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(54) **Insect repellent treatment of textiles**

(57) The invention concerns a fabric with insect repellent properties and a method for the manufacturing of a similar fabric in which a solution comprising an insect repellent product and a binding agent on a fabric is provided whereby in the solution an acrylate and a elas-

tomer are added in order to enhance the retention of the insect repellent product on the fabric. Hereby, a fabric is produced that retains its insect repellent properties during successive washes.

EP 1 598 475 A2

Description

[0001] The invention concerns on the one hand a method of producing a fabric with insect repellent characteristics in which a solution comprising an insect repellent product and a binding agent is introduced onto the fabric as well as a fabric produced by a similar method on the other hand.

[0002] The invention concerns more particularly the enhancement of the retention of permithrine in fabrics during successive washes.

[0003] Permethrin is an insect repelling agent and is a member of the pyrethrum based substances. Because permethrin is quickly broken down, synthetic permethrin is often used in practice. It is principally used to repel or kill cold-blooded insects like mosquitoes.

[0004] Because of its insect repellent qualities, permethrin is often applied to fabrics, knitwear, non-woven, etc.... However, due to the weak permanence of permethrin, this insect repellent has the disadvantage that after only a few washes it is completely expelled from the fabric. Consequently, fabrics need to be re-treated with an insect repellent product after washing. This procedure has the disadvantage that it leads to increased costs as well as being damaging to the environment.

[0005] In order to retain permethrin longer in fabrics it is known from the American patent publication US 5 252 387 to apply permethrin to fabrics in combination with Amylopectin.

[0006] Another solution is described in the American patent publication US 5 503 918, whereby the permethrin is applied to the fabric together with polyvinylacetate. Here, according to the patent holder himself, it is possible to achieve better results regarding permanency, than with the combination Amylopectin - permethrin described in US 5 252 387.

[0007] The European patent request EP 0 787 851 describes two ways of introducing and applying permethrin into fabrics. In the first specification the fabric is impregnated with a binding agent (acrylic binder), permethrin and where necessary also with a cross-linking agent. A second process treats only one side of the fabric surface with permethrin and binding agent.

[0008] In the American patent publications US 2002/0039596 and US 6.326.015 an insect repellent product is described that can be applied to fabric. The specified product contains an insect repellent product (DEET) and an oil-attracting product, particularly an elastomer. Varying the amount of elastomer controls the measure whereby the insect repellent product is released.

[0009] While the solution described in the aforementioned publication is a good step forward, it still remains true that the insect repelling effect decreases after about twenty washes, because the permethrin slowly disappears out of the fabric, resulting in the need to treat the fabrics similarly once more.

[0010] The aim of the invention is to provide a method

of producing a fabric with insect repellent properties whereby the insect repellent product stays active in the fabric even after a large number of washes. By a large number of washes this patent request means at least 60, preferably 60 to 100 washes and, in particular, to in excess of 100 washes.

[0011] The aim of the invention is accomplished by the application of a method for making fabrics with insect repellent properties in which a solution comprising an insect repellent product and a binding agent are applied to a fabric whereby an acrylate and an elastomer are added to the solution to increase the retention of the insect repellent product on the fabric during successive washes. Acrylate is the preferred binding agent. The named solution is applied in a preferential operation on fabrics, knitwear or on non-wovens. By adding the combination elastomer/acrylate the insect repellent product remains much longer on the fabric during successive washes.

[0012] The specified solution should also contain an anti - foam agent, preferably on the basis of dimethylpolysiloxane and a moistening agent.

[0013] According to the invention, in a particular method for the manufacture of a fabric with insect repellent properties, the amount of acrylate in the solution amounts to at least 20 g/l, in particular at least 90 g/l acrylate. The quantity of acrylate in the solution lies in particular between 20 and 250 g/l.

[0014] In a more preferred method for the manufacture of a fabric with insect repellent properties, according to the invention, is the said elastomer a silicon elastomer. The amount of elastomer in the solution amounts to at least 20 g/l and is preferably between 20 and 60 g/l and amounts to more by particular 50 g/l. Through the combination of silicon elastomer/acrylate the insect repellent product stays much longer on the fabric than with currently known and applied techniques.

[0015] In a more preferred method for the manufacture of a fabric with insect repellent properties according to the invention is the specified insect repellent product permethrin. The amount of permethrin in the solution should be between 10 and 250 g/l, preferably between 20 and 150 g/l, and more in particular between 20 and 50 g/l. Other insect repellent products that can be used by preference are cyfluthrin and deltamethrin.

[0016] According to invention, a particular preferential method for the manufacturing of a fabric with insect repellent properties is that the specified solution is applied to the fabric via impregnation, a spray, coating, lick roll or other known method whereby the fabric is preferably pressed out between two rolls. After this the fabric is dried in a dry unit at a minimum temperature of 110 °C.

[0017] The method can by preference be applied to non-wovens, knitwear or fabrics such as cotton, polyester/cotton, flax, flax/cotton, polyamide, polyamide/cotton, polyester, polyester/viscose, meta aramide, meta aramide/cotton, modacryl, modacryl/cotton, viscose/cotton or combinations thereof.

[0018] Another subject of this invention is a fabric with insect repellent properties provided with a solution comprising an insect repellent product and a binding agent, whereby an acrylate (= binding agent) and an elastomer is added to the said solution to increase the retention of the insect repellent product on the fabric. According to the invention, the fabric hereby retains its insect repellent properties during successive washes. Tests have shown that the fabric retains its insect repellent properties when washing at 60°C for at least 60 washes, by preference between 60 and 100 washes and more.

[0019] According to the invention the fabric is preferably manufactured by a method according to any one of the claims 2 up to and including 9.

[0020] This patent request further contains the use of the combination acrylate / elastomer, in particular silicon elastomer as a retention increasing agent in a solution comprising an insect repellent product. By adding this combination, the insect repellent product remains on the fabric much longer, especially the permithrine, during successive washes.

[0021] In order to clarify the properties of this invention further and to point out extra advantages and peculiarities, there now follows a more detailed description of the applied method of producing fabric according to this method. Nothing in the following description is to be interpreted as a limitation to the protection requested in the conclusions for this invention.

[0022] To make fabric, knitwear or non-woven wash permanent insect repellent, the fabric is impregnated, for example by means of dip coating with a solution comprising an insect repellent product, an acrylate and an elastomer, preferably a silicon elastomer, a moisture agent and an anti foam agent.

[0023] Below is a working example showing the composition of a solution that is applied to fabric in order to make this fabric wash permanent insect repellent (n.b. for example without anti foam agent). The usual quantity of permithrine, which generally is effectively regarded as 700 mg to 1300 mg/m². The concentration on the fabric however, depends on the concentration in the bath, the throughput and the weight of the fabric. One can therefore establish that the concentration required on a certain fabric together with the weight of the fabric defines the concentration of permithrine in the application bath.

Example:

[0024]

- moisture agent → 0,2 g/l
- insect repellent product → 25 g/l
(permithrine)
- acrylate → 90 g/l
(binding agent)
- silicon elastomer → 50 g/l
- product to protect the rolls against

loading → 2 g/l

[0025] The above mentioned products are first dispersed in water that have been brought by the addition of acetic acid 80 % on a PH lying between 5 and 7, in particular 6.

[0026] The resulting solution is then continually fed in an application bath that allows the full breadth of the fabric to be impregnated. Here it should be noted that the solution can likewise be applied discontinued.

[0027] The application of the solution is 48 % (depending on the kind of fabric) in other words 1 kg. Of material takes 0,48 l water and thus the following products are in the 0.48 l (as shown in the example below):

- moisture agent : 0.2 g/l x 0.48 l = 0.096 g
- permithrine : 25 g/l x 0.48 l = 12 g
- acrylate : 90 g/l x 0.48 l = 43.2 g
- silicon- elastomer : 50 g/l x 0.48 l = 24 g
- product that protects the rolls : 2 g/l x 0.48 l = 0.96 g

[0028] There is therefore for 25 g/l permithrine in the bath per 1 kg fabric treated, 12 g permithrine. Assuming that the weight of the fabric is 210 g/m², there is per m²; 12 g/kg x 0.210 kg/m² = 2.52 g/m² permithrine on the fabric. However, the used permithrine is a 50 % product where there is therefore 2.52 g/m² x 50 % = 1.26 g of 1260 mg/m² permithrine on the fabric.

[0029] After the fabric has been impregnated with the solution the specified fabric is uniformly pressed out between two rolls with a specific hardness. The hardness of the rolls similarly determines the absorption of the solution because the harder the rolls, the higher the pressing out level and the less the absorption.

[0030] After this the fabric is dried in a drying unit at a temperature of at least 110 °C. The drying unit consists of various units each with its own heating and air circulation with control aggregates. After drying, the fabric comes into a cooling zone with air followed by contact cooling.

[0031] The following example again shows the effect of the addition of the combination acrylate / silicon elastomer to a solution containing with an insect repellent product.

→ bath containing a solution consisting of permithrine (40 g/l) and silicon elastomer (50 g/l). The quantity of permithrine amounts to:

- original : 1870 mg/m²
- after 1 wash : 650 mg/m²
- after 5 washes : 545 mg/m²
- after 10 washes : 490 mg/m²
- after 20 washes : 280 mg/m²
- after 50 washes : 70 mg/m²

→ bath containing a solution consisting of permithrine

(40 g/l) and silicon elastomer (50 g/l) in combination with acrylate (90 g/l). The quantity of permithrine amounts to:

- original : 2180 mg/m² 5
- after 1 wash : 1895 mg/m²
- after 5 washes : 1965 mg/m²
- after 10 washes : 1685 mg/m²
- after 20 washes : 1753 mg/m²
- after 50 washes : 935 mg/m² 10

[0032] From the above example it seems clear that by the addition of the combination silicon elastomer/acrylate the insect repellent product is retained in the fabric much longer during successive washes than with the combinations (e.g. permithrine + silicon elastomer) as known in current techniques. 15

Claims 20

1. Method for the manufacturing of a fabric with insect repellent properties in which a solution comprising an insect repellent product and a binding agent is applied to a fabric **characterised in that** in the solution an acrylate and an elastomer is added in order to enhance the retention of the insect repellent product during successive washes of the fabric. 25
2. Method for the manufacturing of a fabric with insect repellent properties according to claim 1, **characterised in that** the quantity of acrylate in the solution amounts to at least 20 g/l. 30
3. Method for the manufacturing of a fabric with insect repellent properties according to claim 1 or 2, **characterised in that** the quantity of acrylate in the solution amounts to at least 90 g/l. 35
4. Method for the manufacturing of a fabric with insect repellent properties according to one of the preceding claims, **characterised in that** the said elastomer is a silicon elastomer. 40
5. Method for the manufacturing of a fabric with insect repellent properties according to one of the preceding claims, **characterised in that** the quantity of elastomer in the solution amounts to at least 20 g/l. 45
6. Method for the manufacturing of a fabric with insect repellent properties according to claim 5, **characterised in that** the quantity of elastomer in the solution amounts to 50 g/l. 50
7. Method for the manufacturing of a fabric with insect repellent properties according to one of the preceding claims, **characterised in that** the said insect repellent product is permithrine. 55

8. Method for the manufacturing of a fabric with insect repellent properties according to claim 7, **characterised in that** the quantity of permithrine in the solution lies between 10 - 250 g/l.

9. Method for the manufacturing of a fabric with insect repellent properties according to one of the preceding claims, **characterised in that** the said solution is applied to the fabric by means of impregnation.

10. Fabric with insect repellent properties provided with a solution comprising an insect repellent product and a binding agent, **characterised in that** the said solution has an acrylate and an elastomer added in order to enhance the retention of the repellent product on the fabric.

11. Fabric with insect repellent properties according to claim 10, **characterised in that** the manufacture complies to a method described in any one of the claims 2 up to and including 9.

12. Use of the combination acrylate / elastomer as a retention enhancing agent in a solution comprising an insect repellent product.