

# INSECT-REPELLENT COATINGS USING ESSENTIAL OILS WITH CAVAMAX® AND CAVASOL® CYCLODEXTRINS

Insect repellents are substances that discourage insects from landing, climbing or remaining on a surface. The use of insect repellents can 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. Insects such as fleas, flies, mosquitoes and ticks are pests and are notorious vectors for diseases and germs.



**Encapsulation with cyclodextrins**  
CAVAMAX® and CAVASOL® cyclodextrins are a well-known group of natural carbohydrates that are able to encapsulate other organic molecules in a reversible equilibrium controlled process in water. This process of molecular encapsulation of essential oils with cyclodextrins effectively modifies the properties of the organic guest molecules by reducing volatility, extending the release over time and improving stability and water solubility.

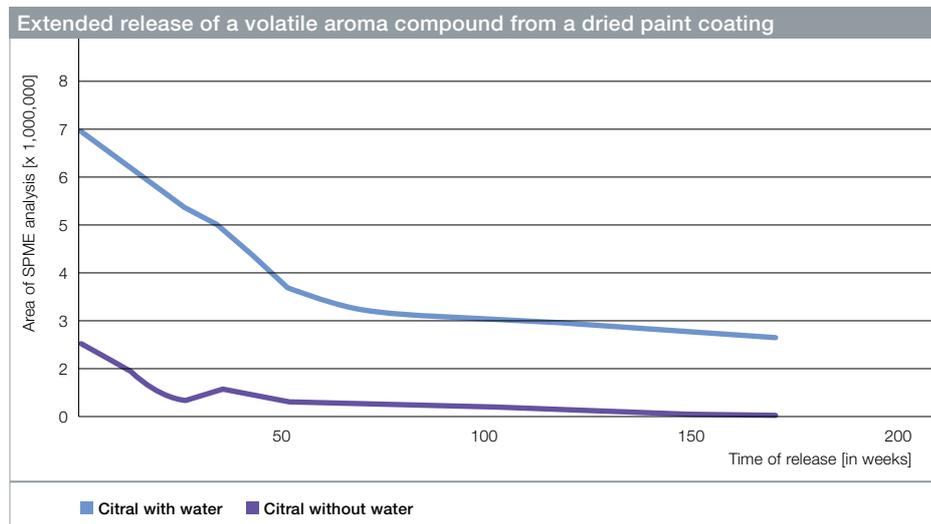


**Consumer trend to natural solutions**  
Consumer concern about using “harsh” chemical insecticides is creating an opportunity for greener, more gentle, natural products that are equally effective. Additionally, repellents do not kill the insect; they simply discourage it from landing or staying in a certain area, helping to keep that area insect-free.

**Encapsulation of volatile compounds**  
WACKER has many years of experience in producing inclusion complexes. The process is easily scalable, reproducible and low in cost. In fact, WACKER has already demonstrated that an inclusion complex of a natural compound like citral, a component of citrus oils, formulated into water-based coatings, releases the citral from the inclusion complex in the dried coating, in an amount that is detectable by the GC and the nose.

## Basics about essential oils

Essential oils like lavender, citronella, rosemary and tea tree oil are well-known natural products extracted from plants. Consisting of many different compounds, they feature a variety of functions, e.g. medicinal properties, antimicrobial activity and animal-repellent properties. Some of these substances have been in use for thousands of years. Today, many essential oils or their components are commercially used as insect repellents, e.g. citronella oil against mosquitoes and other flying insects.



**Formulation of encapsulated essential oils in cyclodextrins**

Molecular encapsulations of different essential oils in CAVAMAX® and CAVASOL® cyclodextrins have now been prepared and formulated into different aqueous coating products. These water-based products have been evaluated using industry-standard methods to identify detrimental changes to the performance of the coating.

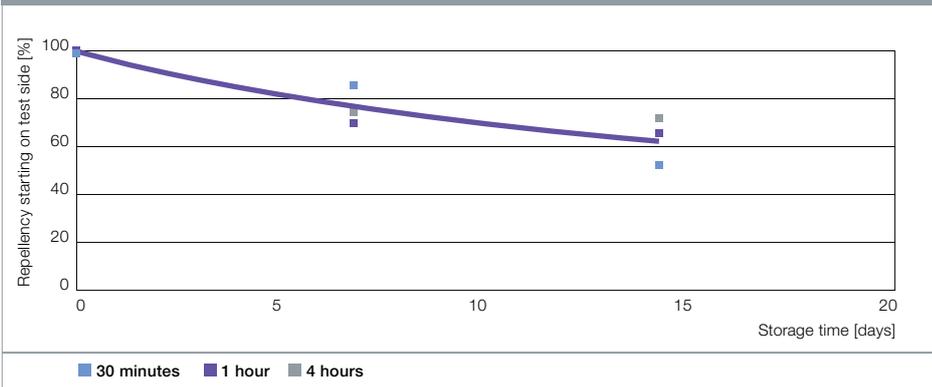
The addition of the encapsulated essential oils to the aqueous coating formulations at 1.8 to 4.5 g essential oil per kilo of paint (0.18 – 0.45%), did not affect the stability of the formulation, or change its color, appearance or the performance of the coating.



**Accelerated insect repellency study**

5% (w/v) CAVAMAX® citronella was post-added to a commercially available water-based latex emulsion paint. It was then applied by drawdown (5 mil, 4" x 4" frame) to Leneta cards and allowed to dry for 24 hours. The control card was treated in exactly the same manner.

Repellency of argentine (sugar) ants to dried paint containing 5% CAVAMAX® citronella oil complex



The coated test and control cards were conditioned at 40 °C and 75% RH for up to 30 days. Samples were then pulled at 0, 7 and 14 days and tested for insect repellency. The test insects in this case were Argentine worker ants or 'sugar ants'.

Argentine ants were effectively repelled by CAVAMAX® citronella oil complex even after it has been stored for 16 days under accelerated conditions. Repellency is measured at different intervals, for example, 30 minutes, 1 hour and 4 hours.

**Regulatory requirement**

Since insect repellents are regulated differently in different countries, it is important to check the regulatory requirements in your country before starting a new project.

**Available products**

Currently, three CAVAMAX® inclusion complexes of essential oils are available for use as insect repellents, and many others have been prepared. If these are not suitable for your needs, please contact us to discuss your specific target and need.

- CAVAMAX® citronella oil
- CAVAMAX® lavender oil
- CAVAMAX® geraniol oil

References / sources:  
 Regiert, M., et al Annex V: PT6 Preservatives for products during storage (In-Can preservatives) MSc Thesis Directory of microbicides for the protection of materials. Ed. W. Paulus obicides for the protection of materials. Ed. W. Paulus



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