International Mycotoxin Regulations

The Maximum, advisory and guidance levels for mycotoxins on maize, maize products and cereals from the European Union, USA and China are provided below for comparison purposes.

The European Union specifies the following maximum levels for mycotoxins on maize in foodstuffs:

Aflatoxin

- Maize and rice to be subjected to sorting or other physical treatment before human consumption or used as an ingredient in foodstuffs, 5.0 µg/kg (B_1) and 10.0 µg/kg (Sum of B_1, B_2, G_1 and G_2).

Fumonisin

- Unprocessed maize with the exception of unprocessed maize intended to be processed by wet milling, 4 000 µg/kg.
- Maize intended for direct human consumption, maize-based foods for direct consumption, with certain exceptions, 1 000 µg/kg.
- Maize-based breakfast cereals and maize-based snacks, 800 µg/kg.
- Processed maize-based foods and baby foods for infants and young children, 200 µg/kg.
- Milling fractions and other milling products with particle size > 500 µm not used for direct human consumption, 1 400 µg/kg.
- Milling fractions and other milling products with particle size < 500 µm not used for direct human consumption, 2 000 µg/kg.

Deoxynivalenol (DON)

- Unprocessed maize, with the exception of unprocessed maize intended to be processed by wet milling, 1 750 µg/kg.
- Cereals intended for direct human consumption, cereal flour, bran and germ as end product marketed for direct human consumption, 750 µg/kg.
- Processed cereal based baby and baby foods for infants and young children, 200 µg/kg.
- Milling fractions of maize and other milling products with particle size > 500 µm not used for direct human consumption, 750 µg/kg.
- Milling fractions of maize and other milling products with particle size < 500 µm not used for direct human consumption, 1 250 µg/kg.

Zearalenone

- Unprocessed maize with the exception of unprocessed maize intended to be processed by wet milling, 350 µg/kg.
- Cereals intended for direct human consumption, cereal flour, bran and germ as end product marketed for direct human consumption, 75 µg/kg.
- Maize intended for direct human consumption, maize-based snacks and maize-based breakfast cereals, 100 µg/kg.
- Processed maize-based foods for infants and young children, 20 µg/kg.
- Milling fractions and other milling products with particle size > 500 µm not used for direct human consumption, 200 µg/kg.
- Milling fractions and other milling products with particle size < 500 µm not used for direct human consumption, 300 µg/kg.

Ochratoxin A

- Unprocessed cereals, 5 µg/kg.
- All products derived from unprocessed cereals, including processed cereal products and cereals intended for direct human consumption with the exception of food for infants and young children, 3 µg/kg. [1]

The European Union recommends the following maximum levels for Aflatoxin B_1 on products intended

for animal feeds with a moisture content of 12%:

- Complementary and complete feedingstuffs depending on the class and age of the animal, 5 – 20 µg/kg.

The European Union recommends the following guidance levels for mycotoxins on products intended for animal feeds with a moisture content of 12%:

Fumonisin $B_1 + B_2$

- Maize and maize products, 60 000 µg/kg.
- Complementary and complete feedingstuffs depending on the class and age of animal, 5 000 – 50 000 µg/kg.

Deoxynivalenol (DON)

- Cereals and cereal products with the exception of maize by-products, 8 000 µg/kg.
- Maize by-products, 12 000 µg/kg.
- Complementary and complete feedingstuffs depending on the class and age of animal, 900 – 5 000 µg/kg.

Zearalenone

- Cereals and cereal products with the exception of maize by-products, 2 000 µg/kg.
- Maize by-products, 3 000 µg/kg.
- Complementary and complete feedingstuffs depending on the class of animal, 100 – 500 µg/kg.

Ochratoxin A

Cereals and cereal products, 250 µg/kg.
Complementary and complete feedingstuffs depending on the class of animal, 50 – 100 µg/kg.[2][6]

In the USA, the Food and Drug Administration (FDA) actions levels for Aflatoxin in animal feeds vary between 20 µg/kg and 300 µg/kg, depending on the intended use (species of animal). The action level for all commodities intended for human consumption is 20 µg/kg (excluding Aflatoxin M_1 (milk) where the maximum level is 0.5 µg/kg).

Advisory maximum levels for DON in animal feed varies between 5 000 and 10 000 µg/kg in grains and grain by-products and 1 000 to 10 000 µg/kg in the complete diet, depending on the species of animal as well as the percentage portion of the diet represented by the grain. Distillers grains, brewers grains, gluten feeds and gluten meals should not exceed 30 000 µg/kg. [3]

Recommended maximum levels for Total Fumonisins ($FB_1 + FB_2 + FB_3$) in maize and maize by-products used in animal feeds varies between 5 000 µg/kg and 100 000 µg/kg based on the class of animal and proportion of the diet (dry weight basis).

Recommended maximum levels for Total Fumonisins ($FB_1 + FB_2 + FB_3$) in human foods are as follows: Degermed dry milled maize products (e.g. flaking grits, maize grits, maize meal, maize flour with fat content of < 2.25%, dry weight basis), 2 000 µg/kg. Whole or partially degermed dry milled maize products (e.g. flaking grits, maize grits, maize meal, maize flour with fat content of > 2.25%, dry weight basis), 4 000 µg/kg. Dry milled maize bran, 4 000 µg/kg. Cleaned maize intended for popcorn and masa production, 3 000 and 4 000 µg/kg respectively. [4]

In China, the maximum limit for Aflatoxin B1 in maize, maize flour (grits, flakes) and maize products, is 20 µg/kg. The maximum limit for DON in maize and maize flour (grits, flake) is 1 000 µg/kg. Ochratoxin A maximum limits are 5.0 µg/kg for both grains (including maize) and milled grain products which include maize flour (grits, flake). The maximum limit for Zearalenone in maize and maize flour (grits, flake) is 60 µg/kg.[5]

The following information was obtained from the Mycotoxins.info webpage supported by Biomin: [6]

Country	Commodity	Sum of mycotoxins	Limit (μg/kg)
China	Corn processing products, peanut cake (dreg)	Aflatoxin B_1	≤50
	Vegetable fat (except corn oil and peanut oil)		≤10
	Corn oil and peanut oil		≤20
	Other flora feed ingredients		≤30
	Piglet and young bird concentrated feeds		≤10
	Concentrated feeds for broiler ducks at later period, growing ducks, laying ducks		≤15
	Other concentrated feeds		≤20
	Calf and lamb concentrate supplements		≤20
	Concentrate supplements used in lactation period		≤10
	Other concentrate supplements		≤30
	Formula feeds of piglets and young poultry		≤10
	Formula feeds for broiler ducks at later period, growing ducks, laying ducks		≤15
	Other formula feeds		≤20
	Corn and its processed products, DDGS products, corn silage, and corn straws	Fumonisins FB (B_1+B_2)	≤60 000
	Calf and lamb concentrate supplements		≤20 000
	Horse and rabbit concentrate supplements		≤5 000
	Other ruminant concentrate supplements		≤50 000
	Concentrated feeds of swine		≤5 000
	Concentrated feeds of poultry		≤20 000
	Formula feeds of swine, rabbit, and horse		≤5 000
	Formula feeds of poultry		≤20 000
	Formula feeds of fish		≤10 000
	Cereal and its processed products	Ochratoxin A	≤100
	Formula feeds		≤100
	Corn and its processed products (except corn husk, sprayed corn husk, dried corn steep liquor powder)	Zearalenone	≤500
	Corn husk, sprayed corn husk, dried corn steep liquor powder, DDGS products		≤1 500
	Other flora feed ingredients		≤1 000
	Concentrate supplements for calf, lamb, and in lactation		≤500
	Formula feeds of piglet		≤150
	Formula feeds of young sow		≤100
	Other formula feeds of swine		≤250
	Other formula feeds		≤500
	Plant feed ingredients	T-2 Toxin	≤500
	Formula feeds of swine and poultry		≤500
	Plant feed ingredients	Deoxynivalenol (Vomitoxin)	≤5 000
	Concentrate supplements for calf, lamb, and in lactation		≤1 000
	Other concentrate supplements		≤3 000
	Formula feeds of swine		≤1 000
	Other formula feeds		≤3 000
Source: National Standard of the People's Republic of China GB 13078-2017, Hygienical Standard for Feeds			
Japan	Corn	Aflatoxin	20
	Formula feed for cattle (except dairy cattle and calves), pig (except piglet), domestic fowl (except chicken and broiler), quails		20
	Formula feed for suckling period		20
	Formula feed for dairy cattle		10

Japan (continue)	Formula feed	Zearalenone	1 000
	Formula feed (cows over 3 months after birth)	Deoxynivalenol	4 000
	Formula feed (except for cows over 3 months after birth)		1 000
Source: https://www.romerlabs.com/en/knowledge-center/knowledge-library/articles/news/worldwide-mycotoxin-regulations/			
Republic of Korea	Feeds for young calves, dairy, piglet, grower, layer/broiler breeders, milk replacer, fiber source for ruminants and all other diets for young animals.	Aflatoxin B_1,B_2,G_1,G_2	10
	All other compound feeds except premix products		20
	All plant originated materials		50
	All compound feeds	Ochratoxin A	200
	All plant originated materials		250
	All swine diets	Deoxynivalenol	900
	All young ruminant diets		2 000
	All other compound feeds except premix products		5 000
	All plant originated		10 000
	Swine diets for piglet, grower, gilt, gestation, lactation	Zearalenone	100
	All other swine diets		250
	Ruminant diets		500
	All other feeds		1 000
	All plant originated materials		3 000
	Diets for swine, horse and rabbit, milk replacer, pet	Fumonisins	5 000
	Aquaculture		10 000
	Ruminant diets except young calves, fiber diets		50 000
	All other compound feeds except premix products		30 000
	All compound diets	$T\text{-}_2/HT\text{-}_2$	250
	Oat, oat processed materials		2 000
	All other plant originated materials except oat		500
Taiwan, Republic of China	peanut, corn, maize	Aflatoxin B_1,B_2,G_1,G_2	15
	rice, sorghum, legumes, nuts, wheat and barley, oats	Aflatoxin B_1,B_2,G_1,G_2	10
	other foods		10
	maize (raw material)	Aflatoxin B_1,B_2,G_1,G_2	50
	all feedstuffs	Aflatoxin B_1	25-100
Vietnam	foodstuffs	Aflatoxin B_1,B_2,G_1,G_2	10
	foodstuffs	total of other mycotoxins	35
Source: FAO corporate documents repository. Worldwide regulation for mycotoxins in food and feed 2003.			

References:

1. COMMISSION REGULATION (EC) No 1881/226 of 19 December 2006 setting maximum levels for certain contaminants in foodstuffs.
2. COMMISSION RECOMMENDATION 2006/576/EC of 17 August 2006 on the presence of deoxynivalenol, zearalenone, ochratoxin A, T-2 and HT-2 and fumonisins in products intended for animal feeding.
3. FDA Mycotoxin Regulatory Guidance, A Guide for Grain Elevators, Feed Manufacturers, Grain Processors and Exporters, August 2011.
4. http://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/ChemicalContaminantsMetalsNaturalToxinsPesticides/ucm109231.htm.
5. National Food Safety Standard, Maximum Levels of Mycotoxins in Foods, GB 2761-2017.
6. http://www.mycotoxins.info/en/regulations/.