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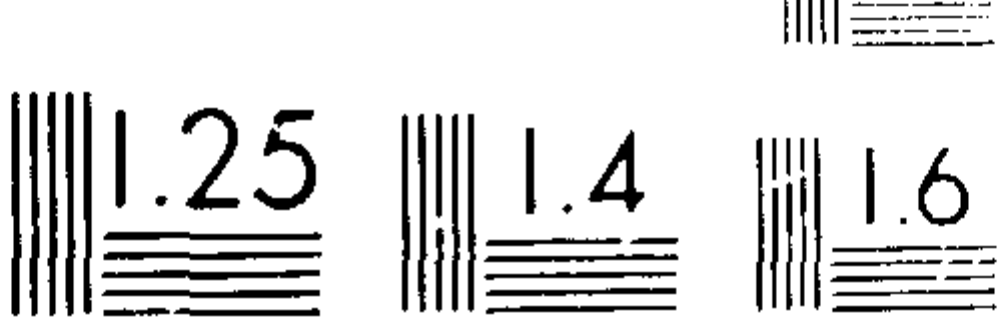
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NON-OIL STAIN DAMAGE IN TEXTILE PROCESSING

Based on the work of T. V. Ananthan, G. R. Pillai and J. Zacharia

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INTRODUCTION

Textiles, during processing, are damaged by various stains from oil, grease, rust, carbon, wood, paint, varnish, tar or dye and, occasionally, from crayons, coloured or lead pencils and coloured chalks. Undesirable marks also appear from improper kier boiling, insufficient desizing and inadequate finishing.

Oil-stain damage in textile processing has been dealt with in a separate UNIDO publication[1/], and it was felt that stains from other sources should also be studied in detail and findings indicating preventive and removal methods published. Data covering a decade of mill investigations in India were scrutanized and details pertaining to non-oil stains were categorized into four groups, namely, stains from coloured markings; stains from foreign fibres; unusual stains and streaks; and stains from various other sources. Their characteristics, identification and preventive and removal measures are indicated.

1/ "Oil-stain damage in textile processing", Textile Monographs (UNIDO/IOD. 316).

I. STAINS FROM COLOURED MARKINGS

At spinning, winding and warping

The textile industry uses an ever-increasing range of fibres in many combinations. Quick and easy identification is needed during the process of their production, transportation and storage and they should therefore be easily identifiable. Even the same type of fibre or blend should be distinguishable from others differing in count of twist, doubling etc.

One way of distinguishing fibres is by fugitive tinting, that is, by tinting them with a colour easily removed by normal wet processing treatments. Another way is to use different-coloured plastic cones, bobbins, pirns, containers etc., the choice depending on their availability and cost. The practice is still, in some mills, to mark the full bobbins, cones and pirns with coloured chalks, crayons or solutions. The colour ingredient is supposed to be fugitive.

Sometimes markings are not washed out but remain forming colour stains (figure I). In these cases, the colouring matter in the marking medium and the wet processing treatment likely to be used assume significance. If the same wet processing treatment is always used, the way to avoid staining is by the selection of suitable fugitive colouring materials in the marking medium. Pigment colours of suitable particle size and with no abrasive properties are often used except for highly twisted yarns. Acid dyes of the level dyeing type are preferable for fugitive marking of cotton or other cellulosic fibres, while selected acid colours can be used for polyester. For wool, nylon and silk, selected direct colours can be utilized. A new class of water-soluble dyes can be adopted by coupling various diazonium compounds to highly ethoxylated aromatic amines. The colours selected should be such as to retain their washability even after heat-setting prior to scouring.

Figure I. Coloured marking stains from weft yarn

Investigations revealed that in one mill three out of the four marking inks used caused slight staining. In another mill, a khaki marking ink contained a yellow dye component that left a light yellow tint after scouring.

Preventive measures:

(a) Use of coloured plastic cones, bobbins, pirns etc. for identification instead of marking over yarn;

(b) Reduction of marking;

(c) Testing of marking material batchwise before use;

(d) Testing whether the colour is completely washable after heat setting of fabric, in cases when heat setting is done before scouring;

(e) Retesting the marking medium for washability when there is a change in the type of fibre;

(f) Use of colours that will not change their hue under different lighting conditions.

On yarn for knitting

Examination of grey knitted fabric showed brown lines, without any fluorescence under ultraviolet light, which were not removable by stain removers. (The lubricant used in the knitting machine produced a red stain with appreciable fluorescence under ultraviolet light.) Bleached knitted fabric showed yellowish brown lines in the course direction of knitting (figure II).

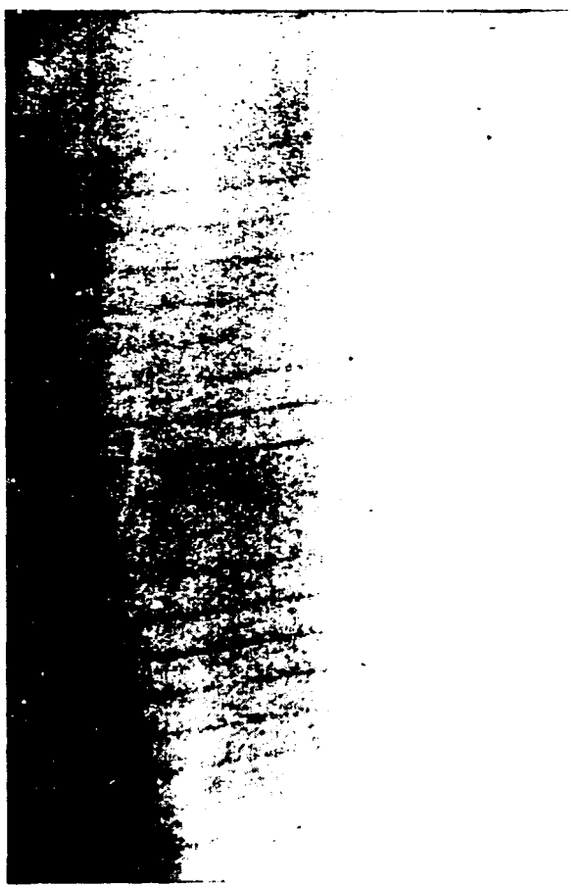

Figure II. Marking stains from roving bobbins on knitted cloth

Inquiries at the yarn manufacturer revealed that if they are not marked at the ringframe and winding stages, roving bobbins are marked with a colour (yellow ochre) for identification purposes. Therefore, one grey and one bleached knitted piece were stained with a solution of this colour powder, and dried and bleached. The stain persisted and the colour was similar to the coloured lines seen on the knitted fabric. Since no other colour marking was used, the yellow ochre was confirmed as the cause of the staining.

If marking cannot be avoided, it should be done with a colour that is easily washable.

A full width of bleached cotton fabric

A black line appeared as continuous staining of weft yarn from two to four picks. The staining showed no fluorescence under ultraviolet light, was not removed by scouring or oil solvents, and was fast to bleaching.

Since this staining was noticed in the grey stage, the marking colours used in speed frames were checked and black "sienna" was found to be used for marking the roving bobbins.

To eliminate this staining, the marking of speed frame bobbins should be reduced, as far as possible. If it cannot be avoided, a small mark should be made with a colour that is easily washable.

From the bleeding of threads used for identification of end pieces in the loomshed

In weaving, a few picks of coloured yarn are inserted to identify the end piece in a warp beam. It was found that this coloured strip bled in wet processing and stained the adjacent folds of cloth. Analysis shows that this coloured yarn is dyed with direct dyestuff, which generally bleeds.

To avoid such bleeding, fast colours, such as produced by vat, azoic and sulphur dyes, may be used.

On the cloth in the loom

Markings are done on the woven cloth in the loom to note shift change, quality number, loom number, piece length and date. They are made with lead pencils, coloured chalks, coloured pencils, crayons etc. They are often not removed in normal wet processing treatments causing waste by necessitating that portion to be flagged or cut off. Preventive measures are similar to those given earlier for coloured marking stains made in spinning, winding and warping.

II. STAINS FROM FOREIGN FIBRES

Jute fibres

When the straps of pressed raw-cotton bales are cut open the hessian wrapper also bursts and gets cut. These cut bits, if not fully separated and removed, mix with the spilled loosened cotton and enter the feeding lattice. Some jute threads originate from picking and ginning, or from the use of torn hessian bags or jute-lined baskets by the cotton pickers. Coir fibres are found, though rarely, when strings or ropes are used for tieing cotton bags or "boras". In the grey cloth they appear as spun-in brown fibres (table 1).

Human hair

Another occurrence, though irfrequent, is hair, probably from the heads of cotton pickers, who are mostly women, mixed with raw cotton. This appears as thin black lines in yarn or bleached fabric (table 1).

Coloured threads

Coloured threads originate from the torn sarees, dresses or cloth bags of cotton pickers and the cloth pieces used by waste collectors at different stages of processing. Such threads get pressed along with the raw cotton and bleed during processing causing colour stains. The threads are often in a fine, double yarn that gets twisted around the basic warp or weft thread. When a white fabric is woven on a loom previously run with coloured threads without the loom being thoroughly cleaned, coloured flecks or yarn cuts may get woven-in. Coloured fluff or yarn may also adhere to the weft during pirn winding and end up woven in. Such stains are prominent on white fabric. Precautions against this should be taken in weaving and pirn winding. Studies of such defects occurring on grey cotton sheeting indicated that most of the spun-in foreign fibres are up to 1 cm in length (table 1).

The foreign material removed from the feeding lattice of bale breakers, from mixing bins and from scutcher laps of a typical mill was weighed (table 2). Even though it weighs very little, e.g. 8 g per bale, such material, being widely dispersed, is difficult to detect and remove from grey fabric. It appears as spun-in coloured fibres and is prominent and objectionable on bleached and light dyed fabrics.

Table 1. Nature and extent of staining from foreign fibres (jute, hair, coloured threads and oily threads)

Material : Grey sheeting
Construction : 68x46
English count : 15sx16s
Width : 153 cm

Piece length (m)	Warp or Weft	Jute, coir — Approximate woven length: Up to 1 cm	From 1 to 2 cm	Over 2 cm	Total	Hair — Approximate woven length: Up to 1 cm	From 1 to 2 cm	Over 2 cm	Total	Coloured threads[a] — Approximate woven length: Up to 1 cm	From 1 to 2 cm	Over 2 cm	Total	Oily threads — Approximate woven length: Up to 1 cm	From 1 to 2 cm	Over 2 cm	Total
106	Warp	66	1	2	69	2	1	2	5	27	10	4	41	30	-	6	36
	Weft	30	-	3	33	4	2	-	6	14	2	2	18	4	-	1	5
52 ex 104 (examined half of the piece)	Warp	15	-	-	15	-	2	2	4	43	1	5	49	15	-	3	18
	Weft	6	-	-	6	1	-	1	2	6	-	3	9	3	-	-	3

a/ Violet, green, red, blue, yellow and black.

Table 2. Quantity of foreign material removed at various stages of processing

(Grams)

	Number of bales	Quantity of foreign material removed at: Feeding lattice	Mixing bin	Scutcher	Total weight
	40	240 + 80 oily cotton	20 + 30 oily cotton	30	400
	35	130 + 45 oily cotton	50	20 (mostly coir cuts)	245
	35	160	50	30	240
	30	190	75	30	295
	55	270	35	34	339
	40	250	60	20	330
Total	235	1 240 + 125 oily cotton	320	164	1 849

Approximate average total foreign material per bale: 8.

Preventive measures. Most threads can be removed by a careful check at the feeding lattice, mixing bins and scutcher laps considerably reducing coloured fibres in grey fabric. Adequate precautions should be taken at cotton picking and ginning to eliminate or avoid the addition of coloured rags or threads and jute yarn to the cotton. Further measures are the removal of hessian from both ends of the bale before opening; careful collection, separation and removal of cut bits of hessian from opened bales at the time of feeding the lattice; and mixing the raw cotton in smaller lumps, which are turned well in the feeding lattice for easy detection and removal of foreign matter. Bale markings, if numerous and not easily washable, may produce coloured fibres. A check-up at one mill showed the following bale marks: ginning press marks in black, merchants' marks in green, the mill's marks with the stacking number in violet, and an identifying black band at the time of delivery for mixing. Tests revealed that these colours,

even after bleaching, were not fully removed and left a slight staining of fibres. It is, therefore, essential that the bale markings should be minimal and the colours used should be carefully selected and tested to ensure full removal on normal processing.

Leaf, seed coat and foreign oily matter

Case studies of grey cloth from different mills containing spots of black or brown of non oil origin were found to consist of:

(a) A leaf or seed coat embedded in the yarn;

(b) A brown mass of seed coat with short fuzz, either woven-in or adhering to yarn, connected to the basal end of the protruding fibres. These often constitute nearly three quarters of the specks on grey fabric. The dyed polyester/cotton shirting at one mill showed them to be randomly distributed over the pieces. Unlike oily spots, they do not have fluorescence under ultraviolet light;

(c) Black foreign matter with oily or greasy components adhering to neps formed by immature fibres. The incidence of this type of stain is found more in double yarn.

Preventive measures are the use of better quality cotton and further improvement in the cleaning of cotton from the blowroom from carding to combing. Treatment with caustic soda at the grey stage, and subsequent bleaching with sodium hypochlorite would reduce the specks considerably.

III. UNUSUAL STAINS AND STREAKS

Brown stains

Dark brown stains were noticed all over the nylon fabric at one mill. The stains were on group of warp with white thread intervening, without staining of the interlacing weft (figure III), which indicated that the staining occurred before weaving. The warp yarn was not sized, hence there was no possibility of staining from sizing. A number of unstained warp threads between the stained ones in group reduced the possibility of any liquid lubricant having dripped over the unseparated warp sheet on the loom.

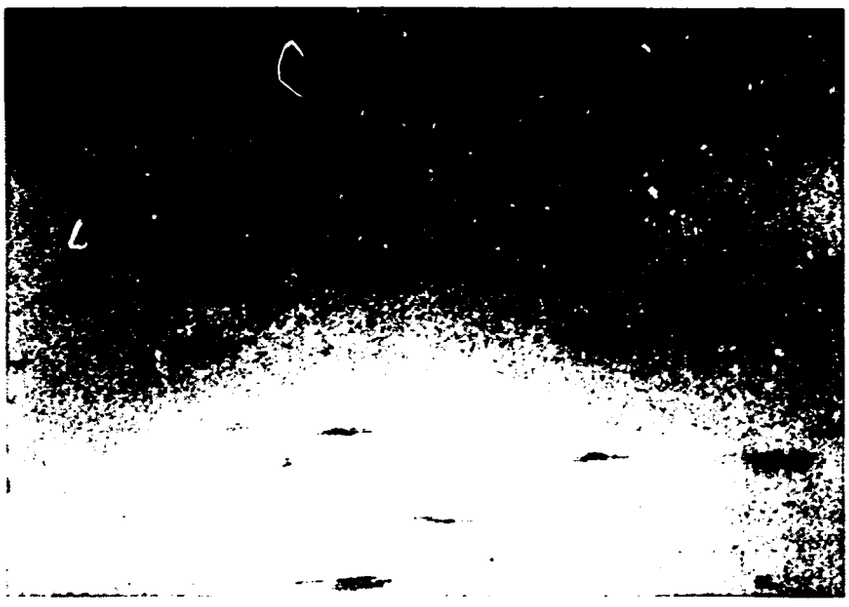

Figure III. Brown stains

It was observed that the mill was using brown paper strips every few metres over the warp beam during warping. The paper strips were found to have black or brown specks all over them and were said to be of inferior quality. These specks did not produce any noticeable mark on a piece of fabric kept over the paper, but the brown paper discarded from the warp beam was found to have darker and bigger black or brown stains.

It was concluded that the hydrophobic fibres when kept under tension on the beam and in contact with the stained paper for some days, and the slight rubbing exerted during weaving, created ideal conditions for this staining. When used under identical conditions, the speckled paper caused similar staining.

Preventive and remedial measures are to examine the paper before use in warping to ensure there are no specks on it, and to spot clean the stains from the grey fabric with a stain remover, preferably containing a non-ionic detergent and solvent preparation.

Stains on dyed poplin

Irregular patches with darker outlines of the same dye were noticed, extending from selvedge to selvedge (figure IV). The disappearance of staining after stripping and redyeing showed that it was not due to any mercerizing effect at the stained spots before dyeing. Scouring removed the staining indicating the presence of alkali or insoluble metallic soap in the cloth when dyeing. Ash content was tested and no significant difference was found between the stained and non-stained portion of the fabric, indicating the absence of metallic soap in the stains. Part of the cloth kept for dyeing was checked and distinct alkalinity (pH 9) was noticed at the loopy portions.

Figure IV. Stains on dyed poplin

It was found that when cloth in rope form, containing traces of alkali, is piled wet and stored for a time for use in dyeing, the overhanging loops get a high proportion of alkalinity by preferential seepage of alkaline water and drying. This causes migration of the dye during dyeing to places that have more affinity for it. Samples when properly washed and dyed did not have this staining.

The preventive measure is adequate scouring and washing before dyeing.

Striped effect from colour liquor jets in padding

A warp striped effect can be noticed when colour liquor jets impinge on dry cotton fabric before the latter enters the colour trough during padding. Such stripes are common in azoic dyeing (figure V).

Figure V. Striped effect from colour liquor jets in padding

Streaks on polyester/cotton fabric

The streaky single warp in yarn-dyed polyester/cotton blended striped shirting was found to be darker than the adjoining threads.

On viewing under the microscope no incrustations were observed on the streaky thread but it showed bright fluorescence under ultraviolet light, which persisted even after washing with oil solvents. The lubricants used in the related machines did not show similar fluorescence. The grey and dyed yarn, dye and scouring liquor were checked. The dyed yarn, wound on paper cones and stored for use, was found to contain fluorescent and non-fluorescent types. Samples of thrums (extra warp cuttings), kept over looms for joining broken warp threads, were collected and examined and some of them were fluorescent.

It was found that the streakiness was caused by the mix-up of yarns, dark with light or fluorescent with non-fluorescent. There was no streakiness when only one type of yarn was used. The dark shade was due to batch variation in dyeing.

The mix-up occurred mainly at winding and creeling and occasionally in the loomshed by the use of wrong thrums for piecing broken ends.

Preventive measures:

(a) Segregate dyed yarn on cones when batch to batch shade variation is significant;

(b) Wind each dyed batch separately;

(c) Mix two lots together only when they are alike in shade and fluorescence;

(d) Check the paper cones at the creel and the warp sheet at the start of warp winding on drum for uniformity of shade;

(e) Avoid the possibility of any optical brightener contaminating the scouring liquor or wash liquor or dyes;

(f) Arrange the supply of thrums for mending warp breaks to avoid the use of wrong ones;

(g) Do not mix darker and lighter shades or fluorescent and non-fluorescent yarns in broad colour bands. If mixed at all, they should be confined to narrow bands of very few threads where the streaking is not very noticeable;

(h) Carry out dyeing tests to compare shade as well as brightness, especially in respect of colours with more yellow components, when a new type of polyester is introduced into a mix.

Red streaks on dyed polyester/cotton fabric

Microscopic examination of red streaks on dyed polyester/cotton fabric indicated that they were composed of fused polyester fibres whose diameter was significantly higher when compared with the base polyester fibres of the warp thread, which meant that the streakiness was caused by stray polyester fibres of different origin.

Black carbon spots or pinheads on processed cloth

Black carbon spots on processed cloth differ from the black or brown specks often seen in grey cloth due to leafbits, seed coats and enmeshed black particles in neps; they also differ from tar particles woven in or sticking to fabric during weaving (figure VI), which appear as black dots, prominent on one side, and generally do not show fluorescence under ultraviolet light unless mixed with a lubricant.

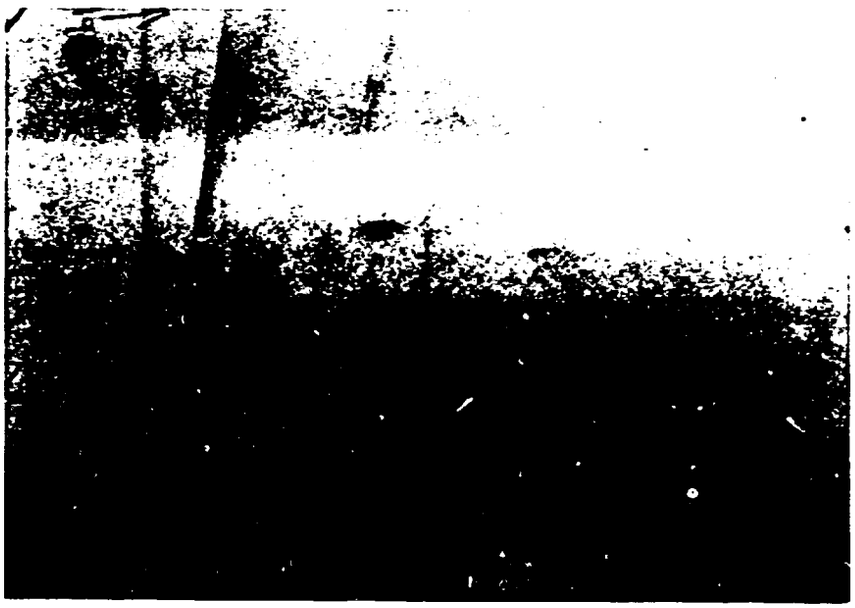

Figure VI. Black carbon spots on processed cloth

Identification

1. Examination under a magnifying glass will reveal that the staining or spot is fresh and thick with well-defined edges and spread over warp as well as weft.

2. Microscopic examination of selected stains and staining matter under suitable magnification may show that it is not hard and cellular like leafbit, seed coat etc. but is a black or brown mass covering the fibres.

3. These spots, and also pure carbon stains, seed coats and leafbits, do not glow under ultraviolet light, whereas oily, greasy or tarry stains give a faint-to-intense glow. The lubricating oils and greases of mineral origin show, with few exceptions, fluorescence varying in intensity under ultraviolet light.

4. Solvents will not dissolve the black spots if they are of leafbits or seed coats. Pure carbon spots are difficult to dissolve, while tar and oil and grease spots are easily dissolved.

5. After stain removal, if the ground is similar to the adjacent dyed or bleached portions, it indicates that staining occurred after dyeing or bleaching.

Causes

Carbon spots invariably come from poor maintenance of the stenters; the lubricating oil on clips, chains, and other leaking machine parts evaporates and gets partly charred or carbonized. Due to a poor or defective exhaust, the carbon particles remain inside the chamber and settle or condense on, or blow over the cloth being processed. Also, the polyester component of the fabric attracts them and helps them to become attached. In hot-air stenter and curing machines the carbon particles escape, along with evaporating oil components, from the exhaust pipe with the help of the exhaust fan. When the fan is not working or working inadequately or when the exhaust pipe is not sufficiently hot, the escaping vapours condense at the exhaust pipe and drip down over the passing fabric creating black or brown spots (figure VII).

Figure VII. Stains from hot-air stenter exhaust pipe

These spots are mainly caused by use of the wrong grade of lubricants; damaged oil seals and bearing houses causing oil leakage; improper functioning of exhaust ducts; irregular cleaning of oily clips, chains and rails; and poor functioning of the hot-air circulation system of the stenter.

Preventive measures are the use of the proper grade of lubricants, prompt repair of leaking parts, regular cleaning of exhaust ducts, clips, chains and rails and proper maintenance of hot-air circulation systems. Normally, a good performance can be obtained by the daily cleaning of lint screens; bimonthly cleaning of the exhaust ducts for all heat-setting stenters; biannual cleaning of drying and finishing stenters; and three-monthly cleaning of radiators, blowers and nozzles.

Spot cleaning with an anionic detergent, or better still, with a mixture of anionic and non-ionic detergent followed by a thorough washing, is a remedial measure.

Atmospheric carbon staining

When excessive smoke from chimneys is not controlled it spreads and pollutes the material at spinning, winding and other operations. This is more acute when the air is very humid and air currents weak.

Polyester yarn or polyester cotton blended yarn of finer counts, during its longer periods of exposure to atmospheric carbon, attracts carbon particles making the bobbin appear grey or black at the lower parts with intensity reduced towards the top. Such stained yarn, when used as weft, produces a band of light broken lines of varying lengths from 7 to 12 cm and when used as warp appears as intermittent lines. These stains are not easily removed by normal scouring.

Preventive measures are:

(a) To keep the air in the spinning, winding and processing sections free from carbon particles;

(b) To employ suitable pollution control measures;

(c) To start the doffs at slightly higher positions;

(d) To cover adequately stored pieces in processing and folding.

The edges of pieces, particularly synthetic materials, folded and stored for a long time attract carbon and become dirty. Such pieces should be adequately covered.

Such stains can be removed by cleaning the woven fabric with an anionic detergent.

IV. STAINS FROM VARIOUS OTHER SOURCES

Bamboo

Fresh bamboo when used for hanging the hanks of wool in the wet processing can cause yellow marks across the hanks. Seasoned bamboo or aluminium pipe should be used instead of bamboo.

Caustic spillage

Spillage of caustic soda, often in concentrated form, occurs at times in the J-box, during naphtholation and the addition of caustic soda in jigger and during mercerization. When the spillage is over fabric, it produces spots that have a differential dye pick-up resulting in darker spots or patches.

Desizing

When desizing of grey fabric is inadequate, size on certain portions is imcompletely removed and marks appear that remain on the fabric, affecting subsequent processes. The portion concerned may not get fully bleached or dyed thereby creating patches or marks.

Dirty calender rollers

Stained selvedge or streaks at the selvedge often occur when a wide width white fabric is run after a coloured fabric without proper cleaning of the calender rolls. Thorough cleaning is essential before running white fabric.

Dirty knots

Weavers piecing broken ends with dirty or greasy hands cause the knots to become black or brown and these are seen as dark spots after processing.

Preventive measures:

(a) Improving the quality of yarn to reduce yarn breakage to a minimum;

(b) Using a suitable hand cleaner before piecing;

(c) Spot-cleaning the stained knot with a suitable stain remover.

Drying range rollers

Drying range rollers, over which fabric is run, should be kept clean otherwise coloured fluff from previous fabrics may adhere to the wet cloth surface causing staining. Thorough cleaning of the drying range is essential whenever a white fabric is run after coloured fabrics (figure VIII).

Figure VIII. Stains from drying range rollers

Kier boiling

Stains caused by kier boiling may be due to uneven piling, insufficient circulation of the boiling liquor, inadequate pumping, over-crowding improper desizing etc. Such stains are as less absorbent than the surrounding portion.

Paraffin wax

A special type of stain on warp-dyed calendered cotton tickings was investigated. The staining was apparently on warp only and the stained warp was dark and shining. The weft did not appear to be tinted at the stained patch but was duller than the weft at the non-stained portion. The staining was very prominent at the calendered side. The stains did not form any definite pattern or repeat but appeared as streaks, always in the warp direction and were more similar to warp staining than to cloth staining. The pattern indicated that the staining material had rubbed against the yarn surface rather than been placed over it.

Microscopic examination revealed incrustations or coatings on the fibres. The stained portion did not show any fluorescence under ultraviolet light; a sample stained with lubricating oils used in the loomshed, and on sizing and calendering machines showed appreciable fluorescence. Water treatment reduced but did not remove the stains but they were easily removed by padding or spot-cleaning with solvent naphtha or other solvents.

It was found that the warp sheet was contaminated with paraffin wax that melted when the cloth was calendered producing this peculiar staining.

To avoid such stains, paraffin wax should not be used in sizing and weaving.

Premature drying during processing

Fabric that is wet before dyeing often dries partly in the atmosphere, especially at folds and selvedges, causing patchiness appearing as lighter stains or marks. Such patchiness or staining is more pronounced and widespread in the case of certain vats and azoic colours (figure IX).

Figure IX. Stains due to premature drying during processing

Rust

Rust stains are reddish brown with sharp edges and a rough feel. Freshly formed rust usually contains considerable quantities of ferrous hydroxide and carbonate, which are white but finally change to reddish brown and consist chiefly of hydrated ferric oxide. In processed cloth some light rust stains look like oil stains.

When they are frequent, identification of these stains is necessary to facilitate preventive and removal measures.

Two methods of identifying such stains are:

(a) Spot the stain with a drop of 1 per cent solution of potassium ferrocyanide acidified with dilute hydrochloric acid. A prussion blue of potassium ferriferrocyanide indicates the presence of rust as ferric oxide. The application of sodium hydrosulphite will make the blue substance colourless;

(b) Spot the stain with a drop of 1 per cent solution of potassium sulphocyanide acidified with dilute hydrochloric acid. If rust is present, ferric sulphocyanide is formed which is soluble in a 1:1 alcohol/ether solution and can be destroyed by ammonia.

Rust stains occur whenever wet yarn or cloth remains in contact with iron or steel surfaces under certain conditions of temperature and humidity. Long periods of machine stoppage due to holidays, strikes, breakdowns etc. allow the yarn or cloth, either wet or dry, to remain in touch with iron or steel surfaces in humid conditions long enough to develop rust marks. These are often noticed in the weaving and wet processing sections. For instance, pirns get rust marks when they remain for several days in the loomshed in iron doff boxes or rusty metal trays. Also, when there are excessive cross-ends on the looms, pirns are put at the serrated bars. In the long run, these pirns develop rust stains and when used as weft produce rust marks in the weft way.

Likely sources of rust staining in the loomshed are emery rollers, the front-rest and back-rest, the reed, the warp stop-motion device and rusty healds. The emery roller produces spotted rust bands on cloth, weft way (figure X). The back-rest causes rust on warp groups.

The transportation, storing and gaiting of warp beams when not properly handled can cause the rusty flange or core of one beam to hit or rest against the yarn body of another, creating rust marks.

Figure X. Rust stains

Rusty machine parts or tools, when kept over the warp beam or cloth, can develop rust and stain the yarn or cloth. Broken metallic particles woven into the fabric on wet processing cause rust stains. The use of iron detectors will help their early detection and removal.

Iron nails, nuts, screws, iron bars etc. on trolleys and wooden platforms transmit rust marks when wet cloth is kept over them. These can be prevented by adequate painting or covering of the exposed iron surfaces. The use of aluminium in place of iron for nuts, screws and trolley lining is helpful.

Mercerizing contributes to rust stains when the wet cloth is kept for a long time over bottom iron rollers.

In kier, when the protective inner lining is not intact, the exposed iron portions produce clear brownish stains on cloth. Maintenance of a suitable cement lining will avoid such rust marks.

Preventive measures:

(a) Scouring before the application of chemicals in the fabric preparatory process has the advantage of removing most of the metallic contaminants including iron, so also the stains formed during the course of the kier boiling operation. The material so prepared gives a better fabric surface for uniform bleaching;

(b) Spot cleaning rust stains with various chemicals such as oxalic acid (10%), or ammonium bifluoride (5%) along with a suitable non-ionic detergent (½%) for better cleaning. The spot-cleaned portion should be thoroughly washed to avoid any likely staining by these chemicals if dried without washing.

If the rust stains are numerous on terry-cotton fabrics, the fabric should be run with a dilute oxalic acid solution 10 g/l and Lissapol D paste 2 g/l with a liquor ratio of 5:1 for one half to one hour at 80°C and the two ends then rinsed in hot and cold water.

Size

Size stains are found as stiff marks, occasionally brown, which are removed by normal processing or washing. Mangle rolls having dents or not being uniform in circumference will lead to uneven nipping or squeezing causing size marks. In the old type of finishing machines (a starch mangle coupled with a drying range) the wet finished cloth has direct contact with the drying cylinders resulting in a film of starch being formed which is eventually transferred onto the cloth as size marks. They can also come from the scroll rolls that are coated with size stained by coloured fluff. The size should be properly cooked and mixed with the usual ingredients, otherwise it will cause size marks (figure XI).

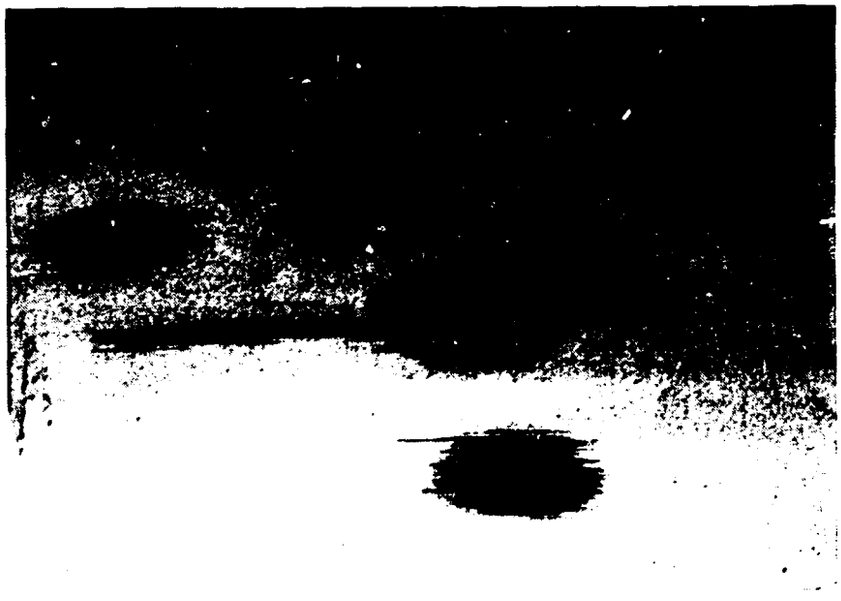

Figure XI. Size stains

Stain remover

Some stains are caused by the application of stain remover and can be categorized as listed below.

Use of unsuitable stain remover

Stain removers that are composed of solvents only are no problem when a spotting gun is used as this cleans the stained portion in a method akin to dry cleaning. The spotting solvent dissolves the stain and is blown off and replaced by fresh solution from the gun, allowing no trace of the stain to remain.

In the case of manual spot cleaning, the cleaning solution is applied over the stain and lightly rubbed. The stain is loosened and dispersed but not removed from the fabric. The loosened, dissolved staining material spreads with the solvent. When the solvent evaporates or dries the staining material is left behind in a much diluted form over a wider area. Smaller stains may not be visible in such cases but darker stains create a halo. When the fabric is subsequently dyed a patch may be formed (figure XII). Some solvents, such as chloroform and to some extent trichloroethylene, affect certain dyes, such as reactive, if the stain remover containing them is used on dyed fabric or on grey fabric and is not fully removed before dyeing.

Figure XII. Patches from faulty application of stain remover seen after dyeing

Remedial measures include washing out the portion of fabric treated with more stain remover until any halo is removed. A better method is to use a stain remover containing detergent with solvent and/or water (water in oil phase or oil in water phase) for spot cleaning and mopping up thoroughly with a wet cloth that will remove all the dissolved or dispersed stains.

Incorrect application of stain remover

Heavy rubbing may injure the fibres causing differential whitening or dye pick-up. Heavy rubbing, even when the fibres are not injured, can cause preferential or better cleaning of the stain area leading to a patchy effect when bleached or dyed (figure XIII).

Figure XIII. Patches from faulty application of stain remover seen after bleaching

The absence of a cloth pad underneath the stain when spot cleaning is done manually can lead to staining. The loosened stain percolates below the fabric and, in the absence of an absorbent pad spread underneath, creates a patch, especially in the case of heavier fabrics.

When spot cleaning is done manually, the cleaned portion should be mopped up with a wet cloth to wipe off the loosened stain and stain remover. A patchy effect is likely to occur in the absence of a mopping up or wiping operation with a cloth soaked in water. The wiping cloth should contain enough water to wipe the portion clean.

A wooden table or varnished surface will be affected by the solvents of the stain remover and can create wood, varnish or paint stains. A glass or porcelain surface will not create such problems.

Preventive measures include the use of a spot cleaning gun, if possible, instead of manual stain-removing; a good stain remover, as this requires the least rubbing; a glass or any other non-staining surface with an absorbent cloth pad underneath; final mopping up or swabbing operations to ensure that no patches are left by the stain remover.

Tar

Tar as woven foreign matter

Bitumen particles fall from old pitch-bound reeds or undried reeds into the warp shed and are beaten-in or woven-in causing black spots on finished cloth. Tar particles from roof coatings also fall over the loom and occasionally get woven-in, forming black spots.

Tar from stamping

Grey pieces are often marked with tar for identification before processing. Improper stamping can spurt the tar to other portions or impress other folds too. The tar marks have the tendency to melt or soften when passing through a hot-air stenter or calendering rollers and in turn impress adjacent folds. The melted tar sometimes sticks to the hot calender bowls which in turn stains the cloth passing over them producing a series of black or brown stains.

Precautionary measures are to keep the pitch-bound reed in good condition; to dry the pitch-bound portion properly before use; and to replace promptly the older ones where the bitumen has started to peel off.

Measures should be taken to avoid the staining of fabric when tar is used to waterproof a roof. Any black spot noticed on grey cloth should be spot cleaned with a solvent such as naphtha or chlorinated hydrocarbon such as trichloroethylene along with detergents.

Tar stains appear as black, sharp, often shining spots that soften on heating and do not usually give any fluorescence under ultraviolet light.

Water

Water marks are generally caused by the falling of condensed water or rain water from a leaking roof over the finished cloth. Leaking steam pipes, steam traps, inadequate blowers, and insufficient heating before running the hot air stenter, calender rollers etc. cause water condensation in machines and at the roof tops which drips on to the cloth being finished or when it is in storage forming light discolouration as water marks (figures XIV and XV). This is especially objectionable on bleached or light dyed cloth. Storing of finished pieces without adequate covering causes water marks from many sources. If the hot water falls from an oily surface, a light brown or black stain is formed. Water marks are generally washable.

When water falls over dry fabric as it is padded, the portion concerned will have a differential dye pick-up and show as light patches after drying.

Figure XIV. Water marks

Figure XV. Blue patches

Wood

When wet fabric, after scouring or bleaching, is piled over a wooden platform that is not well cleaned or conditioned, yellow or brown wood stains occur. So also when such wet fabric is stored on a wooden box or trolley. Generally wood stains are removed by bleaching but the stains are retained when no bleaching is involved, as is the case with certain sorts of fabric for dyeing or printing, or when the staining taking place after bleaching.

Some preventive measures are the use of well-seasoned non-staining wood for platforms, or covering the platform or lining the wooden trolley with polythene.