Proposition 65

Interpretive Guideline No. 2012-01

Consumption of Methanol Resulting from Pectin that Occurs Naturally in Fruits and Vegetables

Office of Environmental Health Hazard Assessment

California Environmental Protection Agency

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Summary

Exposure to methanol in foods prepared from fruits and vegetables does not constitute an exposure within the meaning of Proposition 65[1] when the methanol results from pectin that occurs naturally in fruits and vegetables.[2]

Scope of Interpretive Guideline

The Office of Environmental Health Hazard Assessment (OEHHA) may issue an Interpretive Guideline that interprets Proposition 65 and its implementing regulations, as applied to specific facts. The Interpretive Guideline reflects OEHHA's scientific interpretation of the available information as the lead agency for implementation of the Act.[3]

Methanol was listed as a chemical known to cause reproductive toxicity under Proposition 65, effective March 16, 2012.[4] This interpretative guideline applies only to methanol that is present in food as the result of enzymatic hydrolysis of naturally occurring pectin in fruits and vegetables. It does not apply to methanol that results from the intentional addition of pectin in the production or processing of food, or to non-food exposures.

Methanol from fruits and vegetables

Methanol occurs naturally in fruits and vegetables.[5] Methanol is also formed when fruits and vegetables are physically prepared for consumption by methods that include, but are not limited to, slicing, chopping, pureeing and juicing.[6,7] Table 1 below shows some of the concentrations of methanol that have been reported in various vegetables, fruits and juices. The production of free methanol in all these instances is the result of hydrolysis of methylesters in pectin, a principal component of plant cell walls and the

[1] Safe Drinking Water and Toxic Enforcement Act of 1986, Health and Safety Code section 25249.5 *et seq.* Referred to herein as "Proposition 65" or "the Act."
[2] Title 27, Cal. Code of Regs., section 25501 *et seq*.
[3] Health and Safety Code section 25249.12
[4] California Proposition 65 list of chemicals known to cause cancer and reproductive toxicity. Most recent list is available at: http://www.oehha.ca.gov/prop65/prop65_list/Newlist.html
[5] World Health Organization (1997). Environmental Health Criteria 196 Methanol. International Programme for Chemical Safety, World Health Organization, Geneva. ISBN 92 4 157196 9.
[6] Anthon GE and Barrett DM (2010). Changes in pectin methylesterification and accumulation of methanol during production of diced tomatoes. Journal of Food Engineering 97:367-372.
[7] Lund ED, Kirkland CL and Shaw EW (1981). Methanol, Ethanol and Acetaldehyde Contents of Citrus Products. J. Agric. Food Chem. 29:361-366.

middle lamella between them, by the enzyme pectin methylesterase.[6] Pectin will break down to methanol when the plant cell walls and middle lamellae are disrupted, as can happen through physical processes of food preparation. This allows pectin methylesterases to reach the pectin that otherwise is generally unavailable to the enzymes.

Table 1. Reported concentrations of methanol in vegetables, fruits and juices

Product	Concentration (ppm)	Reference
Dried beans	1.5 – 7.9	WHO 1997[5]
Split peas	3.6	WHO 1997[5]
Lentils	4.4	WHO 1997[5]
Fresh orange juice	11 - 80	Lund et al. 1981[7]
Canned orange juice	12 - 60	Lund et al. 1981[7]
Fresh grapefruit juice	13 - 40	Lund et al. 1981[7]

Methanol is also produced when pectin is broken down by microorganisms in the digestive tract, after fruits or vegetables are eaten.[8] It has been reported that apples contain approximately 1% pectin, and that consumption of one kilogram of apples typically results in release of 0.5 grams of methanol in the human body.[7] Because the pectin methylesters in fruits and vegetables will break down to produce methanol either during food preparation or during subsequent digestion, the total amount of methanol released from consumption of chopped or otherwise physically prepared fruits and vegetables is not expected to be higher than the level that results from consumption of the equivalent amount of unprepared fruits or vegetables. Methanol is readily absorbed from the gastrointestinal tract.

Treatment of naturally occurring chemicals in foods under Proposition 65

Section 25501 of the Proposition 65 regulations addresses the occurrence of chemicals that are naturally occurring in food and that are also listed as known to cause cancer or reproductive toxicity under the Act:

[8] Lindinger W, Taucher J, Jordan A, Hansel A and Vogel W (1997). Endogenous Production of Methanol after the Consumption of Fruit. Alcoholism: Clinical and Experimental Research 21(5):939-943.

> "Human consumption of a food shall not constitute an 'exposure' for purposes of Section 25249.6 of the Act to a listed chemical in the food to the extent that the person responsible for the exposure can show that the chemical is naturally occurring in the food."[9]

Under this regulation, ingestion of listed chemicals that are naturally occurring in food is not considered to be an exposure and therefore is not subject to Proposition 65 warning requirements. The Final Statement of Reasons for the regulation explains the basis for this regulation. For example,

> "Chemicals which are currently subject to the requirement of warning prior to exposure include several chemicals which are naturally occurring constituents of food. The Act does not differentiate between exposures to naturally occurring chemicals and exposures to chemicals added by man. However, due to the abundance of foods which in their natural unprocessed state inherently contain low levels of carcinogens or reproductive toxicants, warnings could appear on a large number of food products, and consequently, diminish the overall significance of food warnings."[10]

> "…[T]he rationale for this special treatment of food is the historical desire to preserve naturally occurring foods in the American food supply, despite the presence in those foods of small amounts of potentially deleterious substances, as well as a recognition of the general safety of unprocessed foods as a matter of consumer experience…this exemption is derived from the distinction in state and federal food adulteration laws between naturally occurring substances in food and those which are added substances."

The intent of the naturally occurring regulation is to exempt from the provisions of Proposition 65 exposures to those chemicals that occur naturally in food. It is limited to levels of these chemicals that occur in the food without addition by human activity and only when the exposure to the chemicals occurs by consumption of food.

[9] Title 27, Cal. Code of Regs., section 25501(a)
[10] Final Statement of Reasons for Sections 25501-25504 (Formerly 12501 – 12505). Available at http://www.oehha.ca.gov/prop65/law/pdf_zip/12501_12504FSORJune1989.pdf.

Methanol as naturally occurring under Proposition 65

Methanol formation in fruits and vegetables that contain pectin is unavoidable. The consumer absorbs the methanol that is formed when fruits and vegetables are prepared for consumption, via digestion after the unprepared fruit or vegetable is eaten, or by some combination of these processes. Based on the available information, there is expected to be no meaningful difference in this regard between consumption of prepared and unprepared fruits and vegetables. Thus, methanol that is the by-product of naturally occurring pectin in the food is not considered an exposure under Section 25501. This applies to consumption of both unprepared and prepared fruits and vegetables. This Interpretive Guideline will remain in effect until it is withdrawn or modified by OEHHA.[11]

[11] Title 27, Cal. Code of Regs., section 25203(e)