

# Tea Tree Oil and the SARS-CoV-2 Coronavirus Pandemic

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## Important Information

This document is intended to provide general advice only and has been prepared to provide producers, traders and manufacturers of products containing 100% pure Australian Tea Tree Oil (TTO) with the evidence currently available on the potential virucidal activity of TTO. This will allow informed decisions to be made when preparing and releasing statements about the efficacy and safety of 100% pure Australian TTO as a topical antiseptic agent either in a formulated product or as the whole oil.

**Note:** Caution is warranted when making any claims whatsoever. As an example a reseller of TTO in the USA recently received a warning letter from the US FDA advising them that their website '*offers essential oil products for sale intended to mitigate, prevent, treat, cure or diagnose COVID-19 in people*'. FDA has determined that these products are unapproved new drugs sold in violation of the Federal Food, Drug, and Cosmetic Act. You can read more here: <https://www.fda.gov/inspections-compliance-enforcement-and-criminal-investigations/warning-letters/gurunanda-llc-604930-03062020>

**TTO is a topical antiseptic and should never be ingested.**

## Responding to Coronavirus (SARS-CoV-2)

SARS-CoV-2 is a novel virus which means there is very low to no immunity in the entire human population thus the spread of the virus is difficult to control and, unless stringent measures are taken to avoid infection, almost impossible to halt. Once infection occurs there is no known cure for COVID-19. Most infections resolve over a relatively short timeframe as the autoimmune system develops and deploys defence mechanisms to combat the infection. It is not clear if reinfection can occur though this is considered unlikely.

Some of the more common strategies for reducing the likelihood of infection are:

- ✓ Washing your hands regularly and thoroughly with soap or detergent
- ✓ Hand sanitisers should be used if no water is available
- ✓ Restrict or avoid contact with others
- ✓ Avoid touching your own face particularly the nose, mouth and eyes
- ✓ Deploy protective equipment (face mask, gloves etc) where contact can occur with anyone either showing COVID-19 symptoms or where they have had contact with a confirmed case

## Tea Tree Oil has Potential as an Antiviral Agent

Tea Tree Oil is a complex mixture of terpenes and other hydrocarbons produced metabolically in the leaves of *Melaleuca alternifolia* an Australian native species also known as the Narrow Leaved Tea Tree.

Common name:	Tea Tree Oil
Botanical name:	<i>Melaleuca alternifolia</i>
INCI:	Melaleuca alternifolia (tea tree) leaf oil
Manufacturing:	Steam distillation
Quality definition:	ISO4730: 2017

TTO has a range of well documented functional properties including:

<b>Function</b>	<b>Possible applications</b>
Anti-bacterial	Acne, oral care, hand sanitiser, body odour, minor wounds or lesions
Anti-fungal	Dandruff, mould, toenail, feet, HVAC/air treatment
Anti-inflammatory	Minor wounds, grazes, insect bites
Anti-yeast	Feminine care, oral care
Acaricidal	Ticks, mites
<b>Antiviral</b>	<b>Home, industrial, personal care</b>

This document addresses the potential antiviral properties of TTO and provides research summaries, references and links to these (see the References section on page 4) for known antiviral functions.

## Common Uses of TTO in the Current Environment

**Hand sanitisers** – formulations with around 70% alcohol and 5-10% TTO are most common. The ethanol evaporates quickly while the TTO remains much longer on the skin potentially providing additional protection through its antimicrobial efficacy.

**Vaporisers or HVAC inserts** – many homes and offices are choosing to use tea tree oil in a vaporiser unit or in an air conditioning unit to provide potential protection from airborne viruses and other microorganisms.

**Surface cleaning products** – formulations with tea tree oil are proving popular for spraying on and wiping down surfaces. We have received many anecdotal reports of tea tree oil being added to daily cleaners to provide the additional potential protection against microorganisms.

## Research Summaries

In **2006** general antiviral data for TTO was first compiled in a seminal paper by **Carson *et al*** [1] (cited by 1046 authors since publication). In the section titled **Antiviral Activity** the authors provide detail and references to the virucidal activity of TTO for:

**Tobacco mosaic virus** After 10 days the lesions were significantly lower in all TTO treatments

**Herpes Simplex Virus** TTO inhibited 50% of plaque formation at a concentration of 0.0009% for HSV type 1 (HSV-1) and 0.0008% for HSV-2, relative to controls

**HSV-1 in Vero cells** TTO was found to exert most of its antiviral activity on free virus, with 1% TTO concentration inhibiting plaque formation completely and 0.1% TTO reducing plaque formation by approximately 10%. (Vero cells are isolated from kidney epithelial cells)

The authors concluded *“The results of these studies indicate that TTO may act against enveloped and non-enveloped viruses, although the range of viruses tested to date is very limited.”*

In **2009** Garozzo *et al* [2] reported antiviral efficacy for H1N1, HSV-1 and HSV-2 viruses at a concentration of 0.025%. Mild virucidal efficacy was observed with a TTO concentration of 0.125% against HSV-1 and for H1N1 and HSV-2 at a concentration of 0.0006%. Antiviral activity is attributed to terpinen-4-ol, the main component of TTO.

In **2010** Astani *et al* [3] compared the antiviral effect of many essential oils against HSV-1 and found TTO most effective starting at 10µg/mL (0.001%).

In **2011** Garozzo *et al* [4] reported TTO inhibits the haemagglutinin glycoprotein complex that is responsible for binding to host cells.

In **2012** an in-depth study of airborne influenza virus inactivation using TTO and Eucalyptus Oils [5] was conducted to help answer the question *‘Can TTO work on airborne viruses?’* The researchers reported that an airborne viral load of 150 Plaque Forming Units (PFU) per ml was reduced to 5±1.82 PFU/ml after 5 minutes and was totally inactivated at 15 minutes when passed through a TTO treated air filter.

In **2013**, in the wake of the H1N1 (swine flu) epidemic, researchers [6] investigated how TTO interacts with the virus and if its mode of action prevents the virus binding to a host cell disabling its ability to reproduce. They found that terpinen-4-ol, the major bioactive component TTO, combines with the viral membrane fusion site of haemagglutinin (HA) and confirmed the Garozzo *et al* (2009, 2011) results by demonstrating, using computational simulations, that TTO could prevent the influenza virus from entering the host cell by disturbing the normal viral membrane fusion procedure. In this study Li *et al* also reported effective antiviral capability at a concentration of 0.02%.

Other research into antiviral activity is provided in the References section see [7] [8] and [9] on page 4.

## Formulation

In 2006 Southwell showed [10] that, as opposed to alcohol-based hand sanitizers which evaporate rapidly, some of the active components in TTO remain on the skin surface for up to 4 hours depending on temperature and physical contact. More recently researchers at Turin University [11] have shown that there is no significant dermal adsorption of TTO components depending on the formulation used and reported that in their test system some of the less volatile compounds, including terpinen-4-ol, remained on skin for up to 8 hours.

## Key Data

- ✓ TTO inhibited 50% of plaque formation at concentrations of 0.0009% for HSV-1 and 0.0008% for HSV-2, relative to controls [1]
- ✓ The minimum effective *in vitro* concentration to kill some viruses is 0.125% [2]
- ✓ Air dispersion through a TTO treated filter can totally inactivate tested viruses at 15 minutes [5]
- ✓ TTO at a concentration of 0.02% prevented tested viruses from entering the host cell which helps prevent viral replication [6]

TTO is safe in most leave-on product formulations to at least 5%; the formulation of TTO-containing products intended for antiviral applications should take into account these data to ensure contact of TTO with any virus before it comes into contact with host cells.

## Current Testing of TTO –containing Products

Applications to test the efficacy of three TTO-containing products (a hand sanitiser, a surface cleaner and a vapour phase product) have been submitted to the Peter Doherty Institute (<https://www.doherty.edu.au/>) who are leading research into the coronavirus. A response on acceptance of one or more of these is expected in April 2020. If an application is successful it is hoped that testing will commence quickly thereafter. If you are interested in receiving further information on this please email [research@attia.org.au](mailto:research@attia.org.au).

## Background

Viruses come in an amazing variety of shapes and sizes, they are the smallest known organisms on Earth and are measured in nanometres (nm) or one-billionth of a meter, ranging in the size from 20 to 750 nm. Because of their size, viruses are hard to detect and very hard to study and control. They can be spread in a variety of ways, most commonly through close contact with an infected source.

- The official name for the novel coronavirus is **SARS-CoV-2**, it was first detected in late 2019 in Wuhan Province, China.
- This coronavirus causes a respiratory illness that has been named **COVID-19** by the WHO.

To date over 80 countries have been impacted and new cases are being detected daily in increasing numbers. The World Health Organization (WHO) maintains a daily Situation Report on their [Coronavirus website](#), there are many useful links in these WHO reports.

Estimates of the death rate from COVID-19 vary depending on sources; around 3.8% of cases recorded to date have resulted in mortality; this may be much higher or far lower depending on population demographics and the ability and availability of reliable testing for SARS-CoV-2. True infection numbers are likely significantly higher than official statistics. On the other end of the scale there are reports of confirmed infections that are completely asymptomatic.

A coronavirus is a type of virus with a crown-like appearance, there have been several other coronaviruses that have significantly impacted humans in the past two decades including the common cold which is also caused by a coronavirus. The best known are:

- |   |                  |
|---|------------------|
| 1. SARS-CoV (Severe acute respiratory syndrome) | 2003 outbreak    |
| 2. MERS-CoV (Middle East respiratory syndrome)  | 2012 outbreak    |
| 3. SARS-CoV-2                                   | current outbreak |

In addition to the coronavirus there is also influenza, a type of virus which mutates (known as antigenic drift and/or shift) and can also become deadly. The best known of these is the 'H1N1' strain (commonly known as swine flu) which impacted human populations in a 2009 global crisis. Another pandemic, the Spanish flu, occurred in 1918 and was the most severe pandemic in recent history with a conservative estimated death toll of 50 million worldwide.

### Other useful links:

General Information: <https://www.worldometers.info/coronavirus/>  
Europe Q&A: <https://www.ecdc.europa.eu/en/novel-coronavirus-china/questions-answers>  
Europe Distribution: <https://www.ecdc.europa.eu/en/geographical-distribution-2019-ncov-cases>  
WHO: <https://www.who.int/emergencies/diseases/novel-coronavirus-2019>  
USA CDC: <https://www.cdc.gov/coronavirus/2019-ncov/index.html>  
Australia: <https://www.health.gov.au/news/health-alerts/novel-coronavirus-2019-ncov-health-alert/coronavirus-covid-19-current-situation-and-case-numbers>

### About ATTIA – the Australian Tea Tree Industry Association

The Australian Tea Tree Industry Association (ATTIA Ltd) is an Australian based not-for-profit organisation formed in 1986 as the peak body to promote and represent the interests of the Australian tea tree industry. From the grower/producers to the manufacturers of off-the-shelf products for public use, ATTIA supports and promotes the responsible use of pure Australian tea tree oil (TTO).

ATTIA's aim is to develop a stable, cohesive, environmentally friendly, and internationally competitive TTO industry producing quality assured pure Australian TTO that meets or exceeds international standards. ATTIA promotes the safe effective use of pure Australian TTO for a wide range of applications.

### References

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9. Brun P, Bernabè G, Filippini R et al (2019) *In Vitro Antimicrobial Activities of Commercially Available Tea Tree (Melaleuca alternifolia) Essential Oils* Current Microbiology 76: 108–116 available at <https://www.ncbi.nlm.nih.gov/pubmed/30421144>
10. Southwell (2006) *Tea Tree Stability and Evaporative Rate*. RIRDC Industry Publications, Australian Federal Government RIRDC 06/112 available at
11. Capetti F, Sgorbini B, Cagliero C et al (2020) *Melaleuca alternifolia Essential Oil: Evaluation of Skin Permeation and Distribution from Topical Formulations with a Solvent-Free Analytical Method* Planta Medica 1-9 available at <https://www.thieme-connect.de/products/ejournals/abstract/10.1055/a-1115-4848>