



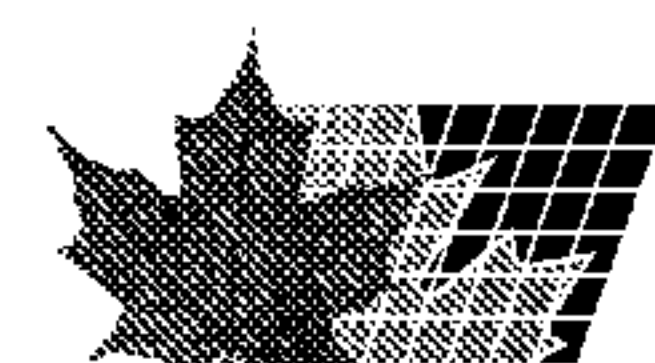
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(54) Title: INSECT REPELLENT FABRIC

(57) **Abrégé/Abstract:**

An insect repellent fabric. The fabric comprises a fabric base and an active insect repellent ingredient. The active ingredient is contained within microcapsules and the fabric base is impregnated with the microcapsules. The preferred active ingredient is a Citronella extract or DEET.



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Insect Repellent Fabric

The present invention relates to an insect-repellent fabric.

In order to render a fabric insect-repellent, one method, particularly adopted by the military, is to soak combat clothing in an insecticide, such as permethrin. However, this tends to make the garments uncomfortable and causes an unpleasant odour. Also, it has a limited period of effectiveness. It is also known to impregnate the heel and toe portions of socks with a scented material such and to impregnate socks and certain sports clothing with natural remedies, as Aloe Vera extract.

Currently, mosquitoes are one of the greatest causes of death in humans. One in 17 people alive today will be killed by mosquito bites. Worldwide, over 700 million people are infected by mosquitoes each year, with over 3 million dying. Even in the United Kingdom, biting insects generally spoil holidays and can be a serious concern for parents with sensitive or allergic children.

It is an object of the invention to provide a textile article which is effective in repelling biting insects and which has a long lasting effect. It is a further object to provide a delivery mechanism which eliminates the need for sticky and malodorous, directly applied chemicals, which tend to be neither safe nor particularly effective. It is a further object to provide a safe and hypoallergenic insect repellent for children.

To this end, in one of its aspects, the invention provides an insect-repellent fabric comprising a fabric base; and an active insect-repellent ingredient, wherein the active ingredient is para-menthane-3,8-diol isolated from a natural source and added to a non-reactive base oil, the non-reactive base oil being substantially free of limonene and linalool, wherein the para-menthane-3,8-diol is contained within microcapsules, and the fabric base is impregnated with the microcapsules.

In yet another of its aspects, the invention provides a method for producing an insect

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repellent fabric, the method comprising impregnating a fabric base with microcapsules, the microcapsules containing para-menthane-3,8-diol as an active insect repellent ingredient, wherein the para-menthane-3,8-diol is isolated from a natural source and added to a non-reactive base oil, the non-reactive base oil being substantially free of limonene and linalool.

In yet another of its aspects, the invention provides an insect repellent material comprising an active insect repellent ingredient contained within microcapsules, wherein the active insect repellent ingredient comprises para-menthane-3,8-diol isolated from a natural source and added to a non-reactive base oil, the non-reactive base oil being substantially free of limonene and linalool.

According to the invention, there is provided an insect-repellent fabric which comprises a fabric base and an active insect repellent ingredient, in which the active ingredient is contained within micro-capsules, and the fabric base is impregnated with the micro-capsules.

Preferably, the microcapsules are in the size range 1 μm to 7 μm , more preferably 2 μm to 4 μm , and would typically have a mean diameter of 3 μm .

5 Preferably, the fabric base is knitted (weft or warp), woven or spun-bonded from a spun yarn made from non-continuous short filaments and/or yarn made from continuous filaments. The material is preferably selected from polyester, nylon, cotton, or any suitable material.

10 The fabric base is subjected to binding and finishing. The binding process may selectively bind the micro-capsules to the fibres and consists of heating to a temperature in a range 40°C to 160°C, preferably 80°C to 120°C, for a period of at least 20 seconds but the precise parameters will be determined by the particular process and machinery being used. The binding process is preferably
15 an ion-exchange process.

The active ingredient may be selected from an extract of Citronella and DEET. The preferred material is para-menthane-3,8-diol; conveniently, this is isolated from a natural source (lemon eucalyptus oil), and then added to a non-reactive
20 base oil. During this synthesis process, the plant extracts Limonene and Linalool, which are known sensitisers, are removed. The invention also extends to the preferred composition *per se* and in its encapsulated form.

Preferably, the impregnated fabric is then cut to size for use in clothing
25 manufacture or for use as an impregnated cloth for topical application of the micro-capsules. Alternatively the fabric can be formed into a finished article first and then impregnated.

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It will be appreciated that the invention provides a unique chemical repelling agent which provides a comparative level of efficacy to military specification DEET products. It also provides a chemical repelling agent specifically designed to eliminate allergens and sensitizers to ensure hypoallergenicity and safety for children. The delivery system of a microencapsulated active agent bound to a fabric at a molecular level, ensures effectiveness, consistency and durability.

Fragrance can also be incorporated, either in the same microcapsules as the active ingredient or in separate microcapsules.

The detection of the fragrance in use can serve as an indicator that the active ingredient is still present and effective.

The invention may be carried into practice in various ways and some specific embodiments will now be described by way of example.

A fabric is first prepared by knitting from non-continuous short filament synthetic spun yarn. Whilst microencapsulated chemicals can be bound to other fibres, this has been found to be the most efficacious. This fabric is then sent to a binding shop for dyeing and micro-encapsulation.

The binding process uses an ionic based process to selectively bind the microcapsules to the fabric. The process heats the ends of the fibre filaments to a point where they 'open' (like a flower). An ion-exchange process then drives the encapsulated active component into the open fabric pore, which then closes around it, binding it in place.

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The active ingredient or component is para-menthane-3,8-diol. It is a modified natural extract of *Eucalyptus Maculata Citriodora*. It is dissolved in isopropyl myristate and subjected to a micro-encapsulation process, using a Melamine based polymer in an aqueous solution at a mean micron size of 3. The resultant product is then combined with a soft acrylic binder in anionic form and applied to the fabric base by means of a paddling mangle, and is then dried at 140°C. The application can also be made via an exhaust process using a non-ionic soft acrylic binder or a spraying or foaming process using a soft acrylic binder in anionic form.

CLAIMS

1. An insect-repellent fabric comprising:
a fabric base; and
an active insect-repellent ingredient, wherein the active ingredient is para-menthane-3,8-diol isolated from a natural source and added to a non-reactive base oil, the non-reactive base oil being substantially free of limonene and linalool, wherein the para-menthane-3,8-diol is contained within microcapsules, and the fabric base is impregnated with the microcapsules.
2. The fabric according to claim 1, wherein the microcapsules are in a size range of from about 1 μm to about 7 μm .
3. The fabric according to claim 1, wherein the fabric base is made from a spun yarn made from non-continuous short filaments.
4. The fabric according to claim 1, wherein the fabric base is made from yarn made from continuous filaments.
5. The fabric according to claim 1, wherein the fabric base is made by a process selected from the group consisting of knitting, weaving, spin-bonding, and combinations thereof.
6. The fabric according to claim 1, wherein the fabric base is made from a material selected from the group consisting of polyester, nylon, cotton and combinations thereof.
7. A method of producing an insect repellent fabric, the method comprising:

impregnating a fabric base with microcapsules, the microcapsules containing para-menthane-3,8-diol as an active insect repellent ingredient, wherein the para-menthane-3,8-diol is isolated from a natural source and added to a non-reactive base oil, the non-reactive base oil being substantially free of limonene and linalool.

8. The method according to claim 7, wherein the fabric base is subjected to binding process and finishing process.

9. The method according to claim 7, wherein the binding process binds the microcapsules to the fibers in the fabric base, the bonding process comprising heating to a temperature in a range of from about 40°C to about 160°C, for a period of at least 20 seconds.

10. The method according to claim 8, wherein the binding process comprises an ion-exchange process.

11. An insect repellent material comprising an active insect repellent ingredient contained within microcapsules, wherein the active insect repellent ingredient comprises para-menthane-3,8-diol isolated from a natural source and added to a non-reactive base oil, the non-reactive base oil being substantially free of limonene and linalool.

12. The material according to claim 11, wherein the microcapsules are in a size range of from about 1 μm to about 7 μm .