

T-2 toxin and HT-2 toxin

1. Description of substance

T-2 toxin is a trichothecene mycotoxin mainly produced by *Fusarium* molds, and HT-2 toxin is its metabolite (1). Major producing fungi include *Fusarium sporotrichioides*, one of plant pathogens that cause scab mainly in wheat and barley etc., and damages cereals by contamination in the field (2, 3).

Trichothecene mycotoxins are classified into three groups* by structural characteristics, and T-2 toxin and HT-2 toxin are classified into Group A.

Name: T-2 toxin

Molecular formula: C₂₄H₃₄O₉

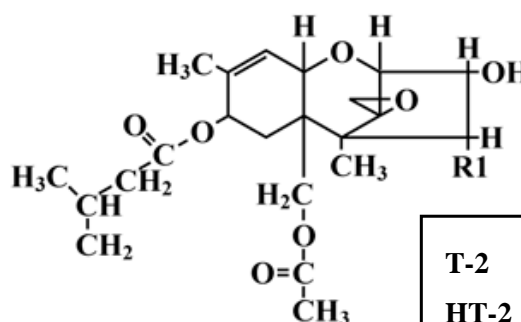
Molecular weight: 466.5

Name: HT-2 toxin

Molecular formula: C₂₂H₃₂O₈

Molecular weight: 424.5

Structural formula



2. Toxicity (from the On-line manual for the diagnosis of livestock poisoning (4))

2.1 Livestock poisoning symptoms

Reduction in feed intake and vomiting appear at the lowest concentration. Moreover, blood disorders such as aleukia (ATA) and aplastic anemia are also observed in addition to gastroenteritis and dermatitis. Also, enhancement or reduction in immune function is observed depending on intake.

2.2 Mechanism of action

Trichothecenes act on serotonin-mediated neurons and induce anorexia and vomiting. In addition, they inhibit the protein synthesis system by binding to the ribosomal 60S subunit, and the effect appears notably in the bone marrow, mucosal epithelia of the digestive tract, and skin, that are regions of active cell division. Moreover, they induce apoptosis in cells in the immune system, and stimulate the production of inflammatory cytokines.

* Groups of trichothecene mycotoxins

Group A: T-2 toxin and HT-2 toxin

Group B: deoxynivalenol, 3-acetyldeoxynivalenol, 15-acetyldeoxynivalenol, nivalenol and fusarenon-X

Group C: roridin A and verrucarin A

2.3 Diagnosis

See the page of fundamentals of diagnosis of poisoning in [Livestock Poisoning Diagnostic Manual On-line Version](#).

3. Contamination in feeds

Natural contamination occurs frequently in mainly cereals cultured in wide areas from mid- to high-latitudes. As for feed materials, they have been detected in maize, wheat, barley, milo, corn gluten feed, corn gluten meal, corn DDGS, and bran. (1, 5)

4. Analysis methods

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

5. Regulatory situation

No standard value etc. is designated in the Codex and in Japan (5); however, T-2 toxin is regulated in many countries in Europe (3).

<Risk assessment by JECFA> (5)

Provisional tolerable daily intake (PTDI) (T-2 or HT-2 individually or in total)
= 0.06 µg/kg bw/day (2001)

LOEL for the change of the white blood cell and the red blood cell count in a short-term toxicity study in pigs (3 weeks)
= 0.029 mg/kg bw/day

6. Monitoring test results etc. in Japan

See http://www.famic.go.jp/ffis/oie/sub2_h23_gaiyou_e.html or
http://www.famic.go.jp/ffis/oie/obj/h23famic_monitoring_e.pdf (T-2 toxin only.)

7. Measures for feed contamination prevention

Trichothecene mycotoxins are highly heat-stable and their toxicity is not reduced by ordinary procedures of processing and cooking; contamination prevention measures at the stage of agricultural production are important.

The Ministry of Agriculture, Forestry and Fishery, Japan, have edited and released the “Guidelines for the reduction of contamination with deoxynivalenol and nivalenol in wheat and barley, etc.” (6) as measures for the prevention of scab to be conducted in the production site by farmers and relevant organizations, etc. In addition, the CODEX alimentarius “CODE OF PRACTICE FOR THE PREVENTION AND REDUCTION OF MYCOTOXIN CONTAMINATION IN CEREALS, INCLUDING ANNEXES ON OCHRATOXIN A, ZEARALENONE, FUMONISINS AND TRICOTHECENES” (7) have been released and efforts by GAP (Good Agricultural Practices), GMP (Good Manufacturing Practices), HACCP (Hazard Analysis Critical Control Point), etc. are recommended.

Calcium hydroxide monomethylamine is effective as a method for decontamination. However, the effect is dependent of water content and temperature. Bentonite and clay exposed to canola oil adsorb T-2 in feeds and suppress absorption in the digestive tract. Hydrated sodium calcium aluminosilicate can prevent harmful effect of micotoxins produced by *Fusarium* fungi to livestock; however, it is not effective in poultry. (5)

8. Effects on foods (livestock products) and humans

There is little knowledge on the persistence of T-2 toxin and HT-2 toxin in milk, meat and eggs. Intake of contaminated cereals, etc. causes vomiting, anorexia and enteritis in humans. Humans are highly sensitive to vomiting by T-2 toxin. While cardiovascular damages are also suggested in addition to damages in hematopoietic organs and immune function in animal experiments, effects on circulatory organs have not reported in humans.

9. Reference

- (1) Y. Konishi and K. Sugiyama. The Risk Assessment of Mycotoxins and Its International Trends, *J. Food Hyg. Soc. Japan*, **49** (1), 1-10, 2008.
- (2) Food and Agricultural Materials Inspection Center, Association of Feed Analysis Methods. 2009. Methods of Analysis in Feeds and Feed Additives.
- (3) Japanese Society for Food Hygiene and Safety. 2010. Encyclopedia of Food Safety.
- (4) 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/trichothecene.html (Accessed 15 Nov 2012)
- (5) Ministry of Agriculture, Forestry and Fisheries (MAFF). 2010. Risk Profile of T-2 toxin. http://www.maff.go.jp/j/syouan/seisaku/risk_analysis/priority/pdf/chem_t2.pdf (Accessed 15 Nov 2012)
- (6) MAFF. 2008. Guidelines for the reduction of contamination with deoxynivalenol and nivalenol in wheat and barley, etc.
- (7) CODEX alimentarius. 2003. Code of practice for the prevention and reduction of Mycotoxin contamination in cereals, including annexes on Ochratoxin A, Zearalenone, Fumonisin and Trichothecenes.