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IMPREGNATION OF PERMETHRIN-LOADED NANOPARTICLES IN DIFFERENT TYPES OF FABRICS FOR CLOTHING AIMING A LONG TERM INSECT REPELLENT ACTION

Assumpção E.R.[1,*]; Pohlmann, A.R.[1], Guterres S.S.[1]

[1]Laboratório de cosmetologia, Faculdade de Farmácia, PPGCF, UFRGS.
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Introduction: For centuries mankind have been searching for ways to prevent insect bites through natural and/or artificial practices, in an attempt to avoid some diseases and also its annoying bites.[1] The development of topical formulations containing repellents and residual insecticides, that can be impregnated in fabrics, have been a great advance in prevention of insect bites.[2] Despite the effectiveness of topical repellents they have some disadvantages, like the need of extensive and frequent applications, skin irritation, low systemic absorption and its application is not recommended for babies younger than six months.[1] Because of this, insecticide impregnation of fabrics has gained prominence. Some studies have used permethrin, a synthetic pyrethroid derivative of natural pyrethrins, to impregnation of fabrics due to its essential quality of residual insecticide and repellency, besides being more effective in fabric than in skin.[3] Fabrics impregnated with insecticide have a broad application, e.g., uniforms of the military combatant, mosquito nets and cloths for tourists in endemic areas, refugees and populations at risk of diseases caused by insects. The application of nanotechnology in the textile industry is very new. It has been used to provide new features to fabrics, such as insect repellency, circumventing the limitations of the use of drugs in free form. Lipid nanoparticles, represented by nanostructured lipid carriers, consist of a mixture of a solid lipid with a liquid lipid, which appears solid at room temperature.[4] These systems, with an average diameter in the range of 50 nm to 1000 nm, provides an alternative to liposomes and polymeric nanoparticles because they can avoid the use of organic solvents and have high stability.[5] Another advantage is to allow the use of various lipid materials in the preparation of the nanoparticles, such as liquid lipids with repellent activity, potentiating the desired action.

Objective: The aim of this study is to incorporate the lipid nanoparticles in different fabrics and evaluate its effectiveness against insects, time of release of drug and residence time of nanoparticles in the fabric after several washes.

Materials and Methods: The lipid nanoparticles will be prepared by high pressure homogenization using citronella, soybean or neem oil associated with cupuaçu butter. The lipid nanoparticles will be characterized in terms of particle size, size distribution, and zeta potential. The impregnation of nanoparticles in the fabrics will be performed by immersion of different pieces of fabrics (cotton and polyester) in a becker containing an aqueous dispersion of nanoparticles, under magnetic stirrer. After the impregnation, the fabric will be submitted to a transmission electron microscopy analysis. The content of permethrin in the fabrics after washing will be determined by high performance liquid chromatography through method previously validated. *In vivo* analysis will be performed through a repellency test, where an arena divided in boxes will be built and mosquitoes will be placed in the center box, being assessed the amount of mosquitoes in boxes with or without the tested formulations. Additionally, will be performed toxicity of contact/residual activity test, which consists in the transfer of the mosquito to a test tube containing fabric, in sequence the migration of the mosquito will be evaluated. The data will be analyzed using Analysis of variance (ANOVA) and t-test with significance level of 0.05%.

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