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(54) **Wax/silicone dispersion for thread treatment.**

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Description

This invention pertains to a liquid composition that may be applied to threads and plied yarns using kiss roll application methods. The composition does not require heat to liquify it during the application and provides superior performance over traditional "hot melt" compositions.

Typically a wax/silicone coating is placed on a thread to improve certain characteristics of the thread such as the breaking strength, coefficient of friction, amount of wear and to add antistatic properties. The wax/silicone coating is applied to the thread by two methods known in the art; kiss roll (hot melt) methods and exhaust finish methods.

The kiss roll application methods comprise using a mixture comprising a wax, a linear polydimethylsiloxane and a stabilizer or surfactant. The mixture, which is typically a solid at room temperature, is heated to liquify. The mixture is then picked up on a roller across which the thread is drawn before being wound onto a spool. One of the disadvantages of these "hot melt" mixtures is that they must be heated prior to application. Another disadvantage to using a hot melt mixture is that the thread winders must be run at significantly slow speeds to prevent slinging off of the mixture. When the mixture splatters it solidifies and creates a clean up problem which results in costly clean up time.

The exhaust finish application methods use an emulsion comprising a wax, a linear polydimethylsiloxane, water and a cationic surfactant. The wax may be added to the emulsion as, a solid or it may be pre-emulsified in water. These emulsions are liquid at room temperature and usually contain large amounts of water in the continuous phase. The exhaust finish emulsions are applied by placing the emulsion in a bath and then dipping a "spool" of thread into the bath and allowing it to sit in the bath for a period of time until the active ingredient is fully exhausted onto the thread and a clear liquid remains. Typically the bath of the emulsion is heated during the application period. The thread is then dried and wound onto the final spools. When used, the exhaust emulsions typically provide superior thread sewing performance results than the kiss roll mixtures. However, the exhaust finish emulsions are higher priced, they are cationic and therefore lead to waste water problems, they are difficult for the thread manufacturers to handle and they typically do not result in an even application on the thread.

Because of the high amount of water in the continuous phase of the exhaust emulsions and their cationic nature it is not possible to apply the exhaust finish emulsions using kiss roll application methods. Applying exhaust finish emulsions using kiss roll application methods will typically lead to rusting and other complications with the kiss roll production equipment.

US-A-4 434 008 to Dumm et al. teaches an exhaust emulsion composition comprising, on a water free basis, (a) about 5 to 80 weight percent of a silicone oil having a viscosity of from about 500 to 50,000 mm^2/sec at 25 °C.; (b) about 10 to 80 weight percent of a wax with a melting point of not less than about 40 °C.; (c) about 1 to 10 weight percent of fatty acids with 6 to 22 carbon atoms; (d) about 0.4 to 12 weight percent of cationic imidazolinium salts; and (e) from about 0 to 10 weight percent of ethoxylated fatty amines. The composition is produced by emulsifying (in water) the silicone oil with a portion of the fatty acid and imidazolinium salt and emulsifying (in water) the wax with the remainder of the fatty acid and imidazolinium salt and then combining the two emulsions together. The compositions typically comprise 30 percent or more water in the continuous phase.

There has been a long felt need in the art for a high performance composition that is liquid at room temperature and can be easily applied using the kiss roll application methods without corroding or otherwise destructing the application equipment. It is further desired to have a composition that can be applied at high spool winder speeds.

It is an object of this invention to show high performance liquid compositions which can be applied to thread and plied yarn at room temperature using kiss roll application methods.

This invention provides a thread treating composition which is liquid at room temperature comprising

(A) at least 60 percent by weight of a silicone oil having a viscosity of 5×10^{-6} to 5×10^{-3} m^2/s (5 to 5,000 centistokes) at 25 °C;

(B) at least 5 percent by weight of a wax emulsion in which the wax is selected from paraffin waxes, microcrystalline waxes, semicrystalline waxes, polyethylene waxes, ester waxes, and natural waxes, which have a melting point of higher than 40 °C; and

(C) 0.5 to 5 percent by weight of a silicone surfactant,

the sum of the components adding up to 100 percent by weight.

This liquid composition can be applied to threads and plied yarns (herein referred to as threads) using kiss roll methods.

Component (A) of this composition is a silicone oil with a viscosity of 5×10^{-6} to 5×10^{-3} m^2/s (5 to 5,000 centistokes) at 25 °C, preferably 2×10^{-5} to 1×10^{-4} m^2/s (20 to 100 centistokes) at 25 °C. The

silicone oil preferably is a linear dimethylpolysiloxane oil. A portion of the methyl groups can be replaced by alkyl groups with a longer chain length and/or by phenyl groups. The terminal chain ends of the silicone oil are typically formed by trimethyl silyl groups. However, hydroxyl groups may be present on the terminal chain ends.

The silicone oil is present in the composition at level of at least 60 percent by weight. The silicone oils can be exemplified by, but not limited to, polydimethylsiloxanes, DOW CORNING® 200 FLUIDS, hydroxyl endblocked polydimethylsiloxanes and mixtures thereof.

Component (B) of this invention is a wax emulsion comprising a wax which typically has a melting point of higher than 40 °C. and water. Useful waxes are petroleum waxes such as a paraffin waxes, microcrystalline waxes and semicrystalline waxes; synthetic waxes such as polyethylene waxes, Fischer-Tropsch Waxes (polyethylene), and chemically modified hydrocarbon waxes (ester waxes); natural waxes such as beeswax and carnauba; and mixtures thereof. The waxes are supplied as an emulsion in water typically comprising 10 to 80 percent by weight of the wax, preferably 50 to 80 percent by weight. Preferred wax emulsions are those that contain paraffin at levels of 50 to 70 percent by weight. The emulsions of the waxes may be produced using methods known in the art or they are commercially available.

The wax emulsion is typically present at 5 to 40 percent by weight based on the total composition. The wax emulsions may be exemplified by Rayolan® CPN produced by Boehme Filatex, Inc. (50% paraffin, cationic), Uscosoft® HTW produced by Ivax Inc. (28% High Density Polyethylene Emulsion), Uscosoft® LPD produced by Ivax Inc. (40% Low Density Polyethylene Emulsion), Michem® Emulsion 47960 produced by Michelman Industries (60% paraffin, nonionic), Emulsion 150-50 produced by Chemical Corporation of America (50% paraffin, m.p. 66 °C (150 °F), nonionic), and Emulsion 135-50 produced by Chemical Corporation of America (50% paraffin, m.p. 57 °C (135 °F), nonionic).

Component (C) is an silicone surfactant. Silicone surfactants are well known in the art. For example they may be polydiroganosiloxane-polyoxyalkylene copolymers such as those described in US-A-4 265 878 to Keil; organopolysiloxane-polyoxyalkylene block copolymers such as those described in US-A-4 532 132 to Keil; and siloxane copolymers such as those described in US-A-4 087 478 to Keil.

The silicone surfactant is usually used at levels of 0.5 to 5, percent by weight based on the total composition.

The liquid composition of this invention is prepared by thoroughly dispersing the organic compatible silicone surfactant (C) with the silicone oil (A) using agitation or other similar means. The wax emulsion is then added into the silicone oil/surfactant mixture. The final composition is then dispersed or emulsified using a homogonizer, sonolator or other dispersion means.

The liquid compositions of this invention are useful for thread lubricants which are applied using kiss roll application methods. The liquid composition is typically applied on the thread at concentration of 2 to 15 percent by weight of the thread, depending on the type of thread being treated. One skilled in the art will be able to determine the amount necessary to create the best properties in the thread. Since the composition is liquid, it is not necessary to heat them for the application however, mild heat, preferably less than 50 °C., can be used if desired.

So that those skilled in the art can understand and appreciate the invention taught herein, the following examples are presented.

The term "parts" used herein refers to parts by weight.

Example 1

Four liquid compositions in Table 1 ere prepared by mixing a silicone surfactant, DOW CORNING® Q2-3201 SURFACTANT, with a polydimethylsiloxane (3.5×10^{-4} m^2/s (350 cs) at 25 °C.) until homogeneous. The wax emulsion was added and the mixture was agitated vigorously for an additional 15 minutes. The compositions were applied to a spun polyester thread at a 5% add on level using an ATLAB® finish applicator (simulated kiss roll application method). The treated thread was evaluated for the Drag Value (the value that relates to final tension of the thread after it has been pulled over the guides of an industrial sewing machine). The value reported is an average of the three measurements. The drag value was also measured on untreated thread and on a thread that was treated with a commercially available exhaust finish emulsion which was applied using exhaust finish technology. Results are given in Table 1.

Table 1

	Silicone Oil	Wax Emulsion	Silicone Surfactant	% Finish on Yarn	Drag Value
I	78	10(A)	2	4.1	240
II	88	10(A)	2	6.3	205
III	78	20(B)	2	7.8	260
IV	78	20(C)	2	1.6	230
V	Untreated				755
VI	Commercially Available Exhaust Finish				181

(A) Rayolan CPN® produced by Boehme Filatex, Inc.
(B) Uscosoft LPD® produced by Ivax Inc.
(C) Uscosoft HTW® produced by Ivax Inc.

Example 2

Eight liquid compositions in Table 2 were prepared by mixing the silicone surfactant with the polydimethylsiloxane until homogeneous. The wax emulsion was added and the mixture was agitated vigorously for an additional 15 minutes. The compositions were applied to a spun polyester thread at a 5% add on level using a kiss roll application method. The treated thread was evaluated for the Drag Value (the value that relates to final tension of the thread after it has been pulled over the guides of an industrial sewing machine). Results are given in Table 2.

Table 2

	Silicone Oil	Wax Emulsion	Silicone Surfactant	Drag Value
VII	78(i)	20(D)	2(a)	260
VIII	79.5(i)	20(D)	0.5(a)	205
IX	78(i)	20(E)	2(a)	210
X	78(ii)	20(E)	2(a)	205
XI	78(ii)	20(E)	2(a)	240
XII	78(iii)	20(A)	2(a)	240
XIII	89(iii)	10(A)	1(a)	260
XIV	78(iii)	20(A)	2(b)	230

(A) Rayolan® CPN produced by Boehme Filatex, Inc.
(D) Emulsion 150-50 by Chemical Corporation of America
(E) Emulsion 130-50 by Chemical Corporation of America
(i) Polydimethylsiloxane having a viscosity of 5×10^{-4} m^2/s (500 centistokes) at 25 ° C.
(ii) Polydimethylsiloxane having a viscosity of 3.5×10^{-4} m^2/s (350 centistokes) at 25 ° C.
(iii) Polydimethylsiloxane having a viscosity of 5×10^{-5} m^2/s (50 centistokes) at 25 ° C.
(a) DOW CORNING® Q2-3201 INTERMEDIATE
(b) DOW CORNING® 3815C INTERMEDIATE

Example 3

A liquid composition was prepared by mixing 81 parts of a polydimethylsiloxane having a viscosity of 5×10^{-5} m^2/s (50 centistokes) at 25 ° C. with 2 parts of a silicone surfactant, DOW CORNING® Q2-3201 INTERMEDIATE, until the silicone surfactant is well dispersed. A commercially available paraffin wax

emulsion, Michem® Emulsion 47960 produced by Michelman Industries was added slowly and stirred for 30 minutes. The resulting mixture was passed through a sonolator at 5.5MPa (800 PSI), 0.001 orifice. (Sample XV)

The liquid composition, Sample XV, was applied at a 5.6% finish level to pink, black and white spun polyester sewing thread using a kiss roll applicator. Thread count was 41/2. A comparative test was also done by applying a nonionic silicone/wax emulsion, 50% solids, to the same type of thread at a 5% solids level using a kiss roll applicator. Results are given in Table 3. Corrosion and mildew are problems identified with use of the comparative fluid.

Table 3

Finish	Friction Index		
	White	Pink	Black
XV	247	273	242
Silicone/Wax Emulsion	305	283	274

Example 4

The same liquid composition that was prepared in Example 3 (Sample XV) was applied to a spun polyester (spun poly) and a polyester wrapped polyester (poly/poly) thread at a 8% finish level using a kiss roll applicator. For comparison a commercially used hot melt silicone/wax product, 100% solids, was applied at an 8% finish level using the kiss roll applicator. Tego®-1894, an exhaust finish emulsion (50% solids), produced by Goldschmidt Corporation was applied at an 8% finish level using a dye bath (exhaust finish method). Comparative results are given in Table 4.

Table 4

Finish	Coefficient of Friction	
	Poly/Poly	Spun Poly
XV	0.19	0.18
Hot Melt	-	0.20
Tego-1894®	-	0.18

Example 5

The same liquid composition that was prepared in Example 3 (Sample XV) was applied to a polyester wrapped polyester (poly/poly) thread at a 6% finish level using a kiss roll applicator. For comparison an exhaust emulsion finish product produced by Boehme Filatex, Inc., Rayolan® T-24, was applied at an 6% finish level using exhaust finish (dye bath) methods. Results are given in Table 5.

Table 5

Finish	Drag Value
XV	240-250
Rayolan® T-24	250-280

Claims

1. A thread treating composition which is liquid at room temperature comprising
   (A) at least 60 percent by weight of a silicone oil having a viscosity of 5×10^{-6} to 5×10^{-3} m^2/s (5 to 5,000 centistokes) at 25 °C;
   (B) at least 5 percent by weight of a wax emulsion in which the wax is selected from paraffin waxes, microcrystalline waxes, semicrystalline waxes, polyethylene waxes, ester waxes, and natural waxes, which have a melting point of higher than 40 °C; and
   (C) 0.5 to 5 percent by weight of a silicone surfactant,
   the sum of the components adding up to 100 percent by weight.

2. A composition as claimed in Claim 1 wherein the silicone oil has a viscosity of 5×10^{-6} to 5×10^{-4} m^2/s (5 to 500 centistokes), and the wax emulsion is a paraffin wax emulsion.

3. A method of treating thread by applying to the thread the composition as described in Claim 1, using a kiss roll.

Patentansprüche

1. Mittel zur Behandlung von Fäden, das bei Raumtemperatur flüssig ist, enthaltend
   (A) mindestens 60 Gewichtsprozent eines Siliconöls mit einer Viskosität von 5×10^{-6} bis 5×10^{-3} m^2/s (5 bis 5.000 Centistoke) bei 25 °C;
   (B) mindestens 5 Gewichtsprozent einer Wachsemulsion, wobei das Wachs ausgewählt ist aus Paraffinwachsen, mikrokristallinen Wachsen, halbkristallinen Wachsen, Polyethylenwachsen, Esterwachsen und natürlichen Wachsen, die einen Schmelzpunkt von mehr als 40 °C haben; und
   (C) 0,5 bis 5 Gewichtsprozent eines Silicons als oberflächenaktiven Stoff,
   wobei die Summe der Bestandteile sich zu 100 Gewichtsprozent addiert.

2. Mittel nach Anspruch 1, wobei das Siliconöl eine Viskosität von 5×10^{-6} bis 5×10^{-4} m^2/s (5 bis 500 Centistoke) hat und die Wachsemulsion eine Emulsion eines Paraffinwachses ist.

3. Verfahren zur Behandlung eines Fadens, bei dem man das im Anspruch 1 beschriebene Mittel unter Verwendung einer Berührungsrolle auf den Faden aufbringt.

Revendications

1. Composition de traitement du fil qui est liquide à la température ordinaire, comprenait
   (A) au moins 60% en poids d'une huile de silicone ayant une viscosité de 5×10^{-6} à 5×10^{-3} m^2/s (5 à 5 000 centistokes) à 25 °C;
   (B) au moins 5% en poids d'une émulsion de cire dans laquelle la cire est sélectionnée entre les cires de paraffine, les cires microcristallines, les cires semi-microcristallines, les cires de polyéthylène, les cires d'esters et les cires naturelles, qui ont un points de fusion supérieur à 40 °C; et
   (C) 0,5 à 5% en poids d'un surfactant au silicone,
   la somme des composant atteignant 100% en poids.

2. Composition selon Revendication 1, dans laquelle l'huile de silicone a une viscosité de $5 X 10^{-6}$ à 5×10^{-4} m^2/s (5 à 500 centistokes), et où l'émulsion de cire est une émulsion de cire de paraffine.

3. Procédé de traitement du fil par application au fil de la composition décrite dans la Revendication 1, à l'aide d'un rouleau applicateur.