

Improvement of herbal mosquito repellent nanopatch- P. D. Juyal- Nanaji Deshmukh Veterinary Science University

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Mosquitoes are among the most disturbing blood sucking insects afflicting human beings. Several mosquito species belonging to genera Anopheles, Culex and Aedes are vectors for the pathogens of various diseases like Dengue fever, Malaria, Yellow fever, Japanese Encephalitis and several other infections. Mosquitoes alone transmit diseases to more than 700 million people and over one million deaths are reported annually across the globe. Therefore, the control of mosquitoes is an important public health concern around the world. As most of the mosquito repellent products and devices available in the market are reported to have harmful effects on human beings, the objective of the present study is to develop effective plant-based mosquito repellent products.

Mosquitoes such as Aedes, Anopheles, and Culex are a serious threat to the public health as they are known vectors for various protozoans, viruses, and bacteria which result in many life threatening diseases like malaria, filariasis, yellow fever, Japanese encephalitis, chikungunya, and dengue. These vectors have been considered as a major obstacle to socioeconomic development of developing countries particularly in the tropical region. Despite considerable efforts in recent years to control vector-borne diseases, malaria alone produces 250 million cases per year and 800,000 deaths including 85% children under five years (WHO, 2010). Therefore, the prevention of mosquitoes could be better than the cure of vector-borne disease. Hence, use of the mosquito repellents on exposed skin area is strongly recommended. Insect repellents usually work by providing a vapor barrier deterring the arthropod from coming into contact with the skin surface. Most of the commercial mosquito repellents are prepared using nonbiodegradable, synthetic chemicals like N, N-diethyl-3-methylbenzamide (DEET), dimethyl phthalate (DMP), and allethrin, which may lead to their higher exposure to the environment and, hence, the unacceptable health risks. With an increasing concern on public safety, a renewed interest on the use of natural products of plant origin is desired because natural products are effective, environment friendly, biodegradable, inexpensive, and readily available.

Currently, the US Environmental Protection Agency (US-EPA) has registered citronella, lemon, and eucalyptus oil as insect repellents due to their relatively low toxicity, high efficacy, and customer satisfaction. These are effective in the concentration range of 0.05% to 15% (w/v) alone or in combination with other natural or commercial insect repellents. Citronella oil

does repel mosquitoes and is required in its large amount to be effective due to the rapid volatility (evaporates too quickly from surfaces to which it is applied) and, hence, it would be unsafe for topical application because of its irritant nature (in the said concentration range). Formulating cream may ensure the avoidance of direct contact of the oil to skin and diminish the volatility, which would lead to the effective and safe (nonirritant) delivery of the oil for longer duration.

In-process quality control (IPQC) is a crucial phase in the manufacture of mosquito repellents. Some specific tests are performed at various time points in the manufacturing process to ensure that the finished products are consistent from run to run, remain effective over a long period, and are safe to use. Initially, raw materials are checked to ensure whether they meet the previously set specifications or not. Consequently, formulation of interest is tested on the basis of pH, specific gravity, and moisture content. As far as development of cream (a semisolid formulation) is concerned, other unambiguous quality control parameter like texture profile need to be addressed appropriately in order to improve the stability, elegance, and, hence user acceptance more deliberately.

Mechanism:

The Nanopatch is designed to deposit vaccine antigens just under the surface of the skin, amongst the dense populations of immune cells. This enables the antigens to be efficiently and effectively trafficked to lymph nodes for processing. In a wide range of animal models we've shown that as little as 1/10 – 1/100 of a dose of vaccine delivered this way can produce an immune response equivalent to a full dose by needle/syringe. We're exploring this effect in humans in current clinical studies. In addition to this, vaccines coated onto the Nanopatch are in a dry format and can be engineered to be stable outside of cold-chain – a huge potential win for developing and emerging markets.

An insect repellent is a substance applied to skin, clothing, or other surfaces which discourages insects from landing or climbing on that surface. Insect repellents help prevent and control the outbreak of insect-borne diseases such as malaria, Lyme disease, dengue fever, bubonic plague, river blindness and West Nile fever. Pest animals commonly serving as vectors for disease include insects such as flea, fly, and mosquito; and the arachnid tick.

Some insect repellents are insecticides, but most simply discourage insects and send them flying or crawling away. Almost any might kill at a massive dose without reprieve, but classification as an insecticide implies death even at lower doses.

Result:

There were considerable efforts made to promote the use of environmentally friendly and biodegradable natural insecticides and repellents, particularly from botanical sources. However, limited period of effect is the major drawback of these products. There is a need in art for a safe, cost effective and highly efficient carriers/absorbent composition of matter that provides for a controlled time release of an aromatic substance, such as an essential oil or a combination of essential oils.

The repellent action is attributable to a one or mixture of essential oils including eucalyptus oil, citronella oil, geranium oil, rosemary oil, lemongrass oil and neem oil. Resultant nanopatch have shown enhanced surface-to-volume ratio, high porosity, numerous active sites, and controlled release of

encapsulated oils. The developed nanopatch serve as matrix for essential oils, enclosed in a perforated backing substrate and further with a release liner to protect the volatile component from the external environment. The resulting patch provides an effective means of personal protection against flying insects and safe for use in children.

Biography:

Dr. P.D. Juyal, Vice Chancellor, Nanaji Deshmukh Veterinary Science University, Jabalpur retired from university service after attaining superannuation. Dr. Juyal served in various capacities in different universities including, Punjab Agricultural University and GADVASU, Ludhiana for a period of about 34 years, and Director R& D, ISF College of Pharmacy. During his professional journey, Dr. Juyal significantly contributed in the field of Veterinary Parasitology. He presented his work in several national and international conferences in India and abroad. He has more than 200 publications to his credit. He is also the co-author of one Text and two reference books. He is a recipient of many national and international awards and recognitions.