Licorice extract, powder

Botanical Source	Glycyrrhiza glabra
Synonyms	LICORICE EXTRACT, SPRAY DRIED; LICORICE POWDER
IUPAC Name	
CAS Reference	68916-91-6 84775-66-6
E Number	

Food Legislation

Council of Europe (CoE)	
Number	Comment
218	Listed by the Council of Europe as acceptable for use in food.

US Food and Drug Administration	
Number	Comment
184.1408	Approved by the US FDA. FDA 21 CFR 184.1408

Joint FAO/WHO Expert Committee on Food Additives (JECFA)		
Number	ADI	Comment
-	-	-

FEMA	
FEMA No.	Comment
2629	Generally recognised as safe as a flavour ingredient:GRAS List Number 3

Natural Occurrence and Use in Food
Found in licorice; used in candy, baked goods, meat products.

Estimated Intake from Food and Drink	
Daily Intake mg/kg/day	FEMA Possible Average Daily Intake mg
0.03997	470.804

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Tobacco Product Related Chemical and Biological Studies for Ingredients Added in a Mixture

Smoke Chemistry		
Published Source	Level Tested %	Comment
BAT	2.00000	At maximum application level this ingredient is not associated with significant increases in levels of Hoffmann analytes in smoke.

Ames Activity		
Published Source	Level Tested %	Comment
BAT	2.00000	Within the sensitivity and specificity of the system the Ames activity of the cigarette smoke condensate was not increased by the addition of the ingredient.

Micronucleus		
Published Source	Level Tested %	Comment
BAT	2.00000	Within the sensitivity of the in vitro micronucleus assay the activity of the cigarette smoke condensate was not increased by the addition of the ingredient.

Neutral Red		
Published Source	Level Tested %	Comment
BAT	2.00000	Within the sensitivity of the test system the in vitro cytotoxicity of the cigarette smoke condensate was not increased by the addition of the ingredient.

Inhalation		
Published Source	Level Tested %	Comment
BAT	2.00000	The results indicate that the addition of the ingredient had no discernible effect on the inhalation toxicity of mainstream smoke.
Lorillard	2.00000	The results indicate that the addition of the ingredient had no discernible effect on the inhalation toxicity of mainstream smoke.

Mouse Skin Painting		
Published Source	Level Tested %	Comment
Lorillard	1.80010	None of the changes appeared to be substantial enough to conclude that the tumour promotion capacity of the condensate was discernibly different between condensate produced from cigarettes with the ingredient in comparison with condensate from cigarettes without the ingredient.

References

Baker RR, Pereira da Silva JR, Smith G. The effect of tobacco ingredients on smoke chemistry. Part I: Flavourings and additives. Food Chem Toxicol. 2004; 42 Suppl:S3-37.

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Gaworski CL, Dozier MM, Heck JD, Gerhart JM, Rajendran N, David RM. Brennecke LH, Morrissey R. Toxicologic evaluation of flavor ingredients added to cigarette tobacco: 13 week inhalation exposures in rats. Inhal. Toxicol. 1998; 10:357-381

Gaworski CL, Heck JD, Bennett MB, Wenk ML. Toxicologic evaluation of flavor ingredients added to cigarette tobacco: skin painting bioassay of cigarette smoke condensate in SENCAR mice. Toxicology. 1999; 139(1-2):1-17.

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Tobacco Product Related Chemical and Biological Studies for Ingredients Tested Singly

References
Baker RR, Bishop LJ. The pyrolysis of non-volatile tobacco ingredients using a system that simulates cigarette combustion conditions. J. Anal. Appl. Pyrolysis 2005, 74, 145-170.
Carmines EL, Lemus R, Gaworski CL. Toxicological evaluation of licorice extract as a cigarette ingredient. Food Chem Toxicol. 2005; 43(9):1303-1322.

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Toxicological Data on the Unburnt Ingredient

[+ve, positive; -ve, negative; ?, equivocal; with, with metabolic activation; without, without metabolic activation]

In vitro

Test system	Test conditions	Endpoint	Activation status	Results	Reference
Mouse lymphoma cells	No experimental details given, reported only as an abstract	Mutation	With and without S9	+ve	Heck et al. 1989 (abstract only)
Salmonella typhimurium strains TA98, TA100, TA1535, TA1537 and TA1538	No experimental details given, reported only as an abstract	Mutation	With and without S9	-ve	Heck et al. 1989 (abstract only)
Salmonella typhimurium strains TA98, TA100	Water and methanol extracts of "Kanzo" (*Glycyrrhizae radix*). 10 mg extract/plate, tested using the preincubation method.	Mutation	With and without S9	-ve (limited study as only two strains tested)	Morimoto et al. 1982
Salmonella typhimurium strain TA100	Antimutagenic activity of an aqueous extract was tested at 50-500 ug/plate against nitrosamines (known mutagens).	Antimutagenicity	With and without S9	Extract reduced potency of known mutagens [protective effect]	Ikken et al. 1998

	Text also cites a submitted paper [not identified in searches] by the same group where this extract was tested for mutagenic potential.	Mutation		-ve (limited study as only one strain was tested)	
Salmonella typhimurium strain TA100	An ethanolic extract of licorice at up to 2 mg/plate was tested for its ability to reduce the activity in Ames tests of a known mutagen. Text also cites a submitted paper [not identified in searches] by the same group where this extract was tested for mutagenic potential	Antimutagenicity Mutation	With S9	The licorice extract reduced the mutagenic activity of a know mutagen. -ve (limited study as only one strain was tested)	Ikken et al. 1999
Salmonella typhimurium strain TA100	Crude licorice extract ("Ext 348") at up to 4.5 mg/plate was tested for its ability to reduce the activity in Ames tests of a known mutagen.	Antimutagenicity	With S9	The licorice extract reduced the mutagenic activity of a know mutagen in dose-dependent fashion.	Ngo et al. 1992
Salmonella typhimurium strain	Extract of licorice prepared by "infusion,	Antimutagenicity	Without	A 29% decrease in mutagenic	Badria, 1994

TA100	expression and maceration". Tested at 0.1 mg/plate in the presence on a known mutagen (ethyl methanesulfonate) and observed for antimutagenic effect.			potency of the known mutagen. (This was classified as weak activity by the investigator). There is no indication that the extract alone was tested for mutagenicity. A poorly described and limited study.	
Salmonella typhimurium strain TA98 (injected into the mouse peritoneum)	Extract of licorice prepared by "infusion, expression and maceration". Bacteria injected into the peritoneal cavity of the mouse, and the extract given by gavage, apparently at 2 mg [about 60 mg/kg bw]. After 3 hr, peritoneal exudate was plated. The mice were also treated with a known mutagen (aminoanthracene) but details were not given.	Antimutagenicity	Not applicable	A 60% decrease in mutagenic potency of the known mutagen. (This was classified as positive to strong activity by the investigator). There is no indication that the extract alone was tested for mutagenicity. A poorly described and limited study.	Badria, 1994
Bacillus	A rec assay	DNA damage	Without	+ve	Morimoto

subtilis bacteria, strains H17 (rec+) and M45 (rec-)	measuring differential killing, indicative of DNA damage. Water and methanol extracts of "Kanzo" (*Glycyrrhizae radix*) were tested at up to 6 mg/disc.				et al. 1982

References

Badria F A (1994). Is man helpless against cancer? An environmental approach: antimutagenic agents from Egyptian food and medicinal preparations. Cancer Letters 84, 1-5.

Heck J D et al. (1989). An evaluation of food flavouring ingredients in a genetic toxicity screeening battery. The Toxicologist 9, 257 (abstract).

Ikken Y et al. (1998). Antimutagenic effect of fruit and vegetable aqueous extracts against N-nitrosamines evaluated by the Ames test. Journal of Agricultural and Food Chemistry 46, 5194-5200.

Morimoto I et al. (1982). Mutagenicity screening of crude drugs with *Bacillus subtilis* rec-assay and Salmonella/microsome reversion assay. Mutation Research 97, 81-102.

Ngo H N et al. (1992). Modulation of mutagenesis, DNA binding, and metabolism of aflatoxin B_1 by licorice compounds. Nutrition Research 12, 247-257.