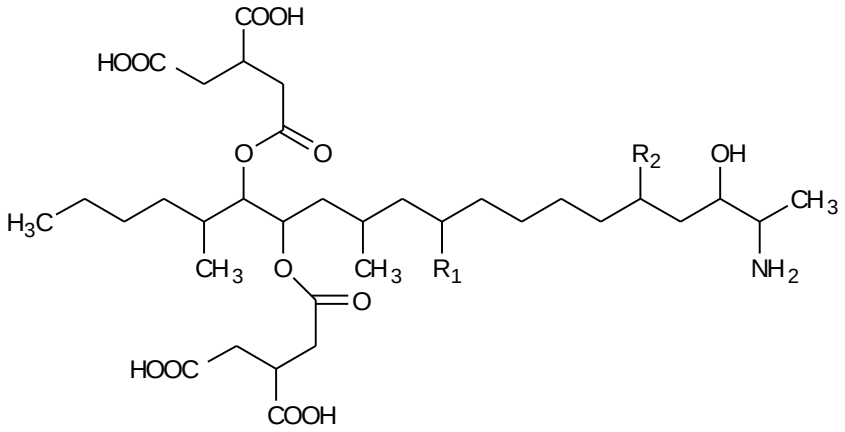
Fumonisin

1. Material Properties

Fumonisin is a mycotoxin produced by fungus of the *Fusarium*. Contamination of mycotoxins, especially in maize, is concerned throughout the world. This mycotoxin was discovered relatively recently (in 1988) and fumonisin A, B, C and P series have been reported so far. Among them, the important ones are B_1, B_2 and B_3 in B series (1).



	R_1	R_2	Molecular formula	Molecular weight
Fumonisin B_1	OH	OH	$C_{34}H_{59}NO_{15}$	721.83
Fumonisin B_2	H	OH	$C_{34}H_{59}NO_{14}$	705.83
Fumonisin B_3	OH	H	$C_{34}H_{59}NO_{14}$	705.83

2. **Toxicity** (from the On-line manual for the diagnosis of livestock poisoning (2))

2.1 Livestock poisoning symptoms

The leukoencephalomalacia of horses presents clinical symptoms such as apathy, frailty, anorexia, constipation and jaundice. Liver damage elevates serum AST, GGT, LDH activities and total bilirubin concentration. Pathologically, changes in the brain and liver are drastic.

The leukoencephalomalacia of swine is characterized not by the brain lesions but by pulmonary edema and pleural effusion.)

In the experiment which administered fumonisin to calf for a long time, elevation of serum AST and GGT activity, and liver lesions have been observed.

2.2 Mechanism of action

Fumonisin inhibits the biosynthetic pathway of the sphingolipid such as hepatocytes, neurons, renal cells, vascular endothelial cells, which presents poisoning symptoms.

Some reports say that fumonisin impairs the cardiac function and causes cardiovascular abnormality, which is ascribed to pulmonary edema.

Fumonisin impairs the liver function of all the animals.

Swine develops a pulmonary edema when the density in feed exceeds 20 ppm.

2.3 Diagnosis

See the page of fundamentals of diagnosis of poisoning in Livestock Poisoning Diagnostic Manual On-line Version.

3. Contamination of feed

Fumonisin is frequently detected from maize throughout the world in high concentration. Therefore, take due consideration on by-products of maize. The most major contaminating Fumonisin is Fumonisin B_1, followed by B_2 and B_3. Combined pollution with mycotoxin of trichothecene class and with aflatoxin is also found (3).

Contamination is reported from other cereals and vegetables including milo, wheat, soybeans, rice, and asparagus. However, their contamination level is usually lower than that of maize.

4. Analytical method

See http://www.famic.go.jp/ffis/oie/sub3/sub3_mycotoxin.html

5. Regulation status

The regulation values are not set either for feed or food in Japan.

<Risk evaluation by JECFA (4)>

Provisional tolerable daily intake (PMTDI) = 2 μg/kg weight/day

(Simple or compound substance of FB_1, FB_2 and/or FB_3) (2001)

6. Monitoring inspection results in Japan

See http://www.famic.go.jp/ffis/oie/sub2_h21_gaiyou_e.html or http://www.famic.go.jp/ffis/feed/obj/H21FAMIC_monitoring_e.pdf

7. Measures for feed contamination prevention

It is important to prevent fungus from cereals in the stage of land consolidation. After harvest, sufficient drying, storage at appropriate temperatures, and sorting out of cereals in bad conditions are effective measures. The Codex Alimentarius Commission has prepared the "Code of practice for the prevention and reduction of mycotoxin contamination in cereals, including annexes on Ochratoxin A, Zearalenone, Fumonisin and Trichothecene class" (5).

8. Influences to food (livestock) and to human

It is reported that maternal exposure to fumonisins through consumption of highly contaminated maize during early pregnancy is associated with increased risk for neural tube defects (NTDs) of newborn, especially in human populations that rely heavily on maize as a staple. (6)

For livestock products, however, it is reported that little fumonisin B_1 accumulates in edible tissues, except for liver and kidney, carryover of fumonisin into egg has not been found and carryover of fumonisin into milk also does not pose a threat to consumer health. (7)

Provisional maximum tolerable daily intake (PMTDI) evaluated by JECFA is 0.002 mg/kg bw, which is group PMTDI for fumonisins B_1, B_2 and B_3, alone or in combination. (8)

IARC has reported that fumonisin B_1 is possibly carcinogenic to humans (Group 2B). (9)

9. Reference

(1) Food and Agricultural Materials Inspection Center, Association of Feed Analysis Methods. 2009. Methods of Analysis in Feeds and Feed Additives.

(2) National Institute of Animal Health. 2010. On-line manual for the diagnosis of livestock poisoning. http://www.naro.affrc.go.jp/org/niah/disease_poisoning/manual/ochratoxin.html (Accessed 27 May 2012)

(3) Japanese Society for Food Hygiene and Safety. 2010. Encyclopedia of Food Safety.

(4) Ministry of Agriculture, Forestry and Fisheries (MAFF). 2010. Risk Profile of Fumonisin http://www.maff.go.jp/j/syouan/seisaku/risk_analysis/priority/pdf/chem_fumo_nisin.pdf (Accessed 31 July 2012)

(5) CODEX alimentarius. (2003) Code of practice for the prevention and reduction of

Mycotoxin contamination in cereals, including annexes on Ochratoxin A, Zearalenone, Fumonisins and Tricothecenes.
http://www.codexalimentarius.org/input/download/ standards/406/CXP_051e.pdf
(6) Stacey A. Missmer et al., Exposure to Fumonisins and the Occurrence of Neural Tube Defects along the Texas–Mexico Border, *Environ Health Perspect*., 114(2), 237-241 (2006).
(7) K. A. Voss et al., Fumonisins: Toxicokinetics, mechanism of action and toxicity, *Anim*. *Feed Sci*. *Tech*., 137, 299-325 (2007).
(8) JECFA, Safety evaluation of certain food additives and contaminants. WHO Food Additives Series, 47, 103-279 (2001).
(9) International Agency for Research on Cancer (IARC) - Summaries & Evaluations FUMONISIN B_1.
http://www.inchem.org/documents/iarc/vol82/82-05.html