

Citriodiol

What is Citriodiol®?

A clinically proven insect repellent that is naturally and sustainably sourced, Citriodiol® is the cornerstone product of Citrefine International Ltd, a family-run company committed to socially and environmentally responsible business practices and products. Citriodiol® is a truly unique active ingredient. It is highly effective in repelling many species of biting insect, is sourced directly from nature in a sustainable manner that actually benefits our planet, and it has a proven track-record of safe use. Perhaps this is why Citriodiol® is found in so many brands of insect repellent around the world, and is a favorite with consumers. Good for the family, good for the planet.

Citriodiol® was developed more than 20 years ago when one of Citrefine's founders, Dr Paul Clarke, a specialist in tropical medicine, recognized the need for an effective and natural option to protect against the increasing threat of vector borne disease. His primary concern was finding a low-toxicity alternative to DEET with efficacy rigorous enough to protect against Malaria. Through a multitude of clinical laboratory and field trials, Dr Clarke proved that Citriodiol® readily met this need, and it is now used to prevent the spread of Dengue fever, West Nile virus and Lyme disease, and more recently to protect against Chikungunya and Zika viruses.

Citriodiol®'s efficacy is its greatest asset, but the good news for people concerned about the environment – or just their sporting equipment – is that Citriodiol® provides a great alternative to synthetic repellents. It readily biodegrades, is sourced entirely from an essential oil, and unlike DEET, has no plasticizing effect. This lemon-scented active ingredient is made from Eucalyptus citriodora oil through a simple process that is environmentally sustainable. Citriodiol®'s credibility as a repellent is unmatched by any other naturally sourced active ingredients and top entomologists refer to its efficacy as comparable or superior to synthetic active ingredients. As a regulated substance, Citriodiol®'s safe toxicity and environmental profile is confirmed by strict regulatory review and approval in numerous markets, such as the US, Australia, Canada and various EU Member States.

Benefiting our Planet

Essential oil production is an inherently green business, as the health and vitality of the soil and trees themselves play a vital role in the quality of oil produced. Steam distillation is used to extract the oil, which is an age old process using only the leaves and twigs of the trees, without harvesting the entire tree. These coppiced trees continue to grow thus becoming self sustaining and using more carbon dioxide and producing more oxygen for the benefit of the greater environment.

Growing the Trees:

- Eucalyptus citriodora trees are generally grown on small plantations.
- Seedlings are planted and tended by hand by local workers.
- No synthetic fertilizers are used; the soil is simply conditioned with lime on planting and every couple of years thereafter to ensure it provides the best possible conditions for growth.

- Waste leaf from the distillation process is used to improve the soil and to help to retain moisture.
- Weeds are often controlled by running cattle in the plantation - which also fertilizes the soil.
- The trees and oil are not genetically modified.

Harvesting the Leaves and Managing the Trees:

- Leaves and branches are harvested by hand from the trees by teams of local workers including both men and women.
- Branches are cut selectively from each tree during the harvesting process so that the trees can continue to grow and produce new leaves for many years.
- Once the branches have been harvested, the twigs containing leaves are cut from the branches. The leaves and small twigs are steam distilled to produce Eucalyptus citriodora oil.
- The number of harvests each year is adjusted to ensure the on-going health of the trees.
- Once or twice during the 10-15 year life span of each tree, it will be cut to a stump and allowed to regrow.
- At the end of its life it will be cut down and a new line of trees will be planted adjacent.
- The trees which are cut down are used as fuel either on the plantation or sold to local businesses.
- On some plantations the trees are turned into charcoal (a key source of fuel for the local population) using brick ovens on the plantation – another very sustainable process.

Distilling the Oil:

- Leaves are placed in a large vessel and compressed using a large circular weight and then the vessel is sealed.
- Steam is passed through the vessel to distill the oil from the leaves. As the steam cools the water and oil separate and the oil is captured in drums.
- The water used to produce the steam is recycled through the distillation pots and is then used for irrigation.
- Waste leaves and surplus twigs are used as fuel to fire the boiler which produces the steam and the leaves are also used to maintain the soil.
- No other fuel is required to run the boiler and in fact excess energy generated by the process is used to run other equipment on the plantation.
- Some of the waste leaves can be used to make dyes for fabric.

The employees:

- Workers on the plantations are nearly all local.
- Plantations provide good, stable jobs for both men and women and are important to the local economy.

Making Citriodiol® - Mimicking Nature's Aging Process

- In nature, as the oil found in the leaves of the Eucalyptus citriodora tree ages, the main constituent of the oil (citronellal) gradually turns into p-menthane-3,8-diol (PMD).
- Some PMD is found in the “young” oil, but only in small amounts. Because it is more difficult to distill the oil when it is more mature and because the PMD is central to the efficacy in repelling biting insects, Citrefine's suppliers harvest the oil from leaves that are about 18 months old.
- This oil is supplied to Citrefine who use a simple manufacturing process to convert the citronellal to PMD.

The result is Citriodiol®, which contains a minimum of 64% PMD and only a negligible amount of citronellal. The other naturally occurring minor components in the Eucalyptus citriodora oil remain largely unaffected by this process.

In this way Citrefine is effectively mimicking nature's own aging process.

Safety – For the Consumer and the Environment

In addition to the many toxicological studies done on Citriodiol® to ensure product safety for consumers, Citrefine has also conducted environmental testing to ensure that its products are safe for the environment. These tests have proven that Citriodiol® is readily biodegradable, so will not build up to potentially harmful levels in our soils and waterways, unlike many synthetic counterparts such as DEET. Because Citriodiol® is

from a natural plant oil and is readily biodegradable, it is also not toxic to birds, honey bees and other beneficial insects.

Citrefine International Limited is committed to producing naturally sourced repellent products that are effective and safe for both consumers and our planet. To this end, we are continually building upon our body of research and developing ways in which we can improve the environmentally friendly products we can offer.