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(54) Sewn products and method for preventing seam puckering

(57) Seam puckering on a sewn product made of cellulosic fibers, synthetic fibers and/or animal fibers can be prevented from occurring by simply applying a (meth) acrylate resin finish and/or a polyester resin finish to the seams on the sewn product, then hot pressing the seam. The addition of an acidic catalyst, a polyether compound, or a combination of a cellulose-reactive resin finish with an acidic catalyst to the (meth)acrylate finish and/or polyester resin finish provides a better seam pucker preventing effect on cellulosic fibers than do existing cellulose-reactive resin finishes.

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Description

[0001] The present invention relates to a method for preventing seam puckering on sewn products. The invention also relates to sewn products obtained by such a method in which seam puckering is prevented from occurring.

[0002] The seams on sewn products such as garments are generally sewn with a sewing machine. When a garment has been sewn, wavy deformations known as seam puckering sometimes arise at the seams, detracting from the appearance of the garment. When seam puckering occurs during sewing, the puckered seams can be smoothed and flattened by treatment such as pressing to render the deformations inconspicuous. However, subsequent laundering of the garment may cause it to revert to its original deformed state, allowing seam puckering to reappear. Sometimes laundering even makes seam puckering worse than immediately after the seams have been sewn. Such seam puckering, particularly seam puckering after laundering, is a major problem affecting the appearance of garments.

[0003] Seam puckering due to laundering arises in the two following types of situations.

(1) When the machine sewing thread shrinks due to laundering.

(2) When pressing or ironing intended to make seam puckering after sewing less conspicuous causes the fabric near the seam to be excessively stretched, giving the fabric a tendency to shrink and return to its original stage on being left alone or laundered.

[0004] One way to prevent seam puckering on laundering that is employed when puckering is caused by situation (1) above is to use a machine sewing thread which undergoes little laundering shrinkage, such as polyester spun yarn or polyester filament yarn. Yet, although such a method is able to better reduce the occurrence of seam puckering than sewing thread having a large laundering shrinkage such as cotton, it cannot eliminate seam puckering due to shrinkage of the fabric.

[0005] A solution that has been proposed when puckering is caused by situation (2) above is to place and bond between the two layers of fabric at the seam a tape-like adhesive web or an interlining coated with an adhesive. In this approach, the tape or interlining stabilizes the fabric so that it does not shrink, making it possible to prevent seam puckering from occurring as a result of laundering. However, the tape or interlining is very troublesome to apply. Moreover, in places such as armholes where the seams are curved, the tape or interlining is difficult to apply neatly along the curves. Hence, the productivity and workability are very poor.

[0006] Another effective method for preventing seam puckering is a so-called post-curing process in which the fabric is impregnated with a resin finish in a finishing step, then is simply dried. After sewing, the entire sewn product is heat treated, causing the resin to react. Unfortunately, in this method, because the resin finish is applied in an unreacted state to the entire fabric, long-term storage of the fabric is impossible. Moreover, there is also the drawback that if the fabric is creased during finishing or sewing, the creases tend to remain permanently.

[0007] There is also what is referred to as a pre-cure resin finishing process in which treatment up to heat treatment is initially carried out on the fabric in the finishing step, thereby inducing the resin finish to react with cellulose fibers. Although this method resolves the drawbacks of the above post-curing process, seam puckering is conspicuous and the resulting fabric has a markedly inferior appearance.

[0008] JP-A 2004-60071 and JP-A 2004-100131 disclose, as effective means for preventing the seam puckering of sewn products containing cellulosic fibers in particular, methods in which a cellulose-reactive resin finish is applied to the seams of the sewn products. Although these methods are effective on sewn products made of cellulosic fiber-containing structures, there exists a need for a method which is effective as well on sewn products composed of structures which contain fibers other than cellulosic fibers, such as synthetic fibers (e.g., polyester, nylon) and animal fibers (e.g., wool, silk).

[0009] It is therefore desirable to provide a method which can prevent seam puckering not only in sewn products made of cellulosic fibers, but also in sewn products made of synthetic fibers or animal fibers, and to provide sewn products obtained by such a method in which seam puckering is prevented from occurring.

[0010] We have discovered that when an aqueous solution of a (meth)acrylate resin finish and/or a polyester resin finish, to which solution preferably at least one selected from among acidic catalysts, polyether compounds, cellulose-reactive resin finishes, fluorescent pigments and other pigments has been added, is applied by a suitable means such as a spray, brush or roller to the seams on a sewn product and hot pressing is subsequently carried out, e.g. by ironing, seam puckering on the completion of sewing can be reduced or eliminated. That is, after sewing, the shape of the fabric at seams thereon which have been smoothed and flattened by pressing or ironing becomes set in the smoothed and flattened state due to adherence of the resin, as a result of which the fabric does not shrink. Seam puckering from laundering can thus be prevented from occurring. In addition, by adding an acidic catalyst or a polyether compound to the aqueous solution of a (meth)acrylate resin and/or a polyester resin, the water resistance (laundering durability) of the adhering resin can be enhanced.

[0011] The above method may be carried out on any type of fabric material. For example, suitable use can be made

of fabrics composed of cellulosic fibers, synthetic fibers, or animal fibers; and various fabrics produced from blends of such fibers or woven from combinations or mixtures of different yarns composed of such fibers. Moreover, by adding an acidic catalyst or a polyether compound or a combination of a cellulose-reactive resin finish with an acidic catalyst to the aqueous solution of a (meth)acrylate resin and/or a polyester resin, there can be obtained a finish which has an even better seam pucker preventing effect on cellulosic fibers than do prior-art cellulose-reactive resin finishes.

[0012] Accordingly, the invention provides a method for preventing seam puckering on a sewn product, which method includes the steps of applying a (meth)acrylate resin finish and/or a polyester resin finish to a seam on the sewn product, then hot pressing the seam. It is preferable for a mixture of the (meth)acrylate resin finish and the polyester resin finish to be applied to the seam. The resin finish may additionally include at least one substance selected from the group consisting of acidic catalysts, polyether compounds, cellulose-reactive resin finishes, fluorescent pigments and other pigments. Hot pressing is typically carried out with a hot pressing machine or by ironing.

[0013] The invention also provides a sewn product obtained by the foregoing method for preventing seam puckering.

[0014] Using the method of the invention, seam puckering can be prevented from occurring by simply applying a (meth)acrylate resin finish and/or a polyester resin finish to the seams on a sewn product made of not only cellulosic fibers, but synthetic fibers and/or animal fibers. The addition of an acidic catalyst, a polyether compound, or the combination of a cellulose-reactive resin with an acidic catalyst to the (meth)acrylate resin finish and/or a polyester resin finish enables a better seam pucker preventing effect to be achieved on cellulosic fibers than is possible with prior-art cellulose-reactive resin finishes.

BRIEF DESCRIPTION OF THE DIAGRAMS

[0015] FIG. 1 is a diagram showing an upper front body section of fabric onto which a pocket has been sewn.

DETAILED DESCRIPTION OF THE INVENTION

[0016] The inventive method for preventing seam puckering is carried out by applying a (meth)acrylate resin finish and/or a polyester resin finish to a seam on a sewn product, then hot pressing the seam.

[0017] As used herein, the term "sewn product" refers to products obtained by sewing together multiple pieces of textile fabric, such as woven fabric, knit fabric or nonwoven fabric, that are shaped in accordance with the intended shape of the final product, or to products obtained by the successive application of stitches to a single piece of textile fabric. Illustrative examples of sewn products include dress shirts, knit shirts, jumpers, coats, jackets, skirts, trousers, blouses, sweaters, cardigans, outfits, work clothes, uniforms, school uniforms, office workwear and sportswear. Items thereon such as collars, sleeves, cuffs, and pockets are also included.

[0018] Illustrative, non-limiting examples of the fibers making up the foregoing textile fabric include not only cellulosic fibers such as natural cellulose fibers (e.g., cotton, linen), regenerated fibers (e.g., rayon, cuprammonium rayon, polynosic, high-strength regenerated cellulose fibers (e.g., Tencel)) and partially regenerated fibers (e.g., acetate), but also synthetic fibers such as polyester, nylon and acrylic, and animal fibers such as wool and silk. A single type of fiber may be used alone or two or more types of fibers may be used together in the form of, for example, blend spun yarn or mixture or combination weave fabric. Because the invention is particularly effective on cellulose fibers and polyester, the use of 100% cotton products or polyester/cotton blends is preferred. In polyester/cotton blends, the proportion of polyester is from 0 to 100%, and preferably from 45 to 65 wt%.

[0019] "Seam on the sewn product" refers herein to the stitches that are successively applied to one or more piece of textile fabric. Such stitching has a repeating structure shaped as a straight or curved line formed by repeated crossing of the sewing thread above and below the textile fabric. Specifically, "seam on the sewn product" includes seams for attaching pieces of textile fabric to each other (e.g., plain stitching, reverse stitching), seams to finish the seam allowance (e.g., top stitched seam, flat felled seam, catch stitching, buttonhole stitching), and ornamental stitching for decorative purposes. The sewing thread used is preferably a machine sewing thread having a small laundering shrinkage, such as polyester spun yarn or polyester filament yarn. However, even if a machine sewing yarn having a large laundering shrinkage such as cotton yarn is used, the occurrence of seam puckering can be reduced by the method of the invention.

[0020] (Meth)acrylate resins that may be employed in the invention are polymers containing an ester group-bearing acrylate or methacrylate. Use may be made of any (meth)acrylic acid ester-containing polymer, including polymers obtained by homopolymerizing an acrylate or methacrylate such as methyl (meth)acrylate, ethyl (meth)acrylate or butyl (meth)acrylate; and copolymers obtained by copolymerizing a (meth)acrylate with another monomer such as acrylonitrile, styrene, vinyl acetate or ethylene. However, a (meth)acrylic acid ester-containing polymer which has a high glass transition point (Tg) (preferably at least 10°C, and more preferably from 20 to 80°C) and forms a hard coat is advantageous. Examples of suitable copolymers include (meth)acrylic-styrene copolymers, (meth)acrylic-acrylonitrile copolymers, (meth)acrylic-vinyl acetate copolymers and (meth)acrylic-vinyl acetate-ethylene copolymers. Of these, (meth)acrylic-styrene copolymer resins are especially preferred because they have a high glass transition point and do not leave

conspicuous resin spots on the fabric.

[0021] Polyester resins that may be used in the present invention include polyethylene terephthalate and polybutylene terephthalate. For the same reasons as those given above, it is preferable that these resins have a glass transition point (Tg) of at least 10°C, and especially from 20 to 80°C.

[0022] In the practice of the invention, it is advantageous to use the (meth)acrylate resin and the polyester resin in admixture. Because the (meth)acrylate resin has a good adhesion particularly to cellulosic fibers and the polyester resin has a good adhesion particularly to synthetic fibers such as polyester, nylon and acrylic fibers, through the synergistic effects of both, a good seam pucker preventing effect can be obtained in fabrics produced from blends of these respective types of fibers and in combination or mixed weave fabrics made using both types of fibers. The mixing ratio of the (meth) acrylate resin and the polyester resin in such a case may be suitably selected according to the mixing proportions of the fibers that make up the fabric.

[0023] The (meth)acrylate resin and/or polyester resin is preferably used as a resin finish dissolved or dispersed in a suitable medium such as water, methanol, ethanol or isopropanol. The amount of the resin used, expressed as the solids equivalent, is preferably 5 to 25 wt%, and more preferably 10 to 20 wt%. Too much resin may give areas of application a hard feel and leave resin spots on the fabric, whereas too little resin may result in a weak pucker preventing effect.

[0024] To accelerate curing of the resin finish and enhance its water resistance, an acidic catalyst may be added to the resin finish used in the invention. Illustrative examples of the acidic catalyst include borofluoride compounds such as zinc borofluoride and magnesium borofluoride; inorganic acids such as phosphoric acid, hydrochloric acid and boric acid; and organic acids such as citric acid, tartaric acid, malic acid, maleic acid and malonic acid. The amount of catalyst added, based on the (meth)acrylate resin and/or polyester resin (total resin weight), is preferably 2 to 15 wt%, and more preferably 4 to 8 wt%.

[0025] To improve the water resistance (laundering durability) of the adhering resin, a polyether compound may be added to the resin finish of the invention Here, "polyether compound" refers to a polymer, surfactant or the like having a polyether structure, illustrative examples of which include polyethylene glycol, polypropylene glycol, polyethylene oxide and derivatives thereof. Typical, non-limiting, examples of such derivatives include polyoxyethylene alkyl ethers, polyoxyethylene fatty acid esters, polyoxyethylene-polyoxypropylene glycols, polyoxypropylene alkyl ethers, and polyoxyethylene-polyoxypropylene alkyl ethers.

[0026] The amount of polyether compound used, based on the (meth)acrylate resin and/or polyester resin (total resin weight), is preferably 1 to 35 wt%, and more preferably 15 to 25 wt%. Too much polyether compound may result in conspicuous resin spotting, whereas too little may weaken the seam pucker preventing effect. In particular, when used on sewn products made of cellulosic fiber-containing textile materials, the concomitant use of a polyether compound greatly enhances the pucker preventing effect. A better seam pucker preventing effect can be obtained than when prior-art cellulose-reactive resin finishes are used.

[0027] To increase the seam pucker preventing effect on cellulosic fibers, the resin finish of the invention may have added thereto an acidic catalyst or both a cellulose-reactive resin finish and an acidic catalyst. The cellulose-reactive resin finish is a compound having on the molecule at least two functional groups of one type selected from among epoxy groups, carboxyl groups and methylol groups. Illustrative examples include polyglycidoxy compounds having at least two epoxy groups, polycarboxylic acid compounds having at least two carboxyl groups, and polymethylol compounds having at least two methylol groups.

[0028] The amount of acidic catalyst used in this case may be set within the same range as that described above. The amount of the cellulose-reactive resin finish used, based on the (meth)acrylate resin and/or the polyester resin (total weight of resin), is preferably from 30 to 150 wt%, and more preferably from 50 to 100 wt%.

[0029] To prevent a decrease in whiteness or a change in color at areas of resin application due to hot pressing treatment following application of the resin finish to the seams on a sewn product, a fluorescent pigment or other type of pigment may be added to the resin finish of the invention.

[0030] Methods for applying the resin finish include application with a brush, roller or syringe, and spraying. Spraying may involve application of the resin finish using a trigger-operated container or an aerosol-type container.

[0031] The range over which the resin finish is applied may be suitably selected according to the circumstances under which seam puckering appears after sewing. However, when the stitches are situated on a straight line, application along the seam over a range of 2 to 10 mm, and preferably 3 to 7 mm, both to the left and to the right of the stitching (i.e., over a total width of 4 to 20 mm, and preferably 6 to 14 mm) is preferred.

[0032] The pickup of the resin finish applied is not subject to any particular limitation, and may be selected as appropriate for the textile material of which the sewn product is made. However, it is preferable for the amount of resin solids, based on the weight of the fabric material, to be from 5 to 25 wt%, and especially from 10 to 20 wt%. A pickup that is too high may harden the hand in areas of the sewn product where the finish has been applied and result in conspicuous resin spotting, whereas a pickup that is too low may diminish the pucker-preventing effect.

[0033] Following application of the resin finish, drying and heat treatment is carried out along the seams of the sewn product.

[0034] Drying following application of the resin finish may be carried out by ambient air drying or hot air drying, although drying and heat treatment can be carried out at the same time by pressing or ironing. The application of heat treatment while pressing or ironing so as to smooth and flatten seam puckering that has arisen from sewing serves to stabilize the shape of the fabric in a smoothed and flattened state.

[0035] Heat treatment by ironing is also possible, although ironing must be carried out with care. Preferred heat treatment methods include pressing techniques involving the application of pressure which are capable of smoothing out seam puckers that have arisen from sewing.

[0036] Heat treatment conditions such as temperature and time may be selected as appropriate for the resin finish to be used. A temperature within a range of 140 to 170°C, and especially 150 to 160°C, is preferred. A time of at least 15 seconds, and especially at least 20 seconds, but not more than 60 seconds, and especially not more than 40 seconds, is preferred.

[0037] Pressing is carried out at an applied pressure of preferably at least 1.0 kgf/cm^2, and especially at least 1.5 kgf/cm^2. The pressure applied is not subject to any particular upper limit, with a higher pressure generally being preferable. The pressure applied is typically up to 3 kgf/cm^2, and especially up to 4 kgf/cm^2.

[0038] According to the invention, a (meth)acrylate resin and/or polyester resin finish is applied to the seams on a sewn product, following which pressing or ironing is carried out on the areas to which the resin finish has been applied, thereby smoothing and flattening seam puckering that has arisen during sewing. At the same time, heat treatment to induce reaction of the applied resin finish is carried out. By means of these simple operations, seam puckering can be effectively prevented.

EXAMPLES

[0039] The following Examples of the invention and Comparative Examples are provided to illustrate the invention, and are not intended to limit the scope thereof.

Example 1

[0040] Using a pre-cured, resin-finished plain weave (50^S warp yarns at density of 148 ends/inch, $80^s/2$ weft yarns at density of 70 picks/inch) fabric made from polyester/cotton = 65 wt%/35 wt% blended staple yarn, an upper front body section for a dress shirt having a pocket sewn thereon was produced by an ordinary shirt sewing operation.

[0041] The resin finish was applied with a small commercial brush along the seams of the pocket shown in FIG. 1 over a width of 5 mm to the left and 5 mm to the right (for a total width of 1 cm) of the seam. Referring FIG. 1, which is a diagram showing an upper front body section of fabric, pocket 2 is sewn with seam 3 onto the upper front body 1.

[0042] The resin finish was prepared by adding water to chemicals having the resin formulation shown in Table 1, and bringing the volume up to 100 ml.

Table 1

Ingredient	Amount
Unikensol AK317 1)	30 wt%
Plascoat RZ570 2)	10 wt%
Malonic acid	1 wt%
1) An acrylic-styrene copolymeric resin (solids content, 50 wt%; Tg, 30°C) produced by Union Kagaku Kogyo KK. 2) A water-soluble polyester resin (solids content, 25 wt%; Tg, 60°C) produced by Goo Chemical Co., Ltd.	

[0043] The resin finish was applied onto the fabric, then ambient air dried, following which it was pressed with a flat-plate press (produced by Kobe Press) at a temperature of 160°C and a pressure of 2.0 kgf/cm^2 for 30 seconds.

[0044] The pressed upper front body section was then laundered, and seam puckering of the pocket before and after laundering was visually graded on a scale of 1 to 5 (1 being the most heavily puckered, and 5 being the smoothest),

based on three-dimensional replicas of seams at each of the five levels, in accordance with the method of AATCC 88-B-1984. The results are shown in Table 3.

Comparative Example 1

[0045] Aside from using the prior-art resin finish for cellulose fibers shown in Table 2, treatment of the fabric and evaluation of the seam pucker preventing effect were carried out in the same way as in Example 1. The results are shown in Table 3.

Table 2

Ingredient	Amount
Riken Resin LNB20 1)	15 wt%
Aqueous solution of zinc borofluoride 2)	2 wt%
1) A cellulose-reactive N-methylol resin (solids content, 40 wt%) produced by Miki Riken Kogyo KK. 2) Concentration, 45 wt%; produced by Morita Chemical Industries Co., Ltd.	

Comparative Example 2

[0046] An upper front body section was produced using the same type of fabric as in Example 1, but without applying resin finish to the pocket seams. Pressing was carried out under the same conditions as in Example 1. The seam pucker preventing effects were rated in the same way as in Example 1. The results are shown in Table 3.

Table 3

Resin Finish	Pucker grade		
	Before laundering	After laundering once	After laundering 5 times
Example 1	5.0	4.5	4.3
Comparative Example 1	5.0	3.5	3.0
Comparative Example 2 (resin finish not applied)	4.0	2.5	2.3
Laundering Method: Method 103 (home laundering) in JIS L1096, tumble drying.			

[0047] As is apparent from Table 3, the sewn product obtained in Example 1 had a considerably higher pucker grade than the product obtained in Comparative Example 1 and the product to which resin finish was not applied that was obtained in Comparative Example 2. That is, the results for the sewn product obtained in Example 1 were excellent and demonstrated that this sewn product was resistant to seam puckering.

Example 2

[0048] Aside from using a pre-cured, resin-finished 100% cotton plain weave (50^s warp yarns at density of 148 ends/inch, $80^s/2$ weft yarns at density of 70 picks/inch) fabric, treatment was administered in the same way as in Example 1, following which the pucker preventing effects were rated. The results are shown in Table 5.

[0049] The resin finish was prepared by adding water to chemicals having the resin formulation shown in Table 4, and bringing the volume up to 100 ml.

Table 4

Ingredient	Amount
Unikensol AP694 1)	30 wt%

(continued)

Ingredient	Amount
PEG 20000 2)	3 wt%
1) An acrylate copolymer (solids content, 45 wt%; Tg, 24°C) produced by Union Kagaku Kogyo KK. 2) A polyethylene glycol (average molecular weight, 20,000) produced by Sanyo Chemical Industries, Ltd.	

Comparative Example 3

[0050] Aside from using the same type of fabric as that described in Example 2 and using the same prior-art resin finish for cellulose fibers (shown in Table 2) as that used in Comparative Example 1, treatment of the fabric and evaluation of the seam pucker preventing effect were carried out in the same way as in Example 1. The results are shown in Table 5.

Comparative Example 4

[0051] An upper front body was produced using the same type of fabric as in Example 2, but without applying resin finish to the pocket seams. Pressing was carried out under the same conditions as in Example 2. The seam pucker preventing effects were rated in the same way as in Example 1. The results are shown in Table 5.

Table 5

Resin Finish	Pucker grade		
	Before laundering	After laundering once	After laundering 5 times
Example 2	5.0	4.5	4.3
Comparative Example 3	5.0	4.3	3.8
Comparative Example 4 (resin finish not applied)	4.0	2.5	2.5
Laundering Method: Method 103 (home laundering) in JIS L1096, tumble drying.			

[0052] As is apparent from Table 5, the sewn product obtained in Example 2 had a higher pucker grade than that obtained in Comparative Example 3, and had a much higher pucker grade than the product to which resin finish was not applied that was obtained in Comparative Example 4. That is, the results for the product obtained in Example 2 were excellent and demonstrated that this sewn product was resistant to seam puckering.

Claims

1. A method for preventing or ameliorating seam puckering on a sewn product, comprising the steps of:

applying a (meth)acrylate resin finish or a polyester resin finish or both to a seam on the sewn product, then hot pressing the seam.

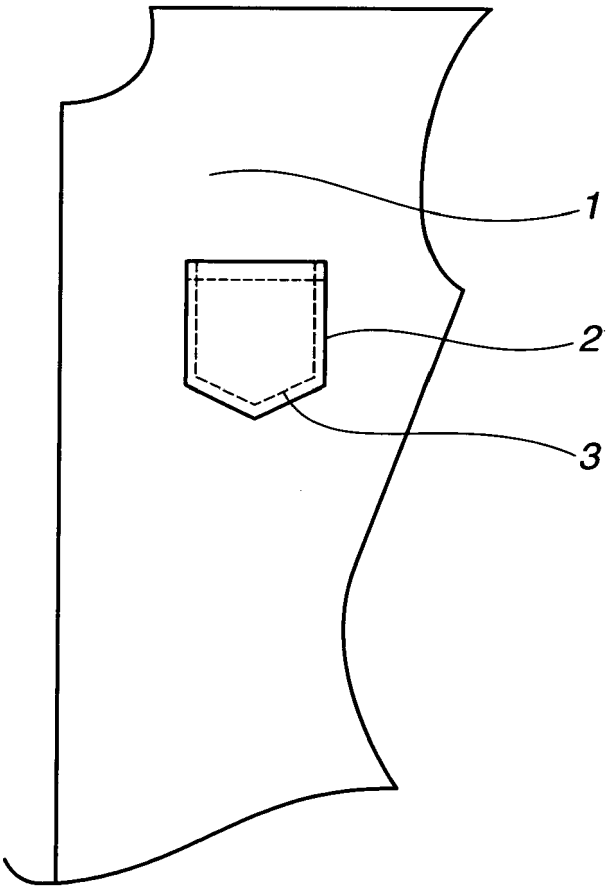
2. The method of claim 1, wherein a mixture of the (meth)acrylate resin finish and the polyester resin finish is applied.

3. The method of claim 1 or 2, wherein the resin finish additionally includes at least one substance selected from the group consisting of acidic catalysts, polyether compounds, cellulose-reactive resin finishes, fluorescent pigments and other pigments.

4. The method of any one of claims 1 to 3, wherein hot pressing is carried out with a hot pressing machine or by ironing.

5. A sewn product obtained by the method of any one of claims 1 to 4.

FIG.1



REFERENCES CITED IN THE DESCRIPTION

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