I INTRODUCTION

Cotton is the most widely used fibre in the manufacture of household textiles. Durability of these textiles is one of the major concerns of consumers. Although wear is a contributing factor, the degradation that household textiles suffer from laundering decreases the useful life of such textiles. Relatively little research has been reported to identify, to assess and to understand the degrading effects of in-service wear and of laundering of textiles.

Abrasion is the wearing away of a substance caused by its rubbing against another substance. Abrasive damage to textiles during actual use may be caused by rubbing against many different types of abradants, for example another fabric, a hard smooth surface,such as, a desk top or a hard rough surface, such as concrete or a brick. In addition, internal abrasion can occur and cause rub against other yarns within the fabric or fibres to rub against other fibres within a yarn. Thus the type and magnitude of abrasive stresses that a fabric must withstand during use will vary with the type of the garment, article and activities of the wearer, and perhaps the amount of ease allowed by the fit of the garment to the body.

The following has been discussed below :

1.1 Importance of abrasion

1.2 Use of Acrylic finishes

1.3 Acrylamide and its importance

1.1 Importance of abrasion

The problem in maintaining the cleanliness and satisfactory appearance of textiles also implies how to prevent the accumulation of soil during wear, handling, use and storage. The soil may be a liquid soil (such as oil or grease), may be a particulate soil (such as dust, sand and carbon) or a mixture of these. Rajkumar (57) has reported that soil as such spoils the appearance of fabrics and shortens their useful life through abrasion and frequent cleaning operations. Dean (19) has found that the degrading actions, of which abrasion is an important one, involve the rubbing away of the component fibres and yarns of the fabrics.

The apparels get solid and stained, some are more prone to these problems than others. Then they are well washed or cleaned, soaps and detergents are quite efficient for this by their wetting and penetration ability. However laundering to remove soil and stain consumes energy and reduces the wear life of the garments. The wear life of a garment can be improved if care is taken by avoiding severity in laundering conditions and by appropriate use of sap and detergent.

Laundering condition referring to abrasion here is an important factor, because abrasion with agitation is helpful in removing the soil out of fabrics. The degree of abrasive damage depends on the type of abradant. In an abrasion study carried out by the author (29) the effect of interlining of a/..

a hard (canvas) lining and soft (rubber) lining, was studied and it was found that abrasive damage was less in the case of fabrics having soft lining as compared to fabrics which had a hard lining.

Many researchers hoped that an abrasion test could be developed which would predict the durability or serviceability of a fabric during use. Such hopes have never been realised because (1) an abrasion instrument is yet to be devised which can either simulate or correlate with all the various types of abrasive stresses and (2) actual wear usually involves mechanical stresses other than rubbing and also the action of various chemical agents on the fabric during laundering etc. However salvage studies by Clegg (15) of worn textiles have indicated that abrasion is a major cause of failure of these textiles. The abrasion may contribute to changes in fabric appearances, such as fussiness, pilling or frosting and to change in fabric performance properties long before fabric rupture occurs. The consumer is often concerned about these less drastic changes in fabric structure that occur with progressive wear as well as with the final failure of the fabric.

Work by Galbraith et al (30) indicated that a laboratory test method which involved a stress to rupture the cotton fibres in polyester/cotton blends was followed by a tumbling type abrasion action. This removed the cotton fibre fragments and made it possible to rank several jean fabrics/..

fabrics in the order of their wear performance. They found that either a tensile stress or a multidirectional stress could be used to rupture these cotton fibres.

Abrasion caused a progressive decline in the breaking strength of the cotton and the polyester fibre. Abrasion caused less strength loss for the resin finished cotton fibres of crease resistant and durable press fabric. The evidence obtained substantiated the theory that resin treated polyester/cotton fabrics sustained abrasion damage through fracture of the embrittled cotton fibres into progressively smallest fragments which then powder out of the internal yarn structure as reported by Dorothy (20).

Microscopic studies of the abrasion of durable press cotton fabric have been mainly limited to abrasion produced on laboratory instruments and laundry treatment rather than that produced by actual wear. Margrate (46) studied the comparison between the shirts which were not worn but abraded in both ways, dry while wearing and wet while washing, and the shirts which were worn and abraded in both ways dry and wet conditions. The type of damage was the same for both as the fabric was resin treated. The outer layer had been smoothed off from the less severely damaged fibres and deep cracks at a wide angle to the fibre axis were frequently observed. In the case of polyester shirts, damage was less, perhaps the polyester fibre acted as a shield and a protector for the cotton fibre present.

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1.2 Use of Acrylic finishes and their properties

Cotton fabric is mostly used in India because of climatic conditions. However, people in India often use pure synthetic fabrics due to their certain physical properties, like wrinkles resistance, strength, abrasion resistance etc. Cotton fabrics are poor in these properties, and this leads to decrease in their utility. Therefore they are improved by blending with synthetic fibres or by application of certain acrylic finishes which have been found to improve the above mentioned properties.

Acrylic sizes are usually supplied as mobile liquids. The liquids can readily be diluted and the solids dissolve very easily in water at any temperature with efficient stirring to give a solution of low viscosity, retain this very low viscosity over prolonged periods and over a wide temperature range.

The usual acrylic polymers are based on acrylic ester on acrylic acid copolymer, each extending over a range of molecular weight. By varying the copolymers, their relative proportions and the molecular weight of the final polymer, it is possible to vary some properties like hardness, moisture and sensitivity. In general, the acrylic ester products are used for the sizing of polyester while the acrylic based products lend themselves to sizing of polyamide. The acrylic acid salt based products are most suited/..

suited to cellulosic fibres. Acrylics can certainly help the producers of cellulose fabrics to manufacture better quality fabrics as per advancing technology so as to ensure competitiveness.

It has been noted that the addition of acrylic size gives an improved size film. This is based on the belief that increase in toughness (measured in terms of tensile strength and elongation/extensibility) is required. This theory put forward by Humpharies (38) was checked by abrasion test intended to simulate the treatment to a yarn on a loom.

Acrylic monomers like acrylic acids, acrylamide, acrylic ester etc are now being allowed to polymerize on cellulose to obtain improved desirable properties of the cellulose, using the congentional pad-dry-cure process (26, 40, 28). In-situ polymerisation is possible, according to a study done by Chavan and Deshpande (12). It can provide a method for modifying the chemical behaviour of cellulosic fibres and their blends with synthetic fibres. They used acrylic acid, acrylamide and their mixtures. The resultant fabrics improved in several useful properties, especially transfer printability with disperse dyes and soil release properly.

1.2 Acrylamide and its importance

Acrylamide ($CH_2 = CHCONH_2$) is the parent compound of a large class of monomers that include methacrylamide (CH_2/..

(CH_2 = C (CO_3) $CONH_2$) and scores of N-substituted derivatives (CH_2 = CHCONHR, CH_2 = C(CO_3) CONHR). Acrylamide is known for its properties which secondary emphasis is placed on methacrylamide, N.iso-propylacrylamide etc.

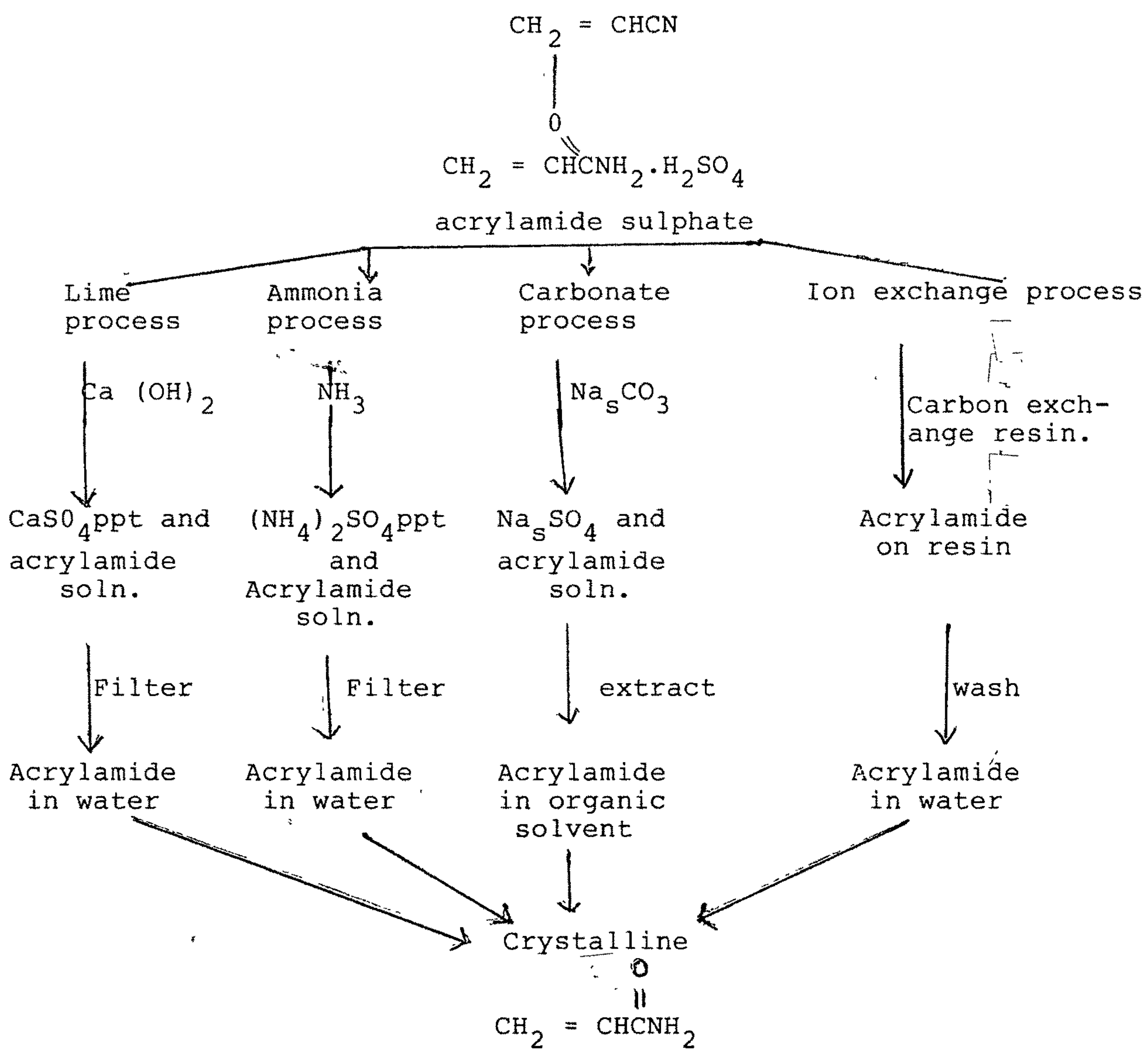
Acrylamide has been known since its preparation in 1893 by Moureu (36) who choese acrylyl chloride and ammonia as reactants. Subsequent investigators (36) have reported synthesis of well over a hundred N-substituted acrylamide and methacrylamide.

The principal commercial route to acrylamide has been the hydration of acrylanitrile. A common starting point is the reaction of acrylonitrile with sulphuric acid and water at about 100°C to form acrylamide sulphate. The several processes then diverge in choice of methods to remove sulphate, to avoid the side reactions and to recover solid monomer.

Process for acrylamide manufacture

In each process, conditions of time, temperature, concentration, inhibitor, pH and so on have been chosen so as to avoid mechanical losses, increase output and minimise undesirable side reactions.

In the presence of free radicals, acrylamide polymerises rapidly to high molecular weight polymers. Common initiators are peroxides, azo compounds rodox pairs, photochemical system and X-rays. Polymerisation in aqueous solution is generally the preferred method. For example, a 10% solution of monomer in/..



Process for acrylamide manufacture.

in water is catalyzed with 1% (based on acrylamide) of hydrogen Peroxide and the solution is heated for two hours at 90°C. A chain transfer agent such as isopropyl alcohol is some times added to reduce molecular weight. If the initial monomer concentration is much above 10%, precautions must be taken to avoid "runaway" reactions and the formation of incompetely soluble products. Polymers may be recovered if deisred, by precipitating and extraction with methanol or acetone. If drying temperature exceeds100°C, insoluble fractions may be produced. Freeze drying is preferred for small preparations but drum drying is more economical in larger scale operations.

Redox catalysts are used for aqueous polymerisation like peroxydisulphate, bisulphate couple and peroxide with, ferrous aluminium sulphate. Acrylamide polymerises so easily that almost all free radical sources have been used with some degree of success.

The polymerisation of acrylic monomers on cotton fabric to form cellulose graft copolymer is existing in textile finishing field. Researchers (12, 14, 22, 28) are emphasising on improving certain properties of such fabrics, which are treated with acrylic monomers like acrylamide, acrylates, acrylonitrile etc.

In a study done by Frick and Gautresux (25) the polymerisation of acrylic monomer on cotton fabric was studied. Radical and ionic initiation were used on dry and wet cotton fabrics. Polymer yield was studied in relation to strength loss/..

loss and reaction conditions. Acrylamide was the most reactive monomer examined. Acrylamide has water solubility, low volatility and general ease of handling.

In another study by Frick and Harper (28) it was reported that reaction products from acrylamide and glyoxal or glutaraldehyde have been used as finishing agents to give cotton fabric wrinkle resistance and durable press properties. Acrylamide reacted with glyoxal or glutaraldehyde to form adducts that appeared to be analgous to the adducts formed by methyl carbamate. The acrylamide-aldehyde adducts were tested as formaldehyde-free crosslinking agents for cotton. These agents are however less effective in producing wrinkle resistance and durable press performance than common cross linking agents of amine formaldehyde type. They were almost as effective as existing formaldehyde-free agents and gave finishes a better resistance.

In the present investigation, attempt is made to study the effects on various properties of fabrics by varying abrasions namely flat, rotary, impact and dry, wet impact abrasion as well as the influence of acrylamide finish on abrasion.