

**Evaluation of
Cinnamon Bark Oil
for Use as a Cigarette Ingredient**

November 2005

INTRODUCTION

Cinnamon bark oil (CAS # 8015-91-6) is currently used worldwide at levels below **5 ppm** in selected cigarette brands manufactured and/or distributed by Philip Morris International. This document is a review of current published toxicology information on cinnamon bark oil abstracted from online toxicity databases.

TOXICITY DATA ON UN-BURNED MATERIAL

The following information was generated from the MICROMEDEX database tool <http://csi.micromedex.com> on November 2nd 2005, unless otherwise indicated.

Overview

Cinnamon bark oil is obtained by steam distillation from the dried inner bark of *Cinnamomum spp*¹. It is used as a medicine for improving appetite and for relieving indigestion². Cinnamon bark oil is a potent fungitoxicant due to the presence of cinnamic aldehyde. The inhalable vapours of the oil are effective in treating respiratory tract mycoses³. It is also inhibitory against many oral bacteria⁴.

As a food flavouring additive, the material has been assessed under the provisions of the *Federal Food, Drug and Cosmetic Act, section 201 (s)*, by the Expert Committee of the USA Flavour and Extract manufacturers' Association (FEMA), to be generally recognized as safe (GRAS) under current conditions of use.

This material appears on the "List of Permitted Additives to Tobacco Products in the United Kingdom" (Department of Health, 2003) at a maximum level permitted for inclusion in cigarettes of 0.1 % w/w tobacco.

Cinnamon bark oil was not mutagenic in the Ames *Salmonella* reversion assay, but it was positive in the *Bacillus subtilis* DNA-repair test⁵. The material has been shown to exhibit strong antimicrobial activity and also to be cytotoxic against Chinese Hamster Cells, causing swelling and atrophy of the cells at 18 µg/ml in an aqueous solution⁶.

¹ <http://www.thegoodscentscompany.com/>, viewed on November 1st 2005.

² <http://healthlibrary.epnet.com/print.aspx?token=af362d97-4f80-4453-a175-02cc6220a387&chunkid=21672>, viewed on November 2, 2005.

³ Singh HB, Srivastava M, Singh AB, Srivastava AK. Cinnamon bark oil, a potent fungitoxicant against fungi causing respiratory tract mycoses. *Allergy Eur. J. Allergy Clin. Immunol.* 50(12): 995-999, 1995.

⁴ Saeki Y, Ito Y, Shibata M, Sato Y, Okuda K, Takazoe I. Antimicrobial action of natural substances on oral bacteria. *Bull Tokyo Dent Coll* 30(3): 129-135, 1989.

⁵ Sekizawa J, Shibamoto T. Genotoxicity of safrole-related chemicals in microbial test systems. *Mutat. Res.* 101(2): 127-140, 1982.

⁶ Inouye S, Abe S, Yamaguchi H and Asakura M. Comparative study of antimicrobial and cytotoxic effects of selected essential oils by gaseous and solution contacts. *The International Journal of Aromatherapy* 13(1): 33-41, 2003.

The following information was generated from the RTECS – Registry of Toxic Effects of Chemical Substances, a database of MICROMEDEX Systems (<http://csi.micromedex.com>) November 2nd 2005.

Health hazard data

Acute toxicity

LD50/LC50 - LETHAL DOSE/CONC 50% KILL

Rat

LD50 - ROUTE: Oral; DOSE: 2650 mg/kg [Food and Cosmetics Toxicology. (London, UK) V.1-19, 1963-81. For publisher information, see FCTOD7. (13,749,1975)]

Rabbit

LD50 - ROUTE: Skin; DOSE: >5 gm/kg [Food and Cosmetics Toxicology. (London, UK) V.1-19, 1963-81. For publisher information, see FCTOD7. (13,749,1975)]

Genetic effects

DNA REPAIR

Bacteria - B Subtilis

DOSE: 200 mg/L [Food and Chemical Toxicology. (Pergamon Press Inc., Maxwell House, Fairview Park, Elmsford, NY 10523) V.20- 1982- (20,527,1982)]

TOXICITY DATA ON BURNT MATERIAL

Data on the toxicity of cinnamon bark oil after combustion has been evaluated in a series of studies. The results of these studies may be found in the following references:

R.R. Baker et al., 2004, “An overview of the effects of tobacco ingredients on smoke chemistry and toxicity”, Food and chemical toxicology, 42S:53-83. ****PEER REVIEWED****

E.L. Carmines, 2002, “Evaluation of the Potential Effects of Ingredients Added to Cigarettes. Part I: Cigarette Design, Testing Approach and Review of Results” Food and Chemical Toxicology, 40:77-91. ****PEER REVIEWED****

K. Rustemeier et al, 2002 “Evaluation of the Potential Effects of Ingredients Added to Cigarettes Part II. Chemical Smoke Composition” Food and Chemical Toxicology, 40:93 - 104. ****PEER REVIEWED****

Roemer et al., 2002 “ Evaluation of the Potential Effects of Flavor Ingredients Added to Cigarettes. Part 3. In Vitro Genotoxicity and Cytotoxicity” Food and Chemical Toxicology, 40:105-111. ****PEER REVIEWED****

P.M. Vanscheeuwijck et al, 2002 “ Toxicological Evaluation of Cigarettes without and with the Addition of Flavor Ingredients to the Tobacco. Part 4. Subchronic Inhalation Toxicity” Food and Chemical Toxicology, 40:113-131. ****PEER REVIEWED****

These studies indicate that chemicals used in the production of cigarettes do not increase the overall toxicity of cigarette smoke.

CONCLUSION

Cigarette smoking causes lung cancer, heart disease, emphysema and other serious diseases in smokers. Smokers are far more likely to develop serious diseases, like lung cancer, than non-smokers. There is no "safe" cigarette. Government health warnings about smoking apply to all cigarettes, regardless of the ingredients added, including those containing only tobacco and paper.

While Philip Morris International has not conducted human studies on the health effects of ingredients used in cigarette manufacture, studies have been conducted using scientifically accepted in vitro and in vivo toxicity assays with various ingredient mixtures (see Toxicity Data on Burnt Material above). These studies show there is no meaningful difference in the composition or toxicity of smoke when the smoke from cigarettes with added ingredients is compared to the smoke from cigarettes without added ingredients. These findings are supported by similar studies from the published literature. It is our scientific judgement, based on the best available data, that cinnamon bark oil used in our cigarettes does not increase the overall toxicity of cigarette smoke.