

Mycotoxins

[Introduction]

Mycotoxin is the generic name of substances that are secondary metabolites of molds and cause acute or chronic physiological or pathological damage to humans, domestic animals, or fish. In addition, poisoning caused by mycotoxins is called mycotoxicosis.

Ergotism by alkaloid, fusarium intoxication, and poisoning by moldy rice etc. have long been known. The most notable accident was mass poisoning deaths of turkeys in Britain in 1960 (Turkey-X disease), which was caused by eating feed that contained Brazilian peanut meal contaminated with aflatoxin.

Mycotoxins that contaminate formula feed and feed material grain include aflatoxin, ochratoxin, zearalenone, deoxynivalenol, nivalenol, fumonisin, T-2 toxin, citrinin, and sterigmatocystin.

FAMIC conducts the monitoring survey of these mycotoxins in feed materials, and mycotoxins have been detected in those as shown below. However, possible contamination in the other feed materials cannot be excluded because only a small number of samples were taken for analysis.

This chapter also contains endophyte-producing toxins ergovaline and lolitrem B.

Mycotoxin	Feed material
Aflatoxin	Corn, milo, cottonseed, cassava, peanut meal, palm meal, sesame meal, soybean meal, pineapple meal
Ochratoxin	Milo, barley, wheat, oats, rye, bran, screening pellets
Zearalenone	Milo, corn, barley, corn gluten feed, corn gluten meal
Deoxynivalenol	Corn, milo, barley, wheat, rye, bran, corn gluten feed, screening pellets
Nivarenol	Corn, milo, rye, barley, wheat, bran, screening pellets
Fumosinin	Corn, milo, barley, rye, corn gluten feed, corn gluten meal, barley bran, bran, corncob meal
T-2 toxin	Corn, milo, corn gluten feed

While liquid chromatography (LC) is the major analysis method for mycotoxins, liquid chromatography- mass spectrometry (LC-MS) or Liquid chromatography- tandem mass spectrometry (LC-MS/MS) including identification of mycotoxins has also been becoming common.

In addition, as for pretreatment, methods that use multifunctional columns are common in the current Feed Analysis standards; however, immunoaffinity columns that have already been adopted in the test method in the Notification of the Ministry of Health, Labour and Welfare, Japan (p.153) is also been examined for feed analysis and is expected to be widely used in the future.

Analysis methods for mycotoxin are still in the process of improvement; therefore it is required to use the best analysis methods at the time.

<<List of mycotoxin analysis methods>>

Table 5-1 lists mycotoxin analysis methods currently listed in the Feed Analysis standards. Also, Table 5-2 classifies mycotoxins by analysis methods.

Table 5-1 List of mycotoxin analysis methods

	Simultaneous analysis of mycotoxins	One-component analysis								
		Simultaneous analysis of mycotoxins (LC-MS/MS)	Simultaneous analysis of aflatoxin (trifluoroacetate derivatization)	Simultaneous analysis of aflatoxin (photochemicalreactor)	Simultaneous analysis of DON/NIV/T2 toxin (LC-MS)	Simultaneous analysis of trichothecene mycotoxins (type B)	Simultaneous analysis of DON/NIV (liquid chromatography)	Simultaneous analysis of fumonisin (LC-MS)	Simultaneous analysis of fumonisin (liquid chromatography)	Simultaneous analysis of ochratoxin A and citrinin
Aflatoxin B ₁	⊙	○	○	○						
B ₂	-	○	○	○						
G ₁	-	○	○	○						
G ₂	-	○	○	○						
Sterigmatocystin	⊙	○								
Zearalenone	⊙	○								
HT-2 toxin	⊙									
T-2 toxin	⊙	○			○					
Neosolaniol	-	○								
Fusarenon-X	-	○				○				
3-Acetyldeoxynivalenol	-					○				
15-acetyldeoxynivalenol	-					○				
Deoxynivalenol	-	○			○	○	○			
Nivalenol	-	○			○	○	○			
Fumonisin B ₁	-							○	○	
B ₂	-							○	○	
B ₃	-							○		
Ochratoxin A	⊙									○
Citrinin	-									○
Ergovaline	⊙									
Lolitre B	⊙									

Note 1) ⊙ indicates a component which has an one-component analysis method; ○ indicates components that can be analyzed simultaneously by a simultaneous analysis method.

2) DON, deoxynivalenol; NIV, nivalenol.

Table 5-2 List of analysis methods for mycotoxins

	TLC	GC	LC	LC-MS	LC-MS/MS	Minicolumn	ELISA
Aflatoxin B ₁	○		○		○	△	△
Aflatoxin (total)			○		○		△
Sterigmatocystin			○		○		
Zearalenone			○	○	○		△
HT-2 toxin				○			
T-2 toxin		○		○	○		△
Neosolaniol					○		
Fusarenon-X					○		
3-Acetyldeoxynivalenol		○					
15-acetyldeoxynivalenol		○					
Deoxynivalenol		○	○	○	○		△
Nivalenol		○	○	○	○		
Fumonisin			○	○			△
Ochratoxin A			○				△
Citrinin			○				

○: Method listed in the Feed Analysis Standards

△: Other method