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PROCEEDINGS

THE BLEACHING OF JUTE FOR TEXTILE PURPOSES

By B. P. Ridge and A. H. Little.

SUMMARY

Details are given of methods that have been found satisfactory for bleaching jute materials to different degrees without undue loss of weight or strength. For mild bleaching, treatment is suggested with cold or warm hypochlorite solutions that are maintained in an alkaline condition. Cold alkaline permanganate followed by a bisulphite clearing process, and hot sodium chlorite under slightly acid conditions also give reasonable results. For better shades a hot peroxide bleach may be given after an alkaline hypochlorite treatment, but for uniformity it is best first to scour the material under mild conditions with a soda ash solution at 65° to 75° C., using about 7·5 per cent. of ash on the weight of jute, whilst still further improvement in shade is obtained if the scouring bath contains a small proportion of peroxide. Other methods that may be used are the ordinary peroxide bleach without previous hypochlorite treatment as normally used for cotton goods, or alternate steepings first in a dilute alkaline hypochlorite and then in a hot solution of sodium hydrosulphite or bisulphite. White or nearly white jute can be obtained only if substantially all the lignin is removed, when the wet strength is seriously reduced.

Information is recorded on the bleaching of yarn in package form and on the processing of mixtures of jute with cotton, linen, wool and rayon.

The behaviour of caustic soda solutions of different concentrations in the woollenising of jute is also illustrated, and finally the need for care in the laundering of bleached jute or mixture fabrics is emphasised owing to mechanical damage that may occur while the material is in the wet, and therefore weak state. Dry-cleaning solvents such as trichlorethylene cause no reduction of strength of either unbleached or bleached jute.

INTRODUCTION

The bleaching of jute in such a way as to give a very light shade with small loss of strength presents difficulties due partly to the resistant nature of colouring matter absorbed by the material from the sluggish impure water often used in retting and partly to the chemical and physical structure of the fibres themselves; more especially to the latter. It has been known for many years that several of the common bleaching agents are capable of improving its colour to a greater or less extent, and various processes have been described by Matthews[1] and in patent and other literature, but hitherto no critical examination of bleaching methods as for cotton, linen and other textile materials has been made, nor have conditions been defined that enable satisfactory light shades to be obtained with minimum losses of weight and strength.

By far the greater part of the world's output of jute is used for packing or foundation materials that do not require bleaching; and until recently, wet processing other than dyeing has been practised only on a very small scale. The progress made in improving even the coarsest of materials and in mixing them

with the finer textile fibres, and the increasing demand for dyed goods, however, indicate that greater scope for bleaching now exists and it is necessary that the processing should be done under conditions that allow for maximum retention of the desirable properties of the fibre. The effect of bleaching in permitting brighter shades to be obtained on dyeing is particularly marked. For example, whilst the basic dyestuffs are capable of giving reasonably bright shades on unbleached jute, the classes of dyestuffs with superior light and washing fastness properties, such as the Azoics and Vats, show pronounced increase in clearness and brightness with increasing degree of bleaching[2]. With unbleached or scoured jute the shades obtainable, particularly with vat colours, are dull and " muddy," whereas with a nearly white yarn or fabric they are of a brightness approaching (though perhaps never equal to) that obtained on cotton.

There are various specific purposes for which bleaching may be required according to the uses for which the treated materials are designed, and among them are the following:—

1. To lighten the shade of poorer grades of raw fibre or yarn in order slightly to improve their quality as judged by colour and lustre.
2. To give a better ground in yarn or fabric that is subsequently to be dyed.
3. To enable composite yarns such as jute-wool carpet yarns, jute-flax or other mixed yarns or cloths to be bleached or dyed as nearly as possible to level shades.
4. To give a relatively good white in furnishing and other fabrics composed partly or wholly of jute, thus enabling novel fabrics or effects to be obtained.
5. To provide a white, lignin-free cellulose of high alpha-cellulose content that may be used in processes where bleached wood pulp or purified cotton is normally employed—for example, in the production of rayon and cellulose esters, or in paper manufacture.

Methods of obtaining cellulose of this type have already been discussed elsewhere.[5, 7]

Processes that have now been examined include various combinations of wet treatments with common scouring, oxidising and reducing agents, whilst the effects of a few gaseous products are also mentioned. Some results of earlier work in the investigation have already been recorded, with acknowledgements, in a " Survey of Jute Research " by Barker[3], whilst others have been referred to by Parsons[4]. Many details having an important bearing on the recommendations are also given in a previous paper[5] to which reference should be made for fuller information on certain sections.

It should be realised at once that the bleaching of jute to a pure white with little adverse effect on strength as with cotton and linen is impossible, owing to the unavoidable breakdown of the natural fibre structure accompanying the complete removal or modification of its coloured constituents. Nevertheless, by choice of suitable methods very considerable improvement in colour can be made and yarns can be bleached to a pale cream with no important loss of dry strength. Such yarns are capable of use for purposes for which the original unbleached material would be quite unsuitable.

Gas Bleaching

For practical purposes, bleaching with gases must be regarded as of little importance. Some attention has been given to the use of sulphur dioxide and for this reason a few comments on the process are made.

Sulphur Dioxide.—By exposing raw jute to a moist atmosphere saturated with sulphur dioxide it is possible to obtain some lightening of the shade but the bleaching effect is only slight. The procedure resembles that employed in the well-known stoving of wool goods in which the gas, obtained from burning sulphur, pyrites or from cylinders, is admitted to a wooden or other suitable chamber containing the material, and is allowed to act for several hours.

The treated fibre is always uneven in shade owing partly to original variations of colour in the bundles from one end of the fibres to the other, and partly

to non-uniform distribution of moisture throughout the load. This uneven moisture content may result from condensation within the chamber and also from uneven distribution of the emulsions used in the previous batching of the jute. The darker butt ends of the fibres always remain substantially unchanged in colour, and owing to absorption of the gas, the treated material is distinctly acid and must be neutralised if tendering is subsequently to be avoided. Neutralisation involves a wet treatment with an alkaline liquor followed by washing and drying, and the extra processing and handling thus necessitated add very considerably to the expense of the process. These disadvantages, together with the smell and corrosive effect of the acid gas on works premises and equipment, are more than sufficient to make the method of little technical importance.

Chlorine.—Chlorine by itself is not a satisfactory bleaching agent for jute. It first darkens it and subsequent treatments with alkaline and bleaching liquors are required if a true bleaching effect is to be realised.

Chlorine Peroxide.—This gas has a more pronounced bleaching action on moist jute than has sulphur dioxide, but after exposure of moist yarn to an atmosphere of the gas for about four hours at the ordinary temperature only a yellow or reddish yellow colour is obtained and the bleaching action under these conditions cannot be considered good. Chlorine peroxide is generally available only on the laboratory scale and owing to its explosive properties it is unlikely to become of great importance as a commercial reagent. The alternative of using sodium chlorite is discussed in a later section.

Wet Bleaching Processes

No reagent or process has yet been discovered that is capable of bleaching the coloured cell-wall and incrusting substances without impairing their adhesion to the ultimate cellulose bundles of the fibre or adversely affecting the composite structure of jute, and for practical bleaching purposes it is still necessary to employ the substances commonly used for the other vegetable fibres.

The processes that may be used, therefore, involve treatment of the material with oxidising agents alone, or with various combinations of hot alkaline, oxidising, chlorinating or reducing substances. All such processes remove non-cellulose incrustants and so diminish the strength of the material to a greater or less extent, particularly in the wet state. For this reason handling of wet jute yarns or fabric should be avoided as much as possible. Similar effects of diminution of strength in the wet state are well recognised in the bleaching or other wet processing of rayon, and if for handling purposes bleached jute is considered to resemble rayon, no more difficulty should arise in dealing with it than is experienced with the latter material. The obvious method of avoiding damage to yarns is to treat them in package form in suitable machines as in the cheese or cone bleaching of cotton, linen or rayon yarns.

Success in bleaching jute depends perhaps not so much on which of the common reagents are used as on the conditions employed. For example, it is obvious from the results already recorded[5] that where strength is to be conserved some of the processes often employed for other vegetable fibres, such as scouring under pressure with alkaline solutions, the use of acid hypochlorite and so on, are too drastic in their action because they affect too profoundly the hemicellulose, lignin and other incrustants. It is necessary, therefore, to choose conditions that enable the incrustants to be retained to a considerable extent, and processes suitable for bleaching to different degrees are given below.

Preparation for Bleaching.—Jute does not wet out easily in aqueous liquids owing mainly to the fact that although its fat and wax content is low, it contains mineral, fish or other oils from the batching operation, and since thorough wetting is essential if uniform bleaching is to be secured either a scouring treatment with a hot alkaline liquor may be given or the material must be wetted out in a solution of a wetting agent. If the agent chosen is resistant to hypochlorite or other bleaching solutions it may be added direct to these liquors. A wetting agent that is unaffected by bleaching powder solutions is Calsolene Oil HS (I.C.I.). The addition of such an agent to bleach liquor is satisfactory

provided that the latter rapidly has access to all parts of the material to be treated. In other words, uniform bleaching depends also on efficient circulation of the liquor throughout the load or on circulation of the material through the solution as in the jig bleaching of cloth or the reeling of yarn. When yarn or fibre lies in a bath without satisfactory movement unevenness can be expected even though a wetting agent is present, and for this reason, where uniform movement of material or liquor cannot be assured, it is better first to wet out the jute in a separate bath containing the wetting agent, then to hydro-extract or squeeze it free from excess liquor and enter it without drying into the bleach bath.

Instead of using wetting agents in the above manner it is also common practice with all vegetable textile materials to scour them with alkali for the double purpose of wetting them efficiently and at the same time removing soluble non-cellulose impurities. From the effects already shown[5] of using alkalis under various conditions it is apparent that when both dry and wet strength are to be maintained the non-cellulose incrustants must be removed only to a small extent and, therefore, mild conditions must be employed. Water alone does not give sufficient cleansing, and for general purposes a treatment for one to two hours at 65-70° C. in a liquor containing about 7·5 per cent. of soda ash on the weight of jute can be recommended. The loss of weight under these conditions amounts to only a few per cent. whilst both the dry and wet strengths of treated yarns are good. With caustic soda in open or pressure boils the loss of weight is much higher and the wet strength is considerably reduced, so that except where very efficient purification is necessary the use of this alkali should be avoided. If specially good bleaching is required and loss of wet strength is not very important provided that the strength of the dry yarn is satisfactorily maintained, the addition of a small proportion of sodium peroxide and silicate to the soda ash scouring liquor mentioned above is of advantage.

Mild Bleaching.—For purposes of mild bleaching, where the colour is changed to yellow or light brownish yellow and little loss of strength occurs, a simple treatment in a solution of bleaching powder is sufficient. The concentration of available chlorine may be from 3 to 7 g./l. but if the best results are to be obtained it is necessary to ensure that the liquor is maintained in an alkaline condition throughout the treatment[5]. For this purpose either the bleaching powder solution may be prepared by mixing the required quantity with water and using it direct without settling, or where a settled concentrated stock liquor is kept it may be suitably diluted and milk of lime added to it in the proportion 1½ to 3 lb. of slaked lime per 100 gallons of liquor.[6] During the bleaching the suspended lime gradually goes into solution, but subsequent souring and washing of the yarn or fibre may be necessary for clearing purposes.

Instead of milk of lime, soda ash may be added, but it should be remembered that this substance first precipitates the calcium from the calcium salts as carbonate and it is only after the precipitation is complete that excess of the alkali capable of exerting buffering action can accumulate in the liquor. The proportion of soda ash required depends on the concentration of available chlorine present and on the content of soluble calcium salts in the original solid bleaching powder, but where the bleach bath is prepared by dilution of the usual concentrated stock liquor the amounts per 100 gallons necessary to precipitate calcium and to maintain the alkalinity may be taken as 10 to 12 lb. of ash for a liquor of 3 g. of Av.Cl/l. and 12 to 15 lb. for one of 5 g./l. concentration. Too great an increase in the alkalinity gives a worse rather than a better colour. For example, by the addition of 5 g/l of both soda ash and caustic soda to a sodium hypochlorite solution of 5 g. of Av.Cl/l an initial *p*H of about 12 is obtained and the colour of jute yarn after one hour's treatment in this liquor is significantly darker than that obtained under similar conditions with a solution at about *p*H 11 containing 10 g. of soda ash per litre but no caustic soda.

Jute yarn can also be bleached rapidly to a cream shade by using a warm solution of sodium hypochlorite to which has been added either sodium silicate or

soda ash in quantity sufficient to maintain the required alkaline conditions. Both the silicate and the soda ash serve in some measure to stabilise the hypochlorite and satisfactory effects have been obtained not only in a Hussong type machine but also in a cheese dyeing machine.

It is necessary that the temperature should not greatly exceed 40° C. otherwise the bleaching is unlevel. The following results are recorded to illustrate the effects obtained on hanks and cheeses previously scoured with soda ash solution at 70° C.

The hanks of yarn were bleached for one hour at 40° C. in a sodium hypochlorite solution of concentration 5 g. of av.chlorine per litre containing 10 g/l of sodium silicate (wt. ratio $SiO_2 : Na_2O = 2 \cdot 0$) using a liquor ratio of 15 : 1. The material was then washed, antichlored and further washed. The results of tests were:—

	g. Av.Cl./l	*p*H	Breaking loads, lb.	Loss of weight
Start ...	5·96	11·1	Original, dry 9·0	—
15 min. ...	2·6	10·4	Scoured ,, 8·45	—
30 ,, ...	1·9	—	—	—
60 ,, ...	1·2	10·2	Bleached ,, 7·5	8·1%

The same yarn in cheese form was bleached with a solution containing 8 g. of av. chlorine and 15 g./l. of sodium silicate at a liquor ratio of 10 to 1 for 30 minutes at 40 to 45° C. It was subsequently antichlored and washed as usual. The material was of uniform colour throughout the cheese and the results of tests on the bleached material were: Breaking load, dry 7·6 lb., wet 5·1 lb. Loss of weight after both scouring and bleaching 7·5 per cent.

The cold bleaching powder treatment mentioned above is suitable for loose jute fibre where either a lighter shade in the otherwise untreated material is required or a better ground is desirable before dyeing. The bleached jute should be antichlored with a sodium bisulphite solution before being dried otherwise serious tendering will result if the residual hypochlorite is dried on during the usual hot drying process. Owing to the difficulty in removing acid it is generally not advisable to give a final souring treatment unless conditions of time and water supply allow for the prolonged washing necessary to remove the last traces before drying.

Bleaching to half- or three-quarter White.—It has already been stated that it is impossible without serious loss of weight and particularly of wet strength to bleach jute to a white or near-white shade, and in all processes to aim at such a degree of bleaching some sacrifice of both these properties must be made. Improvement in colour generally also appears to go hand in hand with removal of lignin and the progressive attack and elimination of this substance as the colour of jute yarn approaches white is shown in Table I, where the effects of bleaching treatments of increased severity are shown.

The whitest sample, No. 8, is seen to have lost over 70 per cent. of its original lignin, but reasonably good bleaching can be secured with a smaller loss as indicated by some of the other samples described. No. 5, with a loss of 12·5 per cent. in weight and 38 per cent. in lignin, was actually darker than No. 4, with losses of only 5·3 per cent. in weight and 28 per cent. in lignin, but no treatment has been found in which significant bleaching occurs without appreciable loss of lignin, and it appears that such loss is inevitable if the coloured non-cellulose incrustants are to be lightened in shade satisfactorily.

Although it is not absolutely essential, an alkaline scour is of advantage as a preparatory treatment before bleaching to good shades because among other things it has a softening effect on the incrustants and enables greater uniformity to be obtained in the subsequent operations. The above mild scour with soda ash (see p. 124) is sufficient, and after washing, a bleach in alkaline hypochlorite of concentration about 3 to 5 g. of av.chlorine per litre should be given for half to one hour at approximately 15 to 1 liquor ratio, whilst for yarn, a reel, cheese or cone

Table I

Treatment	% Loss of Lignin. (*a*)	(*b*)	% Loss of weight	Colour of jute
1. Hot water steep, 3 hours at 70° C....	Nil	Nil	2	Similar to untreated jute.
2. Soda ash scour, 10% on weight at boil for 3 hours.	2·4	17	11·1	Darker than untreated.
3. Oxidising scour, 10% of soda ash, 1% of Na_2O_2 on weight, 2 hours at 65° C.	2·1	15	9·8	Lighter than untreated, but still brown.
4. Soda ash scour, 10% on weight, 2 hours at 65° C. Alkaline chemic 4 g./l, half-an-hour.	3·9	28	5·3	Fair degree of bleaching. yellowish colour.
5. Oxidising scour as (3). Neutral chemic (4 g./l), half an hour.	5·3	38	12·5	Light brown, darker than (4).
6. Oxidising scour as (3), Alkaline chemic (4 g./l), half an hour.	5·1	37	8·9	Good colour, cream, better than (4).
7. Oxidising scour as (3). Alkaline chemic 4 g/l, half an hour, then Peroxide bleach 2·8 g. Na_2O_2/l, 2 hours at 65° C., Liquor ratio 30 : 1.	7·2	52	13·6	Very good white.
8. As (7) but with neutral chemic. Liquor ratio 30 : 1.	9·8	71	25	Almost pure white, slightly better than (7).

(*a*) on weight of original jute yarn, (*b*) on original lignin content.
(Liquor ratio 15 to 1 except where otherwise stated.)

machine, a Hussong type machine, or an ordinary chemicking cistern may be used. The colour so obtained is usually yellowish cream rather than white. The importance of avoiding acid conditions in this operation has already been emphasised[5], and the best colour is given by maintaining the liquor in an alkaline condition throughout by means of either lime or soda ash as already indicated on p. 124.

Further improvements to a pale cream can then be secured by means of peroxide. The yarn is bleached for about two hours at 65 to 70° C. in a solution containing per 100 gallons of water 2 lb. of sodium peroxide, 4·4 lb. of sodium bicarbonate and 8 to 9 lb. of silicate (I.C.I. grades J.81 or C.100), or the equivalent of hydrogen peroxide and soda ash. The results of giving a peroxide bleach after different hypochlorite treatments have been already recorded in Table V of a previous paper,[5] where it is also indicated that when a final peroxide steep is given, a neutral instead of an alkaline hypochlorite bleach may be employed with good results, provided that the concentration of available chlorine is fairly low (about 3 g/l) and the liquor ratio does not exceed 15 to 1. (B.P.489,496.)

The sequence alkaline hypochlorite-peroxide has recently been recommended in B.P.533,020[8], the first stage being of comparatively short duration (5 to 15 minutes). Whilst this time may be satisfactory in certain cases it should be remembered that jute as yarn or cloth is not readily and uniformly wetted by cold aqueous liquids and that without previous scouring or wetting out, or longer treatment with the hypochlorite solution, unlevel effects may be obtained, especially when the yarn is in package form.

For further improvement in colour an oxidising scour may be given before the hypochlorite and peroxide stages using 1 g. of sodium peroxide and 8 or 9 g. of sodium silicate per litre with the customary soda ash. The effects of this sequence and of using a neutral instead of an alkaline chemic have already been described, Tables VI and VIII[5], but it is apparent that the greater purification thus secured is accompanied by a significant further loss of wet strength.

It is a feature of the hot alkaline peroxide bleach, however, that the dry strengths of yarns may be increased above that of the original untreated material owing to the closer setting of fibre on fibre that is then secured, and such increase

of strength has been found for yarns treated not only in hank form in a Hussong type machine but also in cheese form.

The ordinary peroxide bleach as employed for cotton goods may also be used for jute, but although it gives satisfactory results it is generally too expensive for ordinary purposes. The treatments for yarn are best given in an iron kier, boiling pan or vat, fitted with an external tubular heater and pump, but cloth may be bleached throughout on a dye jigger with a wood beck and stainless steel fittings suitable for use with peroxide liquors. Two baths are generally employed, the first being the residual liquor from the second refreshed with soda ash and, if necessary, peroxide. The concentration of peroxide is about 1 g/l Na_2O_2 and of sodium silicate 8 to 9 g/l, whilst if the water employed is soft additional stabilisation of the peroxide is secured by adding magnesium sulphate (Epsom Salt) in the proportion 0·25 g/l. The material is scoured for one to two hours at about 65-70° C., drained, rinsed with warm water, and then bleached in a fresh liquor containing 3 g/l of sodium peroxide, 6·6 g. of sodium bicarbonate and 8-9 g. of silicate per litre, or the equivalent quantities of hydrogen peroxide and soda ash. As indicated later, this method may also be used satisfactorily in the jigger for bleaching wool-jute mixed fabrics where the use of hypochlorite solutions cannot be tolerated on account of their adverse action on the animal fibre.

Permanganate

Neither neutral nor acid solutions of permanganate improve the colour of jute to any marked extent, whilst a hypochlorite bleach following an acid permanganate treatment also gives only a poor result. By the addition of hypochlorite to a permanganate solution, however, it has been stated that better bleaching may be obtained, and the following experiments were made to examine this effect.

To separate portions of a bleaching powder solution containing 3 g. of av.chlorine per litre different proportions of potassium permanganate were added and wetted-out hanks of yarn were bleached in them at 15:1 liquor ratio for one hour at the ordinary temperature. All samples were alterwards cleared in a 1 per cent. solution of bisulphite, washed, and tested, with the following results:—

Table II

	Dry	Wet
Original jute yarn	6·5 lb.	5·6 lb.
Hypochlorite +0·5 g./l. $KMnO_4$	6·5 ,,	5·9 ,,
,, +1·0 ,, ,,	6·3 ,,	5·4 ,,
,, +2·0 ,, ,,	6·5 ,,	6·2 ,,
,, +4·0 ,, ,,	7·4 ,,	5·7 ,,
,, +7·0 ,, ,,	6·8 ,,	5·4 ,,

With the solution containing only 0·5 g/l of permanganate, the latter reagent was very quickly consumed. With those containing 1 and 2 g/l fair bleaching to a yellowish cream was obtained, whilst the effect was slightly better with the higher concentrations. The strength values must be considered good, but as the best shades were little, if any, better than that produced by an alkaline chemic, where strengths are also good, there seems to be little point in using this more expensive treatment.

With alkaline permanganage solutions, however, a marked bleaching action is obtained in one hour or less, and the shade resembles that given by a peroxide bleach. The results of trials by this method are given in Table III.

Half-lea hanks of an unscoured jute yarn were steeped for one hour at 15 to 1 liquor ratio in solutions containing 5 g/l of both potassium permanganate and soda ash at respectively 20°, 40° and 60°, whilst in other trials solutions 2·5 g/l in both reagents and 5 g/l in permanganate and 2·5 g/l in soda ash were employed at the ordinary temperature. The yarns were afterwards cleared with bisulphite in the usual manner.

Table III

Treatment	Breaking load		Loss of weight
	Dry	Wet	
Untreated	8·1	7·0	—
1. $KMnO_4$ 5 g./l., Soda Ash 5 g./l. at 20° C. ...	6·2	4·4	5·2%
2. ,, ,, ,, ,, ,, ,, 40° C. ...	5·1	4·3	7·3%
3. ,, ,, ,, ,, ,, ,, 60° C. ...	4·5	2·8	9·8%
4. ,, 2·5 g./l. ,, ,, 2·5 g./l. ,, 20° C. ...	6·5	4·7	5·4
5. ,, 5 g./l. ,, ,, ,, ,, 20° C. ...	6·2	4·1	4·9

All for 1 hour at 15 : 1 liquor ratio.

No. 1 at 20° C. was of a good near-white colour, whilst with Nos. 2 and 3 at the raised temperature the shade was slightly inferior and the losses of strength and weight were greater. With half the concentrations of permanganate and soda ash, No. 4, and the lower soda ash content, No. 5, inferior shades were also obtained. With sufficiently alkaline solutions, therefore, good bleaching is obtained at the ordinary temperature accompanied by little loss of weight, and these conditions may usefully be employed in cases where the method is sufficiently economical.

Sodium Chlorite

This substance, which is now commercially available in America as a flaked solid of yellowish colour containing about 80 per cent. $NaClO_2$, is sold under the names "Textone" and "C2," the former product being for textile and the latter for wood pulp bleaching. Sodium chlorite has an equivalent chlorine content of 135-137 per cent., and the commercial product is recommended to be used in concentration of about 5 g/l at approximately 80° C. Its solutions in water have an alkaline reaction, but it bleaches to a significant extent only under acid conditions, and the maximum effect is obtained in the immediate neighbourhood of *p*H 5. At lower *p*H values not only is the bleaching effect worse but the decomposition of the chlorite is considerably greater, whilst at higher *p*H both the rate of decomposition and the rate of bleaching are slow.

In comparable experiments hanks of jute yarn were treated at 85° C. in solutions of 4·9g. of sodium chlorite per litre at respectively *p*H 5·3 and 6·4 the liquor/yarn ratio being 20 : 1. It was found that in order to reach approximately the same degree of bleaching as was secured in two hours at *p*H 5·3, eight hours' treatment was required in the solution at *p*H 6·4. The effect of temperature is also marked since at the same *p*H (5·3) and the same initial concentration of chlorite the degree of bleaching obtained after eight hours at 50° C. was considerably worse than that secured after two hours at 85° C.

No very great loss of strength of jute yarn results from the action of chlorite since even with solutions of concentration 17·5 g. per litre the breaking loads for two different yarns treated for one hour in the boiling liquor at *p*H 5 were respectively :—

	Original	Bleached
White jute	7·3	6·2
Red Tossa	5·1	3·9

In concentrations of 5 to 10g. per litre, and at 80 to 95° C. and *p*H 5 to 5·5, chlorite bleaches jute fairly rapidly to a cream in about one hour. This reagent has no tendering action on cellulose and as it is employed in slightly acid solution, neither souring nor antichlor treatments are necessary after the bleaching. As the solutions are corrosive towards many metals, however, care must be exercised in working on the large scale. Polished stainless steel equipment appears to be reasonably satisfactory and bleaching of textile yarns in cheese form in a stainless steel package machine has been done with no apparent attack of the metal. Some slight corrosion has been observed, however, at the rough edges of sawn strips of stainless steel after immersion for several hours in a boiling solution containing 7·5 g. of chlorite per litre at *p*H 5.

Wood equipment may be used, although it is gradually attacked by the hot solutions, whilst earthenware and synthetic resin materials of the bakelite type appear to be satisfactory and may find increasing use with this reagent.

Reducing Agents

Sodium Bisulphite.—Solutions of bisulphite have only a very slight bleaching action on jute. For example, after 18 hours' treatment in a liquor containing 12 g. of the salt per litre at a 50 : 1 liquor ratio the effect is one of cleaning and change of shade rather than bleaching. If mineral acid is added to the liquor the bleaching effect is slightly better, but single treatments with bisulphite solutions are obviously of little importance.

Sodium Hydrosulphite.—Hot 1 per cent. solutions of sodium hydrosulphite produce a rapid lightening of shade, but on drying the yarn the colour deteriorates slightly to a greyish tone, and the final effect is poor. Souring, however, gives a slight improvement.

Stannous Chloride.—An acid 1 per cent. solution of this reagent at 30° C. has little bleaching effect.

Reducing and Oxidising Treatments.—Following a bleach for half an hour in an alkaline hypochlorite liquor containing 5 g. of available chlorine per litre, treatment of the jute for half an hour with 1 per cent. solutions of bisulphite or hydrosulphite at 50° C., or with a 1 per cent. solution of stannous chloride at 30° C., produces further lightening of the shade to a light fawn with little change in the dry strength of the yarn and with very little further loss of weight. With stannous chloride the shade is yellower than with the other liquors and, as would be expected, the final shades are better if a scoured instead of an unscoured yarn is employed. The reverse process, giving first a bisulphite steep and then a chemic, gives a shade hardly better than is obtainable with chemic alone, and apparently the preliminary action of the hypochlorite on the coloured impurities of the jute is required if the subsequent reducing treatment is to be effective.

By repeated alternate treatments, first with hypochlorite and then with hot sodium hydrosulphite or sodium bisulphite liquors it is possible to produce rapid bleaching to a pale cream shade and this method of using alternately oxidising (or chlorinating) and reducing treatments may be employed to give very good colour.

Yarn bleached to a cream shade with hypochlorite and then peroxide may be further lightened to a very pale cream by treatment with hot 1 per cent. sodium hydrosulphite solution.

Bleaching of Jute Yarn in Cheese Form

As already indicated, the bleaching of jute yarn in cheese form offers advantages because mechanical damage produced by frequent handling of the weaker wet yarn is thereby reduced to a minimum. Moreover, not only bleaching but also dyeing can be done in the same machine without disturbing the packages, whilst expensive winding into hanks and from hanks to bobbins is avoided. It is essential that cheeses should be soft, and preferably cross-wound, and the machine in which they are treated should be provided with means of reversing the direction of flow of the treating liquors at frequent intervals. Standard commercial machines are usually quite suitable.

One experiment on bleaching cheeses with a warm hypochlorite solution has already been described (see p. 125) and other methods are given below.

A bleach that is satisfactory for all ordinary, including dyeing, requirements, is obtained by using the sequence " Soda ash scour at a temperature below the boil, wash, chemic, antichlor and wash," and with the standard yarn used for most of the present work a light yellow colour that might be termed a ½ to ¾ white was obtained by the following treatment given in a Staybrite cheese dyeing machine and using throughout a liquor/yarn ratio of 10 : 1.

(1) Scour with 10 per cent. of soda ash on the weight of jute for two hours at 65° C. (2) Wash with hot and then cold water. (3) Chemic with alkaline hypo-

chlorite (5 g. of Av.Cl/l) for one hour at 15° C. (4) Wash. (5) Antichlor with a 1 per cent. bisulphite solution for 15 minutes, wash, hydroextract and dry. (For many purposes these times of scouring and bleaching with hypochlorite may be halved.)

The colour of the bleached yarn was uniform throughout the cheese, the loss of weight was only 7·4 per cent., and the strengths were very good, thus:—

	Dry	Wet
Original untreated yarn ...	8·1 lb.	7·1 lb.
Bleached	8·8 ,,	6·1 ,,

A further improvement in colour to a good cream was obtained by giving a peroxide treatment after the scour and chemic, but normally unless a very good bleach is required this further stage is probably unnecessary.

Two batches of yarn were given the same treatments except that in the one case an alkaline, and in the other a neutral chemic was employed. Both chemics were of the same initial concentration (5 g. of Av.Cl/l) but the alkaline liquor was used for one hour whilst the neutral one was used for only 20 minutes. The respective consumptions of available chlorine under these conditions were approximately the same. The scoured and chemicked cheeses were treated together in the same peroxide bath for two hours at 65° C. using a peroxide concentration of 2·8 g/l calculated as sodium peroxide, and an alkalinity of 0·2N. Results of tests on these yarns were as follows:—

	Treatment	
	Scour, Alkaline Chemic, Peroxide	Scour, Neutral Chemic, Peroxide
Loss of weight	10·8%	13·4%
Breaking load. Dry	8·5 lb.	7·8 lb.
Wet	5·8 ,,	4·2 ,,
Original untreated yarn. Dry	8·1 ,,	—
Wet	7·1 ,,	—

The yarn given the alkaline chemic treatment was more lustrous and of slightly better colour than that treated with the neutral chemic whilst, as shown above, it had a rather lower weight loss and a higher strength in both the dry and wet states. Still better colour and improved lustre are obtained in the sequence scour, alkaline chemic, peroxide, if soda ash in the proportion 10 g. per litre is added to the hypochlorite liquor, other conditions remaining the same.

Cheese Dyeing

Two cheeses of yarn that had been scoured, chemicked and bleached with peroxide as above were subsequently dyed in the usual manner in a cheese dyeing machine with 5 per cent. of Caledon Jade Green 2GS. No oxidising agent was used to develop the shade. The washed yarn was soured with 0·5 per cent. hydrochloric acid, washed, soaped at the boil, further washed and dried. The brightness of the final shade was a notable feature.

On cutting one of the cheeses in two, no variation of shade from inside to outside could be detected and the dyeing appeared to be level, but in order to enable a better examination to be made, the second cheese was rewound into cops and woven as weft into a cotton warp to give a weft-faced fabric. This cloth showed that very good levelness had been secured in the dyeing; no abrupt changes of shade occurred at cop ends, neither was there any sign of progressive change of shade from one end of the fabric to the other, that is, from the outside to the centre of the original cheese. The shade obtained was a close match to that of a similar 5 per cent. dyeing on linen cloth.

The results of these trials show that little difficulty is encountered in bleaching and dyeing jute cheeses in a package machine under the conditions stated.

Bleaching of Mixed Yarns or Fabrics

Under the present world conditions greater attention is being paid to the mixing of a more expensive fibre or yarn with one that is cheaper or more readily obtainable, and an increased use of jute in this way may perhaps be possible. Combinations of jute with flax, cotton and wool are well known and have been used, but care should be taken in bleaching these mixtures because usually the treatment that is the most satisfactory for one fibre has a detrimental effect on the other. Some experimental work on jute mixture materials has already been done and is referred to below.

1. Jute-Linen Yarns

The judicious admixture of linen and jute enables the more expensive linen fibre to be diluted whilst at the same time allowing the resemblance of the resulting yarns to all-linen yarns to be retained. In the bleaching of all-linen yarns much attention has recently been given to the use of neutral and acid hypochlorite liquors under controlled conditions of *p*H and to the subsequent use of peroxide solutions, and processes have been elaborated that constitute a marked advance over older methods, since they enable good whites to be obtained with satisfactory removal of sprit (the residual fragments of woody material from the flax straw) and above all with little degradation of the cellulose itself. It has already been shown[5], however, that the use of acid hypochlorite solutions in bleaching jute should be avoided if strength is to be maintained. On the other hand, for linen, alkaline chemic liquors are much inferior to neutral or acid solutions both in attacking sprit and in contributing to a satisfactory final whitening of the yarns.

The best conditions for jute-linen yarns, therefore, should be obtained by using neutral chemics in conjunction with a peroxide treatment, because not only are they capable of assisting in the production of very good white in linen, with removal of sprit, and with minimum degradation of the cellulose, but also they enable a good colour to be obtained on jute without serious loss of strength.

Since mixed jute-linen yarns in which the proportion of jute does not exceed 50 per cent. resemble, and are designed to replace all-linen yarns, a better colour than for jute alone is normally required and a 3/4 white on the linen scale must be aimed at, whilst sometimes even a 4/4 white may be necessary. On this account the conditions of bleaching covered by B.P.489,496, which provides for the use of the sequence "neutral chemic—peroxide bleach," are of special importance in dealing with these yarns.

A mixed tow yarn containing approximately 50 per cent. of both jute and linen was bleached (A) by the sequence oxidising scour, neutral chemic, peroxide bleach, and for comparison a similar treatment was given to a second batch (B) except that the neutral chemic was replaced by an alkaline liquor.

The conditions were:—(A) *Scour* in soda ash liquor 0·20N in alkali and containing 1 g/l of peroxide (expressed as sodium peroxide) for two hours at 65° C. Wash. *Chemic* for 20 minutes in a neutral hypochlorite liquor containing 4·2 g. of av.chlorine/litre, wash, sour, wash. *Bleach* in a liquor containing 2·8 g. of sodium peroxide, and 6·25 g. of sodium bicarbonate per litre (giving an alkalinity of 0·20N) for two hours at 65° C. The liquor to yarn ratios were in all cases approximately 10:1. (B) For the second batch of yarn (B) the neutral chemic was replaced by an alkaline hypochlorite solution of 5 g. of Av.Chlorine per litre which was used for 45 minutes.

The colour of yarn A was a good 3/4 white and markedly better than that of the corresponding sample for which alkaline instead of neutral chemic had been used, whilst the results of other tests were:—

Loss of weight ...	Yarn A ...	13·3%
Breaking load (Dry).	Yarn A ...	4·0 lb.
	Yarn B ...	3·7 ,,
Origiual unbleached yarn	...	3·8 ,,

The weight loss is normal for a yarn of this type bleached to 3/4 white, whilst the strength values must also be considered good.

Further improvement in colour may be obtained if required by giving the 3/4 white yarn a " white dip " with a dilute hypochlorite liquor in the manner customary in linen bleaching.

The results indicate that for bleaching mixed jute-linen yarns the conditions covered *by the patent quoted* offer advantages over other methods.

Jute-Cotton Materials

Mixtures of jute and cotton usually take the form of fabric in which a jute yarn as weft is woven into a cotton warp, whilst occasionally, for novel effects, jute and cotton yarns are folded to give composite fancy yarns. Unless the bleaching of the jute is taken to a stage when substantially only cellulose remains, that is, to a point when the jute complex has suffered considerably, it is difficult to obtain a pure white. Off-white effects that are satisfactory for most purposes, however, are obtained by using the sequence " Soda ash scour, chemic," or " Soda ash scour, chemic, peroxide." Scouring is best done at a temperature below the boil, whilst for the chemicking either a neutral or an alkaline hypochlorite liquor may be used, but the best colour on yarns consistent with retention of weight and strength has so far been obtained by using the conditions described above for the treatment of jute-linen yarns.

Some coarse materials may be scoured and peroxide bleached in the kier, but for other fabrics, where it is desirable to avoid creasing, the bleaching may be done on a dye jigger of the wooden beck type adapted for the use of peroxide liquors.

Where a specially good white is required, and loss of weight is not a highly important factor, mixed jute-cotton cloths of medium to heavy weights in which the cotton predominates may be given a pressure kier boil with 1 per cent. caustic soda solution, then washed and chemicked with an alkaline hypochlorite solution. In other words, the normal bleach customary for all-white piece goods may be used. With light or open-weave cloths the pressure boil is usually too severe. For very white fabrics it is best to employ as weft jute yarns that have already been bleached in the hank or in package form before being woven. If this is done the subsequent treatment of the cloth by pressure boiling and chemicking as for an all-cotton fabric enables good whites to be obtained that do not yellow on exposure to light. Such drastic treatment, however, should rarely be necessary and is not advisable owing to its adverse effect on the strength of the jute.

Jute-Rayon or Jute-Rayon-Cotton Materials

In novelty jute fabrics it is sometimes the practice to incorporate rayon or both cotton and rayon in order to obtain more attractive effects. Usually it is better to use cotton with the rayon because when rayon yarns are wetted they lose 40 to 50 per cent. of their dry strength, whilst bleached jute also becomes weaker on wetting, as already emphasised. On the other hand, cotton retains its strength on wetting and, therefore, to a great extent enables the weakening that would otherwise occur largely to be avoided.

When the rayon is of the regenerated cellulose type (i.e. viscose or cuprammonium) the sequence " soda ash scour—hypochlorite bleach " may be used with advantage but the scour should be mild and at a relatively low temperature in order to avoid undue loss of weight and possible weakening of the viscose. Also the hypochlorite treatment should be cold and the concentration as low as will enable the desired effects to be obtained on the jute without significant degradation of the viscose. Satisfactory conditions are, therefore:—Scouring at 65° to 70° C. for half to one hour in a solution containing $7\frac{1}{2}$ per cent. of soda ash on the weight of fabric, followed by washing, and then bleaching for about one hour in an alkaline hypochlorite solution containing 3 g. of available chlorine per litre, and following with an antichlor in a dilute bisulphite liquor.

Normally, hypochlorite solutions of this strength would be considered to be too strong for viscose rayon materials, but when jute is present by far the

greater part of the oxidising agent is rapidly consumed by the non-cellulose constituents of this fibre so that the rayon is substantially protected.

The shade obtained by this treatment is usually cream to pale cream but much depends on the quality of the jute employed. With red Tossa varieties no very near approach to white is to be expected but with more readily bleachable types of Daisee and other good qualities much better results can be secured.

An alternative treatment giving rather whiter shades is to follow the above soda ash scour by a peroxide bleach for about one hour at 70° C. in a solution containing per litre 3 g. of sodium peroxide, 6·6 g. of sodium bicarbonate and 6 to 8 g. of sodium silicate, I.C.I. grade J.81 or C.100. If this method is adopted the residual bleach liquor should be used for scouring the next batch since such procedure is not only more economical but enables better shades to be produced than when the alkaline scouring liquor contains no peroxide.

When acetate rayon is present it is necessary to avoid hot alkaline scouring if all hydrolysis of the rayon is to be prevented. In this case, therefore, a wetting out treatment at 50 to 70° C. with a solution of an assistant such as Calsolene Oil HS should be given, and bleaching is best done with a hypochlorite solution of *p*H 9 to 11. Under these conditions no appreciable hydrolysis occurs for times of treatment with the bleach liquor up to two hours[9]. The processing is best done in open width on the jigger as there is then less likelihood of damage to the rayon than obtains when the fabric is treated in rope form.

Jute-Wool Mixtures

For jute-wool yarns or fabrics the use of hypochlorite is not permissible, and the bleaching is best done with peroxide following a mild scouring treatment. Reasonably good results on mixture cloths have been obtained by scouring for one to two hours at 45° C. in a liquor containing 0·2 per cent. of both soap and soda ash, or Lissapol and soda ash, and following this operation by a bleach at the same temperature in a 1 to 1½ volume peroxide solution made alkaline by the addition of sodium silicate. Treatment for three hours or more is required in order to give a satisfactory bleach, but usually it is difficult to obtain a first-class white because of residual yellowness in the jute that can be removed only under more drastic conditions. As wool materials are normally bleached to a creamy white rather than a pure white slight yellowness in the jute is relatively unimportant.

Woollenised Jute

When jute is to be mixed with wool it is sometimes first treated with concentrated caustic soda solution for the purpose of woollenising it. The treatment resembles in some degree the mercerisation of cotton except that no tension is applied, and it has the effect of shrinking the fibres and making them crinkled and springy, although in handle they become harsher and "scrooped." The effect obtained depends to a very great extent on the concentration of caustic soda employed, and usually so rapid is the action that, as with cotton, only a few minutes are required provided that wetting-out by the caustic liquor is rapid. The greater the shrinkage the more crinkled are the fibres and presumably, therefore, the more satisfactory is the effect, but while yarn extensibility is considerably increased by the treatment, for example, from about 3 to 12 per cent, tensile strength is reduced. The loss of strength is due apparently to removal of hemicellulose and other alkali-soluble constituents of the jute since the lignin content remains substantially unchanged.

The effects of caustic soda on jute are illustrated by the results of the following experiments. Half-lea hanks of an unscoured yarn of initially the same size, were steeped for 10 minutes in caustic soda solutions of the strengths given, washed, soured, neutralised with sodium bicarbonate solution, washed and dried. Their lengths were measured under standard load, and tensile strengths and lignin determinations were made as recorded in Table IV.

From these values the shrinkage is seen to increase rapidly with increasing concentration of caustic soda up to 20 to 25 per cent. and thereafter only slowly,

Table IV

% NaOH ...	0	5	7·5	10	12·5	15	17·5	20	22·5	25	30	40
% Shrinkage 500 g. load ...	—	3·0	4·2	6·5	11·8	20·1	23·2	26·2	27·5	28·1	29·5	31·2
% Strength ...	100	85	80	67	—	58	—	45	—	52	36	44
% Lignin content	13	—	—	—	14·0	—	14·1	14·1	—	14·0	—	—

so that from this point of view solutions of not less than 20 per cent. concentration should give the best effects. On the other hand, tensile strength diminishes progressively and approaches a minimum at about the same concentration of caustic soda. Since, however, material treated in this manner is used chiefly for mixing with wool, and the latter is capable of giving sufficient strength to the yarn, the loss of strength of the jute is of less importance.

It may be noted that the effect of concentration of caustic soda is here very similar indeed to that observed in the mercerisation of cotton where maximum effects are also obtained for approximately 20 per cent. solutions at the ordinary temperature.

Unbleached woollenised jute is dark brown in colour but it can be bleached readily with alkaline hypochlorite to a fairly light shade without further significant decrease of strength, whilst a lighter effect still is obtained if a subsequent peroxide treatment is given. The shades obtained with woollenised material are, however, yellower than those of plain jute for identical conditions of treatment, and from the experiments made in the course of this work it appears that woollenised jute is less readily bleached to light shades.

The Use of Bleached Jute in Mixture Fabrics

In the above work emphasis has been laid on the fact that an approach to white can be obtained only by removal of a considerable proportion of the incrustants of jute and in particular the lignin, and it has been shown that such removal has an adverse effect on the wet strength of the yarn. Furthermore, if material is required that will not yellow on exposure to light it is necessary to give treatments severe enough to eliminate all the lignin[5].

If, for example, all-white mixed jute cotton or jute-linen cloths are required that will not yellow on exposure, the results obtained indicate that it is best to bleach the jute yarn first before weaving it into the cloth and subsequently to bleach the fabric itself by customary methods suitable for the second fibre. Although in this way the jute yarn loses strength and tends to approach the condition when there is little incrustant material remaining to bind together the short cellulose ultimates, if the weave is sufficiently close the strength of the cloth can be to a great extent retained because of the binding produced by the interweaving of the picks and ends.

It is obvious, however, that owing to the low wet-strength of well-bleached jute, any subsequent laundry treatments given to the composite fabrics must be conducted in such a way that severe mechanical action while the materials are wet is avoided. In other words much the same care must be taken as is observed in the washing of wool materials, where felting shrinkage can be avoided only by reducing mechanical rubbing to a minimum. If this precaution is observed the life of the fabric is not too seriously shortened because, on drying, the original strength is very largely restored.

As with rayon fabrics, dry cleaning solvents do not cause the pronounced fall of strength that accompanies immersion in water, and for this reason the dry cleaning of composite materials such as furnishing fabrics containing bleached jute may be considered to be satisfactory. For example, the mean breaking loads of a well-bleached jute yarn (*a*) in the dry state and (*b*) wet with trichlorethylene were found to be respectively 4·2 and 4·7 lb. In other words, yarn saturated with this solvent remains as strong as the dry yarn.

Testing

The conditions of testing employed were those previously described[5].

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London Section

PRACTICAL LAUNDERING TESTS FOR TEXTILE GOODS

Paper delivered to the London Section, 21st March, 1944

By Wm. Brown

Mr. Brown began by referring to the various "utility" specifications which had been evolved and the Government control of standards brought about by the war, but he suggested that the ultimate test of all textile goods was their reaction to laundering. In his view, this aspect was not fully appreciated by those whose responsibility it was to determine the quality standards to which textile fabrics should conform and he strongly urged that there should be active liaison between all sections of the textile industry and the laundry industry. It was his considered view that the need for liaison with the laundry industry was not sufficiently stressed as many fabrics found their way to the public which after one or two launderings were quite useless. Mr. Brown felt that this would not be rectified until all specifications besides referring to quality, durability, etc., contained a definite guarantee of "launderability."

Dealing with the complaints received by the laundries, he stated that the most frequent one was that of shrinkage, the causes of which fell into two categories. One was peculiar to woollen garments and was due to the felting of the material, whilst the other was caused by the loss of the "stretch" (imparted in the course of the finishing process). In regard to the latter, he said that there was absolutely no known method of obviating the shrinkage as fabric which had been stretched to more than its manufactured size by the finisher reverted to its original size when immersed in water and, once lost, it was impossible to restore this "stretch." He could not understand, therefore, why fabrics were so stretched by the finishers, and the public forced to purchase garments sizes larger than necessary to "allow for shrinkage." In referring to shrinkage by "felting" Mr. Brown stated that this defect had been overcome by various anti-felting treatments. A process of controlled "chlorination" or equivalent process was applied to all Service underwear and Mr. Brown was convinced that all civilian garments should, by Government order, be similarly treated.

Referring to the misuse of yarns, Mr. Brown then passed round the meeting sample tablecloths in which rayon yarn had been incorporated in border stripes or in the weft; in each instance the rayon portion had shrunk in laundering, resulting in the puckering of the whole cloth where the border had

been of rayon, and the shrinkage of the weft in the second cloth, leaving a formerly square cloth, oblong. Although appreciating the many uses of rayon, he considered that it was quite unsuitable for household articles which must be constructed of a fibre which could withstand much laundering.

With regard to the restriction in supply of certain textile fabrics, Mr. Brown stated that this had led to the introduction of a considerable number of substitutes, many of which had given trouble in laundering. He instanced the substitution of jute for linen or cotton in kitchen towelling and stated that ordinary linen towelling could undergo a washing process designed to secure the cleansing necessary for rubbers, but that jute towels could not stand up to high temperature washing in special chemical solutions and had a life therefore of only two or three launderings. A sample cloth was shown to illustrate his remarks. Another instance where useless substitutes were employed was that illustrated by a mattress cover which was completely manufactured from paper which disintegrated on immersion in water.

Referring to other difficulties with which the laundry had to contend, mention was made of terry towelling, the loops of which "pulled" when laundered. There was a very simple remedy which was to wash the towels for the first time in nets, thus releasing the stretch of the ground weaving so that the loops were firmly anchored and this the laundry did whenever it consciously washed a new towel. Mr. Brown contended, however, that it was very often impossible to ascertain whether a towel was new or had been washed and he, therefore, recommended that the manufacturers should wash these towels before sale to the public, thus obviating this problem. He finally drew attention to the use of synthetic resins for stiffening collars which, when immersed in hot water, became plastic and formed lumps within the collar. Here also the lecturer was firmly convinced that by collaboration between the manufacturer of the material and the laundry, such glaring mistakes as the use of rayon in tablecloths, jute in rubbers, terry towels that "looped" and synthetic resins in collars, would be avoided.

DISCUSSION

Mr. Brassard stated that many of the faults in textile manufacture to which Mr. Brown had referred were the direct result of the horizontal method of production employed in England; as each process was undertaken by a different concern which had, in all probability, never seen the finished article. He referred to the Continental method of manufacture on vertical lines and stated that the consumer should be trained to appreciate the quality of the goods he bought. In regard to the "stretch" of fabric mentioned, Mr. Brassard stated that the finisher in most instances was ordered to return a 100 yard piece of material to the merchant at 110 yards. Referring to the other points raised by the speaker, Mr. Brassard stated that "chlorination" of woollen goods was not yet perfected sufficiently for use on the civilian market as the process rendered the material hard; in regard to the use of rayon for household purposes, he agreed with Mr. Brown that this was a practice to be avoided.

On the subject of shrinkage, Mr. Williams stated that the L.M.S. Railway found it too expensive to purchase pre-shrunk boiler suits, but purchased those two sizes too large instead. He was of the opinion that the manufacturer of the material did not appreciate its reaction to laundering, and it was from this aspect that a remedy should be sought and some form of quality control be maintained.

To this end Mr. Hill urged that the laundry industry's views should be taken into account to ensure that quality control was effective. He stated that throughout the whole process of manufacture the fact that the goods eventually have to be much laundered should always be borne in mind. Mr. Meredith agreed and was of the opinion that all research work was discontinued too soon, and thus the final test of a material, viz., its launderability, was not always submitted to close investigation.

Mr. Goodale proposed and Mr. Brassard seconded the vote of thanks to Mr. Brown, which was carried with acclamation.

Lancashire Section

TEXTILE INDUSTRIAL DEVELOPMENT

By E. J. Poole

Paper delivered to the Lancashire Section, 25th March, 1944

Development work in an industry such as that represented by The Textile Institute must of necessity be complex, primarily because of the variety of materials at its disposal, more especially the varied nature of those of natural origin.

In consequence, equipment should be designed to manipulate the material in accordance with its peculiarities. Plant designed to process one type of material will not necessarily be suitable for another.

Practical experience has established this, but from observations and difficulties encountered throughout the industry there appears to have been comparatively little change, with few possible exceptions in connection with the design of textile machinery and the development of newer materials.

Taking a retrospective view of the industry and in particular the mechanical aspects, the control and manipulation of materials appear to have changed but slightly in principle from those of the earlier times. It must, however, be admitted that most ingenious mechanical means have been devised and are in fact in evidence throughout the industry. These would appear to have served their purpose of increasing production. In so far as newer methods, newer processes or unique and attractive fabrics are concerned there is great need for development.

The first world war was a prime cause of the industrial research and development of the synthetic fibre industry. In consequence of this development, cotton and wool productions suffered, not because of the introduction of these newer materials, but apparently because of the short-sighted view of the industry and its lack of some form of parallel development.

As far as the cotton and wool industries were concerned, the introduction of synthetic fibres, and no less other fibres, was regarded with indifference by some and with serious concern by others; hence these new developments were not considered in their true perspective nor exploited commercially to any appreciable extent except apparently by those responsible for their introduction.

In some respects, the cotton section of the trade may have had reasons for alarm by the introduction of other cellulosic fibres, but for doubtful reasons, similar alarm pervaded the wool section. Apparently not until interesting fabrics produced abroad were marketed was it realised that such synthetic fibres could be combined to some advantage with cotton and wool.

The textile industry of this country maintained a tradition common to it with regard to fashion and design, in apparently waiting, perhaps unconsciously, to be shown the possibilities of the use of synthetic fibres by other industrial centres of the world.

As was the case of this development at that time, we now appear to be in a similar position with respect to the development of textile machinery. Amazing strides in engineering and machinery design for the requirements of war have been made. Is there to be another waiting period for a lead from outside in possible industrial applications of war developments? The magnificent achievements for the purposes of war are surely very clear and will, without doubt influence future mechanical development and introduce the need for greater skill and specialisation in industry with accompanying methods of increased production requiring higher efficiency.

Radical changes in machinery design would appear inevitable in order to cope with the future demands upon industry. It is held that after the war all available machinery and labour in the textile industry will be required for a period of one to three years in order to meet the expected immediate demand.

Should this period extend to three years, which may be probable, the period beyond such a time must not be forgotten because of the immediate apparent prosperity and activity of the industry.

Whilst immediate demands are being met, international trade will be constantly under review and other hitherto undeveloped countries, apart from their recovery from the effects of war, will be preparing to enter into the markets of the world.

If it be assumed, and there appears good foundation for it, that these prospective entrants into the world's markets will produce mainly the simpler fabrics, then our attention will need to be directed towards revolutionary developments in machinery, processing and combining other natural and synthetic fibres with our basic raw materials.

The past has shown what could be done with two materials on which the industry has concentrated, namely, cotton and wool. From these has developed a very large re-manufacturing industry embodying practically all other fibres used in textile manufacturing.

The ingenuity displayed in this large industry in cloth structure, designing and finishing has been great. Its products warrant admiration.

Much development is called for in the production of new fabrics by improved processing, thus enabling new types to be evolved which would possess unique features, not only in appearance, but in wear and handle. They would also be enhanced by differential dyeing and finishing properties and other possible chemical treatments of the materials used.

No apology is offered for suggesting that the different research associations could give practical assistance in revealing physical and chemical features peculiar to different fibres and their behaviour in use from a decorative angle.

By a judicious selection and combination of fibre materials whose physical characteristics are known, together with physical and chemical finishing treatments, it is obvious that new yarns and fabrics with distinctive features might be produced.

Such fabrics however will not be produced without expert personnel and the training of such personnel should now be the immediate consideration of the industry.

Perhaps the majority will have to be instructed from the beginning, but there will be others, at present in the forces, some of whom will be partially trained and should be given every facility to complete their training and there will be those who have been fully trained with some industrial experience, and should be encouraged by the industry to return and offered every possible means to receive a revision course.

The industry may possibly arrange for this through their research association by a scheme whereby those requiring a revision course might be interchanged with trainees in the association who need industrial experience.

As regards new entrants into industry, interest must first be stimulated whilst at school, possibly by a material extension of lectures illustrated by slides or films, given by qualified members of The Textile Institute to scholars of the higher forms in their last one or two years. This may be essential in view of the raising of the school leaving age.

Those subsequently entering industry should then receive a practical training combined with scientific and technical studies, and this scheme would appear highly desirable in order that they may gradually appreciate the absolute necessity for both practical and theoretical training.

At the stage of proficiency, it should be generally realised that it is in the interests of the industry to retain such personnel, otherwise the possibility may arise of key personnel being attracted elsewhere, most probably abroad to the serious detriment of the industry.

Mr. Cleveland Belle, Director of the Cotton Board's Colour, Design and Style Centre, speaking at Manchester Art Gallery some time ago made a plea for reconciliation of the traditional genius of England in the designing and

making of beautiful textiles with the mechanical genius which gave this country the leadership in the mass production of cloth in the 19th century. This will depend upon the training our textile designers and technicians receive and would appear to call for a closer co-operation between the appropriate bodies so that it may be made possible to recognise the textile designers and technicians under the heading of industrial designers.

What has been required is a faculty in design to raise the status of the industrial designer and this has now been established by the Royal Society of Arts under the qualification of the R.D.I. It should be more widely acknowledged and appreciated throughout the industry.

Encouragement should also be given to personnel of an inventive turn of mind with a view to creating in the much anticipated new era of textile machinery, such devices whereby firstly the "blind alley" occupations may be eliminated, except for preparatory training, and secondly, to facilitate the performance of many manual operations. Ample evidence may, it is hoped, be brought forward by the textile machine makers to satisfy the industry in this direction of new equipment and machinery. Yet, whatever the developments, there will still no doubt be those operations which will require minders, and it is important that some means be found to relieve the monotony of the work of these operatives. Not much appears to have been done in the direction of interesting such operatives in the application or uses of the materials they may be working and the consequence of faulty attention.

A scheme might be devised possibly in the form of exhibits of articles into which the materials are made and self explanatory illustrations of processes. The consequences of imperfections in the materials and of careless handling should also be fully explained. There is no reason why operatives should not share to some extent in the trials of articles of wear made from the materials they handle so frequently, such an arrangement would stimulate considerable interest and encourage good work, and would be to the advantage of the industry, especially if the operative could be encouraged to give intelligent and informative reports on such trials.

From the foregoing remarks and suggestions it may be inferred that the industry has done little to keep up to date in equipment and ideas and to stimulate greater interest in the personnel of the industry in their respective capacities.

It may, to the layman, appear that the industry has conducted its affairs in a haphazard manner, indifferent to certain aspects of its work and continuing with obsolete machinery as long as possible and has copied and followed others in a *laissez faire* manner.

Let it be the sincere intention and personal ambition of each and everyone to see that scientific developments and discoveries are directed aright to the benefit of all humanity and not to destruction. The textile industry has achieved much and there remains much to be done. It has been stated by an eminent statistician that the textile industry is one of the most highly organised, and it must be admitted that well qualified business men and industrialists in the industry have made great efforts to maintain modern plant, factory conditions and other amenities. All such efforts, however, will be of no avail without a revival of the personnel of the industry, and of the incentive and ambition on the part of each individual to restore the industry of the country. Nothing will be achieved unless there be a greater freedom of co-operation between the different sections of the industry and some marked degree of co-ordination to avoid unnecessary duplication and irrational competition. The different standards of living of possible competitors still remains a basic problem but, with unity of purpose and concerted action throughout the industry in which the Textile Institute should serve in no small capacity, there should be a reasonable chance for the textile industry to retain its prestige and help to revive prosperity in the United Kingdom and throughout the world.

General Items

Textile Institute Scholarship

At a time when so much consideration is being given to the reconstruction of the textile industry, and particularly to the recruitment of personnel, it is interesting to know that the Institute has just awarded its fourth scholarship. The new scholarship holder is Ronald Sanderson, of 162, Smith Street, Nelson. He was formerly employed with a firm of textile manufacturers in Nelson where he also attended the Municipal Technical College for an evening course in Cotton Weaving. At the present time he is taking a degree course in the Department of Textile Industries at Manchester College of Technology.

The Institute Scholarship, which is one of the most valuable awards available, has a maximum value of £200 a year for the first two years, and of £350 in the final year. If conditions permit it is highly probable that Mr. Sanderson will utilise the scholarship in order to continue his training abroad after he has completed the degree course.

The award is made possible under the terms of a grant from the trustees of the Cotton Trade War Memorial Fund in 1928. The scholarship is available for young craftsmen engaged in the cotton spinning or cotton weaving industry of this country, and enables them to follow an approved course of study, and have an extended training of a special character, or gain industrial experience at home or abroad.

The Scholarships Committee are of the opinion that the type of training which this award permits is eminently suitable for producing the type of man who will be required to play a leading part in the future of industry.

Award of Research Studentship

In May, 1943, the Institute published in the *Journal* a scheme for the award of Research Studentships. The first award has now been made to Mr. R. L. Kitchen, A.T.I., of Huddersfield. In accordance with the scheme, facilities for research are being provided by the University of Leeds, and Mr. Kitchen is undertaking investigations on the subject of " The Action of Hypochlorites and Related Compounds on Proteins, with Special Reference to their Use in Rendering Wool Unshrinkable."

The proposals for the provision of facilities in connection with the research studentships came, in the first instance, from the University of Leeds. The Institute would like to emphasise, however, that any proposals from other Educational Bodies on similar lines would receive equal and sympathetic consideration.

Honorary Life Membership

At the November meeting of the Council, Mr. W. W. L. Lishman, of Todmorden, was unanimously elected as an Honorary Life Member of the Institute in recognition of his valuable services. Mr. Lishman acted as Honorary Treasurer of the Institute from 1930-42, and at the present time he is a Vice-President.

Institute Diplomas

Elections to Fellowship and Associateship have been completed as follows since the appearance of the previous list (October issue of the *Journal*):—

FELLOWSHIP

THOMAS HUGHES ROBINSON, F.R.S.A., A.T.I.
Managing Director, Myers & Robinson Ltd., Bingley.

ASSOCIATESHIP

RALPH WILKS
At present serving in H.M. Forces, formerly with C. F. Taylor & Co. Ltd., Shipley.

Institute Membership

The following applicants were elected to membership at a recent meeting of Council:—

Life Membership

Wilfred H. Barker, High View, Wigan Lane, Chorley, Lancs. (Practical Research and Service Overlooker, Automatic Weaving Machinery, Messrs. Willan & Mills, Rosehill Iron Works, Blackburn).

Emyr Williams, Mill Bank, Trefriw, Caernarvonshire, N. Wales (Woollen Manufacturer, Vale of Conway Woollen Mills, Trefriw, N. Wales).

Ordinary

Reginald James Bray, M.Sc., A.R.C.S., D.I.C., 43, Whinfield, Adel, Leeds 6 (Textile Research Advisor, John Foster & Son Ltd., Queensbury, Nr. Bradford).

Charles Joseph Breakell, 27, Woodside Avenue, Ribbleton, Preston (Salesman and Cardroom Manager, Richard Haworth & Co. Ltd., Ordsall Lane, Salford 5).

Thomas Rennie Dodgson, Brookdale, Hamilton Road, Whitefield (Managing Director, John C. Hamer Ltd., Hope Hill, Radcliffe).

Arthur Fort, 131, Cheadle Old Road, Edgeley, Stockport (Manager, Cheadle Heath Condensor Mill Ltd., Gorsey Bank, Stockport).

George Garside, 9, Turnpike Street, Elland (Worsted Spinning and Twisting Overlooker, Robinson & Barraclough Ltd., Hollyns Mill, Greetland, Nr. Halifax).

K. Hisamouddin, West View, Upper Park Road, Manchester, 14 (Student, Manchester Municipal College of Technology).

John F. McGregor, 23, Blairgowrie Road, Glasgow, S.W.2 (Chemist, Research Laboratory Staff, J. & P. Coats Ltd., Paisley).

Robert William Myers, 39, Fieldway, Clayton, Bradford (Director, T. Butterfield & Co. Ltd., Grattan Mills, 122, Sunbridge Road, Bradford).

George Richard Payne, 13, Fenton Street, Burley-in-Wharfedale, Nr. Leeds (Textile Designer, S. Bottomley & Bros. Ltd., Buttershaw Mills, Bradford).

Arnold Shepherdson, B.Sc., 19, Dawlish Road, Chorlton-cum-Hardy, Manchester (Research Consultant, I.C.I. Dyestuffs Division, Blackley, Manchester, 9).

Frank Edward Stringer, "Newlands," Cursis Stream, Palmerstown, Co. Dublin (Woollen Factory Manager, c/o Hill & Sons Ltd., Lucan, Co. Dublin).

Charles Edwin Whitfield, 7, Daleside Road, Riddlesden, Keighley (Head Designer, Driver, Hartley & Co. Ltd., Dryart Mills, Keighley).

Junior

Peter Burrows, "Howley Dene," Scotchman Lane, Morley, Nr. Leeds (Textile Apprentice and Student).

Albert Hargreaves, 15, Carloon Drive, Wythenshawe, Manchester (Laboratory Assistant, Chamber of Commerce Testing House, 113, Barlow Moor Road, Didsbury, Manchester).

Walter Nutter, 19, Bentley Street, Nelson (H.M. Forces).

Halil Sancak, 1, Otterburn Gardens, Lawnswood, Leeds, 6 (Student, Leeds University).

Ralph Turner, 79, Walden Drive, Haworth Road, Bradford (Apprentice Dyer —Textile Chemist, Chas. Fox & Co. (Dyers) Ltd., Jesse St. Dyeworks, Manchester Road, Bradford).

Employment Register

The following announcements are taken from entries in our Register of Members whose services are on offer. Employers may obtain full particulars on application:—

No. 138—Desires position as Hosiery Works Manager or Assistant Manager. Age 39 years. Technical knowledge of Hosiery Manufacture and Yarn and Fabric testing. Thirty years practical experience of Knitting, Mechanics, Foreman and Works Manager. For last 17 years has been Works Manager on plant of fine-gauge fully-fashioned hose and seamless half-hose. Would consider starting up a new plant. Willing to go abroad.

No. 139—Young man, 31 years of age desires administrative post dealing with the chemical processing of textiles. A.R.I.C., A.T.I., A.M.I.I.A., A.M.C.T. Higher National Certificate in Chemistry. Many years experience as Chemist and Examiner of textiles.

NOTICES: INSTITUTE MEETINGS

LANCASHIRE SECTION

Saturday, 2nd December, 1944—*Manchester*. 2.45 p.m. Lecture: "Nylon Yarns and Some Aspects of Processing and Finishing," by G. Loasby, B.Sc., F.R.I.C., F.T.I. (British Nylon Spinners Ltd.) at the Central Library.

Friday, 8th December, 1944—*Manchester*. 1.0 p.m. Lunch-time meeting at the Institute's premises. "Production of New Designs for Export," by S. Swinburne (Geo. Tingey & Co. Ltd.).

MIDLANDS SECTION

Saturday, 16th December, 1944—*Leicester*. 3.0 p.m. Lecture: "Factory Organisation and Costing," by T. Alan Pratt, A.S.A.A., A.T.I.I. (Secretary, British Hosiery Manufacturers' Association) at the Colleges of Art and Technology.

YORKSHIRE SECTION

Monday, 4th December, 1944—*Bradford*. 6.30 p.m. Lecture: "Scaffolding Threads in Yarn and Cloth Structure," by A. Johnson, M.Sc., F.T.I., at the Midland Hotel.

Members of the Institute are also invited to attend the following meetings:

Friday, 15th December, 1944—*Manchester*. 6.0 p.m. Lecture: "High Tenacity Rayons," by L. Rose (Courtaulds Ltd.). By invitation from the Society of Dyers and Colourists, Manchester Section; at the Grand Hotel, Aytoun Street.

Tuesday, 19th December, 1944—*Manchester*. 6.30 p.m. Dalton Lecture: "Chemistry and Clothing," by Dr. Clibbens (Shirley Institute). By invitation from the Royal Institute of Chemistry, Manchester and District Section; at the Central Library.