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## UK FLOUR MILLERS BRIEFING DOCUMENT

# T2 and HT2 Mycotoxins

Revised November 2019

### Summary

T2 and HT2 are related trichothecene mycotoxins produced by several fungi of the genus *Fusarium*. They produce mycotoxicosis in a wide range of animals including man. They can be found as natural contaminants in a range of cereals including wheat, barley, oats, maize and rye although in the UK the highest levels are found in oats.

The European Commission has not set legal limits for T2/HT2 in cereals intended for human consumption but instead has issued 'indicative' levels for cereals and cereal-based products. The EC will collect more data on the occurrence of these mycotoxins and will review the situation in 2015.

### Mycotoxins

There are more than 300 recorded mycotoxins, which are substances produced by certain moulds and fungi as secondary metabolites that are toxic to humans and animals at low levels. The main mycotoxins of interest to food safety are the aflatoxins, ochratoxin A, patulin, *Fusarium* toxins (DON, ZON, fumonisins and T-2 & HT-2), alternaria toxins and ergot alkaloids. A **UK Flour Millers** briefing document is available for DON, ZON, ochratoxin A and ergot.

### Occurrence

The mycotoxin T-2 belongs to group A of the trichothecene mycotoxins and HT-2 is a derivative of T-2. They mainly occur in grains such as wheat, barley, oats, rye and maize. In the UK their occurrence is associated with *Fusarium langsethiae*, which is one of the fungi causing *Fusarium* headblight in cereals. The incidence of this species of *Fusarium* fungi is strongly associated with wet and cold conditions during flowering and drier conditions during July and August before harvest.

In the UK HT2 and T2 levels tend to occur at relatively low levels in wheat but at much higher levels in oats. A relatively common mean level in oats is 450 ppb compared to the mean level in wheat which is almost always below the limits of quantification of 20µg/kg (ppb). From 2002-2008, each year approximately 1 - 30% of oat samples exceeded 1000 ppb for HT2+T2 (the annual mean was 16%).

Agronomic factors that impact upon HT2 and T2 in harvested oats were previous crop, cultivation and variety. Analysis of the previous cropping history showed there was a stepwise increase in HT2+T2 as the cereal intensity of the rotation increased. Variety was an important factor with higher levels and a wider range detected on winter compared to spring varieties of oats.

*Fusarium langsethiae* infections do not cause the bleached ears resulting in grains that are pink or white and shrivelled, but instead cause ears with a blotchy appearance.

## Toxicology

Trichothecenes inhibit DNA and protein synthesis, but have no proven mutagen or carcinogenic effects. These toxins mainly affect the digestive system and can cause 'alimentary toxic aleukia' and even lead to death. The trichothecene mycotoxins have potent immunosuppressive activity.

Both T2 & HT2 are able to survive heat and are relatively stable during the baking process.

## Legislation

The principal piece of EU legislation regarding mycotoxins is Commission Regulation (EC) No. 1881/2006, as amended. This Regulation sets out specific rules in relation to mycotoxins and other contaminants and includes specific maximum levels for certain mycotoxins in individual foodstuffs based on their toxicity and their contribution to consumers' diets, as well as on the ALARA principle (As Low As Reasonably Achievable). According to this principle, maximum levels should be set at the lowest level that can be reasonably achieved by food processors and manufacturers using good practices.

There are currently no specific maximum levels for T-2 and HT-2. The European Commission (EC) remains under pressure by some member states to introduce maximum limits for all mycotoxins. In contrast the FSA and the UK cereals sector remain opposed to this and prefer an evidence-based approach. In 2013 the EC set 'indicative' levels and in 2019, proposed a set of draft maximum levels for T2-HT2. The latest proposals are listed below.

	Indicative levels for T-2 + HT-2 (ppb) above which investigations should be made	Proposed maximum levels
<b><i>Unprocessed cereals</i></b>		
Wheat, rye and other cereals	100	50
Barley & maize	200	100
Oats (with husk)	1000	500
<b><i>Cereal grains for direct human consumption</i></b>		
Oats	200	200
Maize	100	50
Other cereals	50	20
<b><i>Cereal products for human consumption</i></b>		
Oat bran and flaked oats	200	200
Cereal bran (except oats)	100	50
Other cereal milling products	50	20
Breakfast cereals	75	20
Bread, pastries, biscuits, cereal snacks, pasta	25	10
Cereal-based foods for infants & young children	15	/

## Testing

As with most mycotoxins, there are three basic methodologies for testing for T2/HT2. These include simple rapid tests that purely indicate the presence or absence of mycotoxins and similar kits which quantify levels present;

**Qualitative lateral flow dipstick methods:** indicates the presence of a specific mycotoxin above a certain threshold.

**Quantitative assay methods:** measures the concentration of a specific mycotoxin. They are available in two formats; Quantitative lateral flow which is suitable when a single determination is required and Micro-titer plate ELISA; suitable for analysing multiple samples.

**Confirmatory analysis:** uses highly developed instruments and trained staff in laboratories with current UK Accreditation Serves (UKAS) status. Its methods are validated against (EC) No 401/2006. This method costs typically £100-125 per test.

## The current situation for UK flour millers

The presence of T2/HT2 has been routinely surveyed as part of the AHDB Contaminants Monitoring project where very low levels of these mycotoxins have been identified in wheat grain samples at harvest. The limit of detection is 10 µg/kg for each of T2 and HT2 and the results for wheat in recent years can be summarised as:

Year	No. of samples	LOD (µg/kg)	% samples above LOD	Mean* (µg/kg)	Median (µg/kg)	Min (µg/kg)	Max (µg/kg)
2011	47	20	0%	10	<20	<20	<20
2012	51	20	2%	10	<20	<20	27
2013	76	20	4%	11	<20	<20	50
2014	75	20	0%	10	<20	<20	<20
2015	75	20	0%	10	<20	<20	<20
2016	51	20	0%	10	<20	<20	<20
2017	50	20	8%	12	<20	<20	64
2018	50	20	12%	14	<20	<20	139
2019	50	20	8%	11	<20	<20	43
2020	50	20	4%	11	<20	<20	50

UK millers do not routinely carry out 'due diligence' testing for these mycotoxins. However, processors of whole grains for human consumption, oat millers and maltsters do so.

Where a number of millers test flour and bran for a suite of mycotoxins, T2-HT2 is often included in this. As such, some data on levels of these mycotoxins in flour and bran is available:

#### *Table of flour and bran data*

These data indicate that the proposed maximum levels would pose a compliance issue for a proportion of UK flour and bran.

#### **Future work**

The EC has requested that all member states should continue to monitor levels of T2/HT2 in all cereals and cereal products. **UK Flour Millers** will continue to monitor and report on the levels detected in wheat from the AHDB Contaminants Monitoring project. It will continue to represent the views of members to the FSA and, through the EFM, to the European Commission.

Given the potential impact the proposed maximum levels will have on flour and bran compliance, **UK Flour Millers** will ask the Commission to consider levels. This case will be made alongside other cereal processor stakeholders.