

## Essential Oils: An Assessment of Safety Issues

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### Abstract

Essential oils are derived from plants and contain a wide range of chemicals, most of which are of beneficial value when used in cosmetics. Plants however have evolved over millennia in highly competitive environments and have developed ways of ensuring their survival in the face of threats from animals as well as other plants. The defensive methods used by plants are either physical, such as the growth of thorns, or chemical and plants could be said to have started the process we now refer to as chemical warfare. This paper looks at some of the biochemical effects that can result from exposure to essential oils and puts the use of essential oils into the context of consumer safety. What does an essential oil contain and what are the potential effects of exposure? These are questions that are essential in assuring consumer safety but are not always easily answered.

### Introduction

Essential oils are often used in cosmetic preparations with typical levels of incorporation ranging from 0.01% to 3%, though this may be even higher (up to 100%) in products such as aromatherapy oils. There are numerous reasons for incorporating essential oils into cosmetic formulations; many for example are reported to have 'folk medicinal' properties. Such reported effects can vary from antibacterial & antifungal to carminative or stimulant activities and from astringent or antiinflammatory to prophylactic or hypotensive effects. Additionally many essential oils have a fragrance that is considered pleasant or desirable to the human olfactory system, and therefore they may be used as perfume ingredients. Many essential oils, however, also have less desirable actions ranging from acting on the menstrual cycle (emmenagogues), inducing miscarriage (abortifacients) or having a direct effect on the nervous system (neurotoxic). The commonly held belief that a product made exclusively from natural ingredients or that a single natural ingredient itself must be safe, is clearly wrong. The fact that essential oils, in order to cause beneficial effects, must be biologically active, is often overlooked. "Natural" ingredients take on an almost mystical quality and some people are loathe to acknowledge the existence

of any potential problems, while at the same time promoting the magical benefits to be gained. An extreme example of nature's potential for harm can be seen in Botulinum toxin, the naturally produced by-product of *Clostridium botulinum*, which is the most potent poison known to man with an LD50 in rats of 0.00001mg/kg.<sup>1</sup> It is not just bacteria that can produce potent toxins however, plants have perfected many poisons as a defence mechanism in the ongoing evolutionary battle with their predators and competitors. Common examples are:

- ibotenic acid, produced by Fly Agaric (*Amanita muscaria*) which is both toxic and psychoactive;<sup>2</sup>
- digitalis, produced by the foxglove (*Digitalis purpurea*), which is a cardiac glycoside;<sup>2</sup>
- acetylcholine, histamine and 5-hydroxytryptamine give some nettles (*Urtica* spp.) their sting.<sup>2</sup>
- Ricin is derived from the castor bean (*Ricinus communis*) the oil of which is commonly used in lipgloss and lipstick formulations. Ricin has the ability whereby a single molecule can inactivate in excess of 1,500 ribosomes a minute once inside a cell's cytoplasm<sup>3</sup> – quickly leading to the death of the exposed cell and was the poison contained in a microscopic pellet that was used to murder Georgi Markhov in London.

Despite this potential, there has been little scientific research performed on the possible side effects of many natural ingredients that may be used in cosmetics. Essential oils, like perfumes, may be complex mixtures of hundreds of different chemical compounds from a variety of chemical classes. The main chemical groups found in essential oils are hydrocarbons, alcohols, ketones, aldehydes, esters, oxides, monoterpenes, sesquiterpenoids, phenols, lactones, coumarins & furanocoumarins. However exact compositional data for many essential oils, including some of those in common use, is sparse. The Canadian & American retailer Ashbury's Aromatherapy has one of the most extensive lists of oil information and has compositional and other data for 78 oils (at the time of writing) on its website.<sup>4</sup> Currently the United Nations Industrial Centre for Science & High Technology (ICS) is one of the few laboratories looking into compositional data and lists 74 oils at the time of writing.<sup>5</sup> In contrast there are currently in excess of 150 oils that may be in use in cosmetic

