

The battle against bugs

According to Nina Bicknese, a natural history biologist at the Missouri Department of Conservation, "The worst thing about the Missouri summer isn't sunburn, heat or humidity-it's chiggers." While chiggers might not be familiar to many, such bugs and many others can cause irritaion and much worse. Similar problems in the north of the US appear to have prompted a specialist children's apparel brand, Soy Genius, based near Seattle, to team up with textile finishing technology provider Insect Shield to launch a new collection called Buggies.

All Buggies products are constructed using Soy Genius's specialist fabric blend of soy fibre and organic cotton. The fabric is comfortable, durable and naturally wicking, and also offers antimicrobial functionality and protection from harmful ultraviolet rays from the sun to a rating of UPF 30+.

Child friendly

The fabric contains 56% organic cotton, which is totally free of toxic chemicals. A further 37% is made from soy fibre, which the company claims is "buttery soft" and is a natural by-product of soybean production. It is sustainable, renewable and biodegradable, and offers antimicrobial protection and wicking action, making it difficult for stains to set. The remaining 7% is made from Spandex, which adds stretch and versatility and increases the lifespan of the garment.

"Whether in the backcountry of Belize or in a suburban backyard, Buggies are essential clothing for infants and toddlers who enjoy time outside," says a spokesperson for Soy Genius. "Buggies is the only line of Insect Shield apparel for infants and toddlers; keeping children cute, comfortable and protected. The built-in insect repellent provides a carefree outdoor experience, letting little ones focus on their adventures, not bugs."

Insect Shield's patent-pending process binds insect repellent to fabric to repel mosquitoes, ticks, ants, flies, chiggers and midges. The active ingredient is permethrin, a man-made version of a natural insect repellent found in certain chrysanthemum plants, such as the African daisy. Permethrin has been successfully used in the US since 1977, with an excellent safety record. Permethrin-treated apparel is

Insects such as mosquitoes can carry harmful diseases such as malaria, West Nile virus, leishmaniasis, dengue fever and Lyme disease.

James Gathany/Wikipedia

recommended by the US Centers for Disease Control and Prevention (CDC), the World Health Organization, the American Academy of Family Physicians and the Public Health Agency of Canada.

"We are thrilled to be working with Buggies to bring Insect Shield protection to a younger generation," said Insect Shield's vice-president for business development, Rick Hemmerling. "The Buggies products will help parents have peace of mind so they can concentrate on enjoying their time with family in the outdoors."

Lasting protection

According to Insect Shield, its bug repellent apparel and gear is the first to be registered by the US Environmental Protection Agency (EPA). This means its products have been tested to ensure they will not have adverse effects on people or on the environment.

The active ingredient, permethrin, is completely bonded to the fabric fibres. "The repellents used are invisible, odourless and colourless and do not change the feel of your clothes," a company spokesperson says. The company's products repel a range of bugs that can carry very dangerous diseases such as malaria, West Nile virus, leishmaniasis, dengue fever and Lyme disease.

The reason Insect Shield is so appropriate for Buggies is that it can be worn by children of all ages, as well as by women who are pregnant or nursing. And because the protection is bonded to the fabric fibres, the garments retain effectiveness and repellency through 70 launderings. "Compare this to insect control methods that require fogging or spraying and traditional tropical repellents that last a matter of hours and readily wash off in water," the company spokesperson says.

Kenneth Dardick, who has held leadership positions in the American Society of Tropical Medicine and Hygiene and the International Society of Travel Medicine, says: "Cases of Lyme disease continue to increase each year and have more than doubled in the last 10 years. Permethrin-treated clothing such as Insect Shield is one of the most convenient and effective methods of protection for the entire family."

Beyond working with companies like Soy Genius, Insect Shield is using its technology to help adults and children across the world. According to the CDC website, 41% percent of the world's population lives in areas where malaria is transmitted. Each year 350–500 million cases of malaria occur worldwide, and more than one million people die. The majority of these are young children in Africa.

"From the beginning, Insect Shield has worked with relief organisations to make our technology available to those who need it most,"



Insect Shield garments can be worn by children of all ages, as well as by women who are pregnant or nursing.

Soy Genius/Insect Shield

the company spokesperson explains. "We're involved in efforts to bring Insect Shield to parts of the world where insect control can be a matter of life and death, such as areas where malaria is widespread."

Making it last

Meanwhile, Netherlands-based Tanatex chemicals is also working to protect people from the problems associated with insects. According to the company, more and more people are travelling to and working in areas where insects pose a serious threat to life. The risk of being bitten by mosquitoes, flies, ticks, lice and fleas is not only a nuisance, it points out, but also a potential health risk for travellers of all kinds.

Like Insect Shield, one way it helps protect people from these insects is using pyrethroid products in clothing and uniforms, as they have a good insect knock-down and knock-dead effect. Tanatex has developed a new pyrethroid, Eulan Spa 01, which is a certified Oeko-Tex Standard 100 product. The active ingredient in the product is permethrin, which makes up 10% of the final product.

"Pyrethroids have a long history of use in the protection of people against the nuisance of insects," says Johan Cleyman, global product manager, finishing, at Tanatex. "Already in Napoleonic times, Pyrethrum powders were used to try to protect soldiers against body and head lice. Permethrin is a pyrethroid insecticide that kills insects on contact and through digestion.

"Permethrin is selected as the active ingredient for uniforms in contact with skin is because of

the harmless effect of the substance towards humans. Permethrin has the advantage over deltamethrin and cypermethrin, in that it is an effective insect-killing substance, applicable on garments, with the least negative side-effects."

In a bind

The new product can be combined with special binders such as Baypret Nano-PU to increase its durability against washing. According to the company, Baypret Nano-PU is preferable to other binders such as acrylates and vinyl acetates because of its soft handle and elasticity.

The company recently carried out a study using Battle Dress Uniforms (BDU) that had been treated with permethrin (0.160 mg/cm² permethrin) combined with different binders to investigate their durability against washing. The use of insecticides by cold dipping—often referred to as IDA-KIT—on BDU is standardised by many armed forces.

According to the company, the logistic complexity of providing IDA-kits in the field is high, prompting experts to look for a way of impregnating fabrics to be used for BDUs at the loom stage. A logical conclusion was to combine permethrin with binders such as acrylates or polyvinyl acetate. However, Tanatex found urethane-based binder Baypret Nano-PU was more effective as it forms flexible interfibrillar bridges between fibres. It also improves dry rubbing fastness and fabric strength.

A camouflage polyamide-copolymer (30%-70%) woven fabric weighing 298 g/m² was treated with aqueous suspensions of Eulan Spa 01 and Baypret Nano-PU at a rate of 0.160 mg/cm² of active ingredient. The fabric was compared with a fabric treated with the same amount of Eulan SPA 01 combined with an acrylate binder and the treatment was carried out via the dipping method, using a foulard. Drying was carried out on a Brückner stenter frame.

Put to the test

A sample (10 cm x 10 cm) of the insecticide-treated textile material was then cut into 0.5 to 1cm pieces. Each of the complete cut samples was weighed into a stoppered flask and an international standard solution was added. The final solution was extracted with 45 ml of toluene in a water bath (85-90°C) for 45 minutes. From the extract, two 1µl samples were injected into a gas chromatography (GC) system. The active substance content of permethrin was determined by GC according to the international standard method with flame ionisation and each sample was analysed twice.

The test against mosquitoes was undertaken in World Health Organization test tubes. The fabric was attached to a piece of paper (12x15 cm), before being inserted into the test tubes (length: 12 cm, diameter: 4 cm, upper and lower end closed with gauze), covering the complete inner surface area. Mosquitoes were then introduced into the test tubes. The mosquitoes were kept inside the test tubes for 24 hours and were evaluated continuously for 100% knock-down. After two hours, the mosquitoes were provided with cellulose swabs containing sugar water. During these tests, 20 mosquitoes were introduced per tube and mortality was determined after 24 hours.



The Buggies range: 56% organic cotton, 37% soy fibre and 7% Spandex.

Soy Genius/Insect Shield

The durability of the treated fabrics was tested against 40°C home laundry cycles. Both articles showed an active ingredient loss of between 25-30% after 10 home laundries. However, when 50 home laundry cycles were completed, the urethane-based fabric showed a residual permethrin content of 643 mg/m² while the acrylate-based fabric dropped to a level of 563 mg/m² active ingredient content.

Against yellow-fever mosquitoes, 100% knock-down was achieved with the Baypret Nano-PU bound fabric after 21 minutes, and with the acrylate binder-bound fabric after 26 minutes (based on the average of three replicates). Mortality after 24 hours was 100% in all cases.

Tanatex believes the use of a urethane binder such as Baypret Nano-PU protects the permethrin during washing. Its good film-forming properties did not prevent the permethrin from being bioactive. The tests for bioactivity against yellow-fever mosquitoes showed that a 100% knock-down effect was achieved in less time when the urethane binder was applied. Finally, when using the urethane-based binder system, it claims, a softer handle was obtained then when the acrylate binder was used.