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TEXTILE SIZE

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My invention relates to textile sizing materials and refers particularly to sizes adapted for the treatment of regenerated cellulose and regenerated cellulose esters especially suitable for the production of crepe fabric.

Rayon and other regenerated cellulosic fibers as produced by the manufacturer are plastic in nature and will elongate, or stretch, under the tensions necessary in processing also produce chaffing in weaving. Elongation results in a loss of denier, much of the original pliancy of the yarn and also in a change in dye affinity. In a crepe fabric much of the crepe effect is lost.

It is, therefore, necessary to coat or size these fibres in order to provide an efficient protective coating to the yarns and filaments, to overcome these difficulties. All woven fabrics are composed of warp and filling threads. Those threads which run lengthwise in a fabric are called warp threads; those which are perpendicular to these are the filling threads.

The preparation of warp and filling threads for weaving are different in method and will be briefly described.

Yarn to be used for warps may be either of regenerated cellulose type or of the cellulose ester type; for instance, viscose or cellulose acetate. The threads are very carefully wound on to a beam, which is slightly wider than the width of the final fabric, and has a collar at each end. The threads must be kept parallel to each other throughout the operation which is accomplished by feeding them through the teeth of a metal comb called a reed, closed at top and bottom and placed just ahead of the beam. Each beam at the end of this warping process will contain about 600 yards of warp threads. They represent the final fabric, minus the filling threads.

The next process of warp sizing is carried out on a machine called a slasher. Here the threads are sized by passing over a metal roller, which dips into a trough containing a dissolved size at a suitable concentration and temperature, and which, by revolving at the same speed as the yarn carries up enough of the size to impregnate the yarn. The sized yarn then immediately passes over and under a series of usually five large steam heated cylinders whereby the size becomes dried in the yarn which is then wound on to a similar warp beam at the end of the machine. The whole process is continuous and the nature of the size, speed of running, tension, etc. must be strictly controlled. These beams containing the sized warp threads are then sent to the weaver and set up in the loom.

The process for preparing rayon to be used for filling yarn will be outlined and described in more detail as my process is especially adaptable to yarns which receive a high twist for the production of crepes.

The following treatments are commonly given to filling crepes of this type and usually only to rayons of the regenerated cellulose type:

1. Soaking
2. Conditioning
3. Spinning and twisting
4. Twist setting
5. Copping and quilling
6. Weaving
7. Embossing
8. Boil-off

Rayon yarn is manufactured in various sized filaments, a number of which are combined in a slight twist to produce a given denier size.

A thread 480 meters long weighing 1/20 of a gram or one denier is called a single denier yarn.

The denier size of rayon commonly used for crepes may vary from 100–300 deniers.

1. The yarn is generally soaked in half-case lots (110 lbs.) one lot being used for right hand twist and the other for the left hand twist. Each lot is tinted a distinctive color for later identification. The material for soaking usually consists of an emulsifiable oil together with a size such as glue or gelatine to give firmness. The skeins are soaked in an aqueous emulsion of this size and oil for about 30 minutes at 130° F., after which they are drained and finally hydro-extracted by centrifugal force until they contain about their own weight of moisture. Each skein is then shaken out by hand to avoid tangling and hung up in a warm room to dry.

2. Conditioning is simply the placing of the skeins in a humidified atmosphere to allow the taking up of the normal amount of moisture or humidity characteristic of the fibre. For viscose process rayon, this "regain", as it is called, is about 8½%.

3. The conditioned yarn is next cross-wound on to spools, which are then transferred to the spinning frames to receive a high twist. Crepe fabrics are recognized by their "crinkled" or "pebbled" appearance. The crinkle is the result of the twisting of the yarn but does not show up in the fabric until after the size has been removed in the boil-off process. The amount of twist may be as high as 65 turns for every inch of yarn. The

higher the twist, the greater the contractile power of the yarn after boiling-off, that is, it will kink up more.

As stated above, half of each lot is given a right hand or clockwise twist, and the other half a left hand, or counter clockwise twist. This is necessary in the production of a crepe fabric and both types of twist are used in the weaving of filling yarns into the warp threads in the loom.

4. Twist-setting is accomplished by exposing the properly twisted yarn on spools to an atmosphere of steam under pressure for a definite time. Its purpose is to fix the twist so that it will "stay put" during subsequent rewinding operations and during weaving.

5. Copping is a rewinding operation from the spools to quills, cops or shuttle bobbins especially adaptable to the weaving machine or loom.

6. Weaving is carried out on a loom in which the prepared warp is interlaced with filling threads supplied by the loaded quills on either side of the warp. The twisted yarn from the quills is threaded by means of shuttles, which are the implements by which the filling threads are shot to and fro across the warp, thereby producing the fabric. Each filling thread in the woven cloth is called a "pick" and each warp thread an "end". The two shuttles alternate with each other in their motion across the warp, one carrying right hand twisted yarn and the other left hand twisted yarn. For example, a 2 x 2 filling crepe is produced with 2 picks of right hand twist, followed by 2 picks of left; a 4 x 4 means four picks right hand and 4 picks left. The alternating of opposite twist yarns is necessary to produce an even closed face and pebbles in the finished cloth.

7. Embossing is an auxiliary mechanical creping process, usually applied to insure uniform creping and give a better creping effect. It consists in passing the woven fabric between two rollers under pressure, one roller containing a raised dotted design and the other containing corresponding indentations. If previous sizing and other treatment are correctly carried out, this process should not be necessary, indeed in some cases it has been found to give a flatter pebble than otherwise obtained, but nevertheless, it is commonly carried out as a precautionary measure.

8. The boil-off is the removal of the size from the woven fabric to allow the twisted yarns to spring back to their most natural condition and produce the kinked or creped effect. It is also necessary as a cleaning or scouring process, before the goods are dyed and finished. It is done by immersing and working the goods in a hot liquor containing alkaline solution or emulsifiable oils or soaps. This constitutes the present practice of manufacturing rayon crepe fabrics.

My invention involves the use of a specific size in soaking these yarns, particularly the filling yarn which receives a high twist and by the use of which a heavier, deeper, crepe is produced.

I have found that a condensation product from urea and its compounds and approximately one mole equivalent of aldehydes, when produced under circumstances, acts as a size of great value for the purpose mentioned.

Instead of allowing these two compounds to react to their full extent as they will, producing solidification and polymerization, the mixture is stabilized in aqueous or alcoholic solution by the addition of alkaline emulsifiable oils or soaps. The final product when applied in correct concentration to the yarn will be easily absorbed and upon drying of the yarn will produce thereon a resinous material which will effect a certain amount of shrinkage besides acting as a protective coating on the yarn during the processes prior to and including weaving. Moreover, this size is in no way detrimental to the yarn and is completely and easily removed by the boil-off or scouring treatment prior to dyeing.

Among the urea compounds which I have found suitable for my purpose are urea, thio-urea, phenyl urea, and diphenyl urea.

Among the aldehydes which can be employed in my process are formaldehyde, acetaldehyde and butyl aldehyde.

Among the emulsifiable oils or soaps which I can employ are the sulfonated and unsulfonated castor oil, olive oil, cottonseed oil, rapeseed oil and cocoanut oil.

I give the following as examples of my sizing compounds.

Example 1

	Per cent by weight
Formaldehyde (37% strength)	35
Methyl or ethyl alcohol	15
Cocoanut oil potash soap (anhydrous)	15
Water	10
Urea	25

I mix the formaldehyde with the alcohol, then add the soap and water which may or may not be previously mixed. The mixture is then stirred without heat until the soap has dissolved when the urea is added. Stirring is continued until complete solution is effected.

The amounts given may be varied as long as sufficient alkaline stabilizing material is present to keep the product in liquid form. Furthermore, this size is not limited to the use of urea and formaldehyde but there may be substituted derivations of these compounds, such as thio urea, acetaldehyde, butaldehyde etc.

Example 2

Formula for size without use of alcohol

	Per cent by weight
Urea	30
Formaldehyde (37% strength)	40
Water	15
Olive oil soda soap (anhydrous)	15

Mix formaldehyde with water, dissolve the soap and then the urea

Example 3

Formula with a urea substitution product

	Per cent
Urethane	18
Formaldehyde (37% strength)	16
Water	50
Cocoanut oil potash soap (anhydrous)	16

Example 4

Formula with another aldehyde than formaldehyde

	Per cent
Urea	15
Alcohol	20
Butaldehyde	18
Water	16
Sulfonated oleic acid triethanolamine soap (50%)	45

Example 5

Formula using sulfonated oil soap instead of straight soap

	Per cent
Urea	30
Alcohol	15
Formaldehyde (37%)	40
Sulfonated castor oil potash soap (50%)	15

The following example is given as typical of my soaking procedure:—

Example 6

110 pounds rayon (150 to 300 denier) are soaked for 20 minutes at a temperature of 130° F. in a solution containing 19½ pounds urea formaldehyde condensation product and 50 gallons of water.

The excess of water is removed by centrifugal extraction, the skeins are dried and conditioned after which the usual practice outlined above is carried out.

Example 7

Rayon	pounds	100
Urea formaldehyde condensation product	do	16
Gelatine	do	3½
Water	gallons	50

It is to be understood that any denier size rayon suitable for this type of fabric may be used, also that these proportions can be varied to suit special conditions and that other agents may be incorporated, if necessary, to give additional properties to the rayon.

Among the advantages of my soaking and sizing preparation over present methods are the following:—

1. The sized yarn gives a coarser or heavier crepe than when the usual oil and gelatine is used, for the same type of rayon. This is due to an extra shrinkage treatment which my compound imparts to the rayon.

2. The size is easily diluted with water, no previous heating to dissolve solid or pasty ingredients being necessary.

3. The sized yarn or the woven fabric may be stored indefinitely without fear of the development of objectionable odors such as are caused by rancidity and oxidation.

4. The use of the embossing process may be eliminated.

It will be seen that my process possesses certain definite advantages over previously known processes. I do not limit the process to the sizing of viscose or regenerated cellulose for filling yarns as the compound may also be used in warp sizing on this as well as on rayons of the cellulose ester type.

Gelatine, glue or other similar chemicals may, or may not, be present in my size during its application to the fiber.

In my specification and claims, I employ the word "rayon" in a generic sense to include the regenerated celluloses and cellulose esters among which are viscose, nitro-cellulose and cupra-ammonia cellulose.

I do not limit myself to the particular compounds, times, temperatures, quantities or steps of procedure specifically mentioned, as these are given simply as a means for clearly describing my invention.

What I claim is:—

1. A water-soluble size adapted for the treatment of cellulosic rayon fibers containing a water-soluble condensation compound obtained by mixing a urea compound with an aldehyde in the presence of a water-soluble soap of a member of the group consisting of fatty acids, sulfonated fatty acids and sulfonated fatty oils in an amount sufficient to maintain the size in a water-soluble state on the fibers.

2. A water-soluble size adapted for the treatment of cellulosic rayon fibers containing a water-soluble condensation compound obtained by mixing urea with an aldehyde in the presence of a water-soluble soap of a member of the group consisting of fatty acids, sulfonated fatty acids and sulfonated fatty oils in an amount sufficient to maintain the size in a water-soluble state on the fibers.

3. A water-soluble size adapted for the treatment of cellulosic rayon fibers containing a water-soluble condensation compound obtained by mixing a urea compound with formaldehyde in the presence of a water-soluble soap of a member of the group consisting of fatty acids, sulfonated fatty acids and sulfonated fatty oils in an amount sufficient to maintain the size in a water-soluble state on the fibers.

4. A water-soluble size adapted for the treatment of cellulosic rayon fibers containing a water-soluble condensation compound obtained by mixing urea with formaldehyde in the presence of a water-soluble soap of a member of the group consisting of fatty acids, sulfonated fatty acids and sulfonated fatty oils in an amount sufficient to maintain the size in a water-soluble state on the fibers.

5. In a process for producing a water-soluble size upon cellulosic rayon fibers the step which consists in treating rayon fibers with a water-soluble size obtained by mixing a urea compound with an aldehyde in the presence of a water-soluble soap of a member of the group consisting of fatty acids, sulfonated fatty acids and sulfonated fatty oils in an amount sufficient to maintain the size in a water-soluble state on the fibers.

6. A water-soluble size adapted for the treatment of rayon fibers containing a water-soluble condensation compound obtained by mixing a urea compound with an aldehyde in the presence of a potassium soap of coconut oil fatty acids in an amount sufficient to maintain the size in a water-soluble state on the fibers.

7. A water-soluble size adapted for the treatment of rayon fibers containing a water-soluble condensation compound obtained by mixing a urea compound with an aldehyde in the presence of a triethanolamine soap of sulfonated oleic acid in an amount sufficient to maintain the size in a water-soluble state on the fibers.

8. In a process for producing a water-soluble size upon rayon fibers the step which consists in treating rayon fibers with a water-soluble size obtained by mixing a urea compound with an aldehyde in the presence of a potassium soap of coconut oil fatty acids in an amount sufficient to maintain the size in a water-soluble state on the fibers.

9. In a process for producing a water-soluble size upon rayon fibers the step which consists in treating rayon fibers with a water-soluble size obtained by mixing a urea compound with an aldehyde in the presence of a triethanolamine soap of sulfonated oleic acid in an amount sufficient to maintain the size in a water-soluble state on the fibers.

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