gentle. Since wool is a protein fibre, wool suffers a loss of tensile strength when it is wet. The nature of the protein chains in wool mean that the hydrogen bonds are dissociated in aqueous conditions causing strength loss. Disulphide bonds can also be reduced in some conditions, causing a further wet strength loss which is generally reversible.

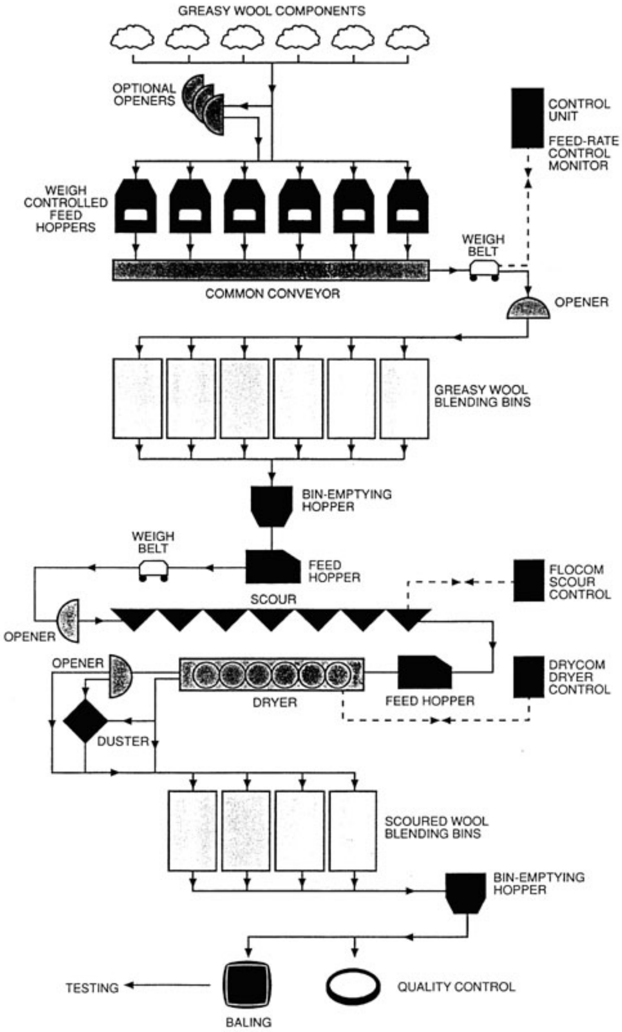
Wool can also become more susceptible to chemical damage in an aqueous medium since the protein chains can be ionised and are attractive to small, charged molecules such as acids and alkalis. Alkaline conditions are far more damaging to the fibre, and at pH > 9.5 will cause yellowing and damage to the fibre.

Thermal degradation of wool will occur with prolonged exposure to even relatively mild conditions, such as those experienced during scouring. This degradation is also manifested as a strength loss and yellowing. The appropriate conditions and controls within in wool scour should ensure that the types of wool damage outlined here are minimised.

3.4 Steps in the wool scouring process

Figure 3.4 shows the layout of a typical scouring plant for crossbred wools, which generally require more sophisticated blending machinery.

Figure 3.4 Scouring plant layout. Source: Wood, 2006.

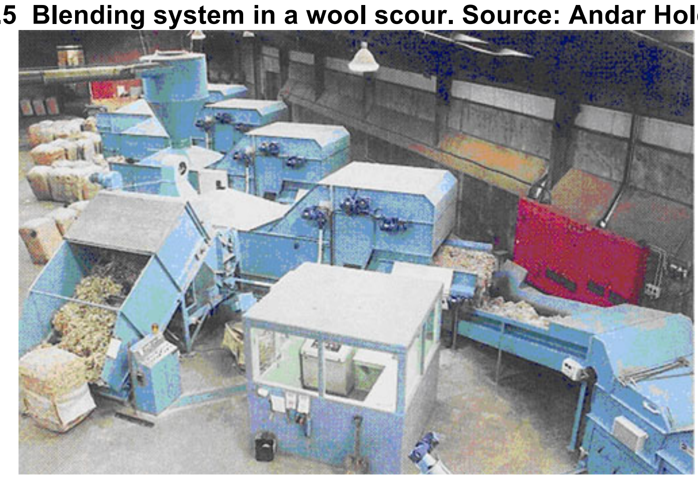


Blending, opening and cleaning

A consignment of scoured wool may comprise a large number of farm lots. Furthermore, the components of a scoured wool blend may vary widely in their characteristics, especially for wool destined for the woollen system. Therefore it is important that some blending be undertaken to amalgamate the components into a reasonably homogeneous batch, keeping in mind that further blending will occur in the tops mill and spinning plant.

Figure 3.5 shows a blending line in a typical scouring plant. The system is computer controlled, and each component has its own dedicated hopper, feeding to a common conveyor.

Figure 3.5 Blending system in a wool scour. Source: Andar Holdings Ltd.



Mechanical opening is undertaken to (a) enable dirt and dust to fall from the fibrous mass, and (b) deliver the wool in a more open form to the scouring bowls so that the liquor can penetrate more effectively. A range of machines is used for opening and cleaning. The early removal of dust and dirt in a dry form contributes to more efficient and effective scouring. If fleeces are cotted, a decotter may be required to be used as a preparatory opening machine.

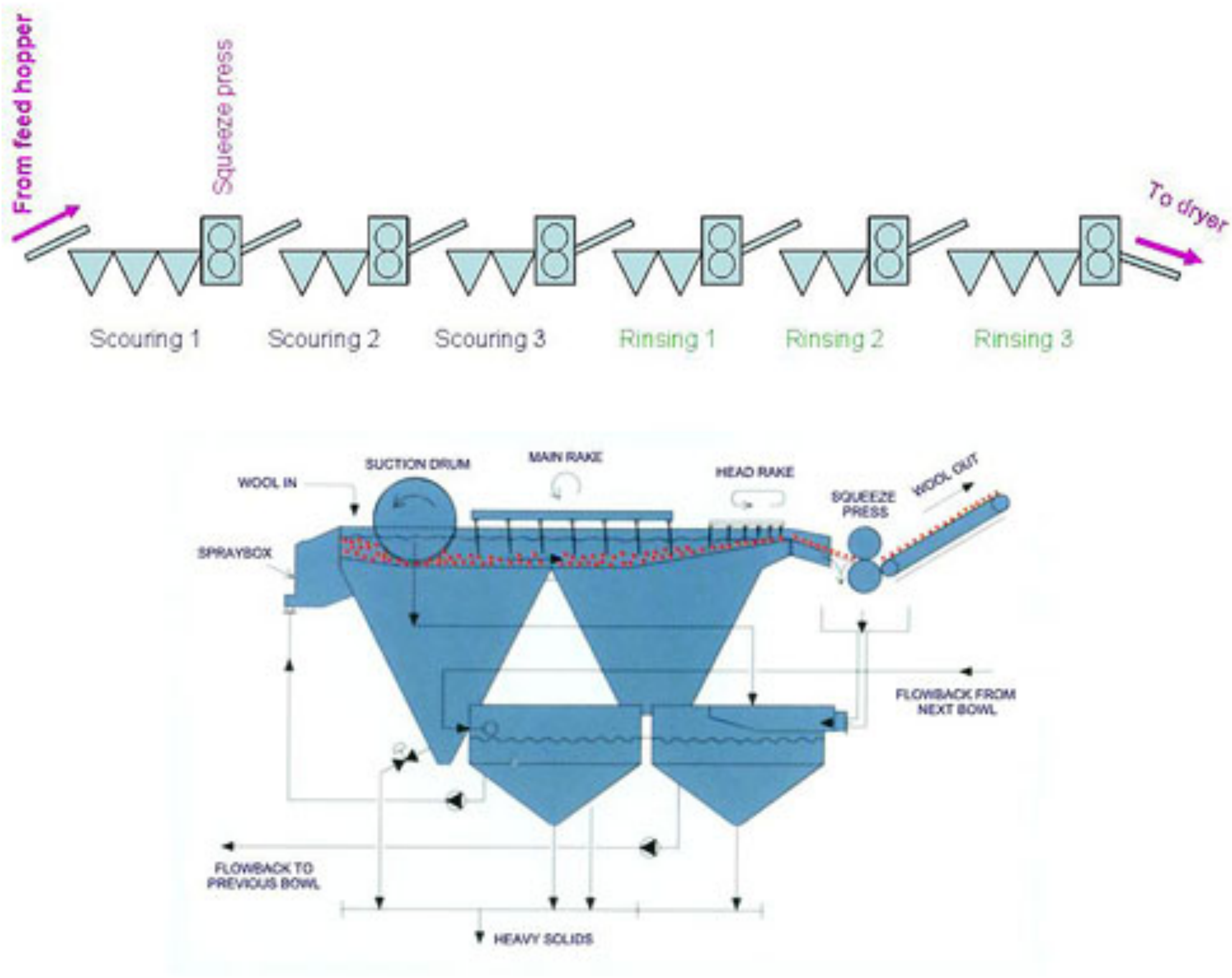
Because of the relative homogeneity of fine wools entering the worsted processing route, and the huge amount of blending that occurs in this route, these wools require less blending before (and after) scouring than coarser wools that are mostly processed on the woollen processing route.

Scouring

The open, blended wool is scoured in a series of bowls containing hot scouring liquor, followed by cold and hot rinses. The scouring water is normally around 65^{o}C, which is hot enough to melt the wax. Detergent is added to help remove the dirt from the fibres and to emulsify the wax so that it doesn't redeposit on the wool.

Figure 3.6 shows a scouring line designed for combing wools and the details of a scouring bowl.

Figure 3.6 A scouring line for combing wools (upper), scouring bowl design (lower). Source: Andar Holdings Ltd.



As the wool enters each bowl, it is dunked under the surface to wet it thoroughly with the liquor in that bowl. A set of harrows gently drags the wool through the liquor, as shown in Figure 3.7. When the wool reaches the other end of the bowl it is lifted up into a pair of rollers that squeeze the liquor out of it. The wool is then dropped into the next bowl where the process is repeated.

Figure 3.7 Immersed wool being moved by the rakes in a scouring bowl. Photograph supplied by E. Wood, courtesy Canesis Network Ltd.

The suint dissolves quickly in the first bowl while the wax and dirt particles are steadily removed by a combination of mechanical agitation and gravity, and by the squeeze rollers. As the wool moves through the bowls it becomes cleaner, and moves into cleaner liquor.

The liquor flows in the reverse direction to the wool movement and is discharged from the first bowl for treatment. Wool grease is extracted from this effluent and refined for a variety of uses.

Finally the wool is rinsed to remove the detergent and to eliminate the remaining solids. The first rinse is normally done with copious quantities of cold water, followed by a final rinse in very hot water before drying.

Wool scouring as a wet process also provides an opportunity for various chemical treatments that may be undertaken in the scour or rinse bowls. For example:

- Sodium metabisulphite is sometimes used as a bleach to reduce the yellowness of average and poor colour wools
- Hydrogen peroxide can be used as a bleach to further brighten good colour wools
- Insect resistant (i.e. mothproofing) chemicals are sometimes added
- Organic acids such as acetic or formic acid can be added to adjust the pH of the wool
- A bacteriostat may be added to sanitise wool destined for bedding products
- Various ‘fibre differentiation’ treatments that modify the lustre, dyeability and other wool characteristics are conveniently carried out in a wool scour.

Drying

Drying is a crucial part of wool scouring. Once the wool has been squeezed for the final time it may still hold 50% water (by weight), while the scourer’s clients will require the wool dried to a precise level, say 16 or 17%. The wool is dried by hot air in a chamber, with the drying process being monitored by a sophisticated sensing system that ensures that the required moisture level (or regain) is maintained. Various types of dryers are used, mostly of the suction drum or conveyor types. Figure 3.8 shows wool leaving a suction drum dryer.

Figure 3.8 Suction drum dryer. Source: Andar Holdings Ltd.

Scoured wool handling

Dried, scoured wool may be further processed, mainly to remove dust and to provide further opening and blending. Finally, the fibre must be either packaged or presented to the next stage of production.

If the scoured wool is to be moved within a plant, conveyors or pneumatic ducting are used. Alternatively, wool may be pressed into farm bales (around 130 kg) or into high density bales (300-450 kg).

Packaging scoured wool in high density bales, restrained by steel bands, minimises the volume that each bale occupies in a shipping container and hence reduces transportation costs. The bale wrapper, which is a nylon or polypropylene fabric, protects the wool from soiling and contamination until the bale is opened for subsequent processing.

It is usually necessary to regularly take samples of scouring production for quality control purposes (in-house testing) or testing by a test house (for certification purposes). A set of narrow tubes with sharp ends are driven into each bale to extract a short representative core sample of wool for both testing purposes.

Figure 3.9 shows a high density bale at the core sampling station.

Figure 3.9 Core sampling of a high density bale. Photograph supplied by E. Wood, courtesy Canesis Network Ltd.

The various processes and the technologies involved in the wool scouring industry are covered in more detail in the subsequent topics in this series.

Readings

The following reading is available on CD

1. Robinson, B. 1991, *A Basic Guide To Raw Wool Scouring,* IWS Technical Information Letter, TIL/ET-6, 1991.

Activities	Available on WebCT
Multi-Choice Questions	Submit answers via WebCT
Useful Web Links	Available on WebCT
Assignment Questions	Choose ONE question from ONE of the topics as your assignment. Short answer questions appear on WebCT. Submit your answer via WebCT

Movies

The following movies are available on CD:

- Canesis Network Ltd. (A), Kapatone Wool Scour, New Zealand Wool Services International and Canesis Network Ltd.
- Canesis Network Ltd. (B) Scouring 04.

Summary

Summary Slides are available on CD

An overview of scouring was presented in this topic. The historical methodology of scouring allowed discussion of the principal objectives and functions of scouring in the modern industry. Over the past 50 years the scouring industry has seen huge changes in terms of technology developments, processing efficiencies and environmentally responsible practices.

Wool scouring in simple terms is the washing and drying of wool. However, in reality there are a considerable number of other operations involved including opening, blending, mechanical cleaning, baling, sampling and testing. Wool scouring also provides the opportunity for other chemical processes to be undertaken. While these key stages are included in the topic, each is covered in much more detail in subsequent topics.

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Glossary of terms

Biological Oxygen Demand	The quantity of oxygen (usually stated in mg) needed to oxidise one litre of waste
Blending	Amalgamating different lots of wool such that they form a homogeneous batch for processing
Brook-washing	The practice of immersing sheep in creek water to remove dust
Builder	A chemical such as sodium carbonate (soda ash) added to a scouring bowl to stabilise the emulsified woolgrease and dirt, thereby preventing its redeposition back onto the wool
Carbonising	An acid-based process for removing vegetable matter from wool
Consignment	A processing batch for scouring, sometimes called a *scourment*
Crossbred	A group of breeds which produce coarser wool, fibre diameter greater than around 30 microns. These tend to be dual purpose sheep farmed for meat as well as wool
Detergent	The chemical agent added to a scouring bowl to remove the grease from the wool and emulsify it

Entanglement	A state of fibres which are intimate contact so that a force is required to separate them. *Felting* is an extreme case of entanglement
Harrow	The assembly of rakes that move wool along a wool scouring bowl
Merino	The fine wool breed, dominant in the Australian sheep flock
Non-polar solvent	An organic liquid with molecules having no charged ends
pH	The chemical scale in which water has a value of 7, acid solutions are less than 7 and alkaline solutions are greater than 7. Strong acids have pH values close to 0 and strong alkalis have values close to 14
Polar solvent	A liquid such as water that has molecules with regions of different charge, i.e. positive and negative ends
Sebaceous gland	The glands in the skin on a sheep that produce wool wax
Sludge	The insoluble solid materials that falls to the bottom of a scouring bowl
Soda ash	Sodium carbonate
Sudiferous gland	The glands in the skin of the sheep that produce suint
Suint	Dried sweat of the sheep in the wool
Vegetable matter	Contaminant in a wool fleece arising from plants, e.g. seeds, burr, twigs etc.
Wax	The fatty secretion that coats wool fibres, produced by the sebaceous gland
Williams box	A circular wool rinsing device developed in the 19th century in New Zealand to be part of a manual scouring method
Woolgrease	Technically, woolgrease is a wax but the name is given to the material once it is removed from the wool