ABSTRACT

Mycotoxins are a group of naturally occurring toxins that are produced by different filamentous fungi genera such as Aspergillus, Penicillium, Fusarium, etc. The word mycotoxin literally is derived from Greek word “myke” meaning fungus and “toxicum” meaning toxin. These contaminants can develop on different food and feed commodities during different stages including pre-harvest, harvest, and storage. Mycotoxins are of concern because their outbreak result in animal and human diseases and economic losses. It has been estimated that global post-harvest losses are approximately at 50%. Human exposure to mycotoxins is typically through consumption of contaminated agricultural products or indirectly by consumption of animal products containing mycotoxins or their metabolites. The chapter provides the latest information on mycotoxin issues and challenges related to food and feed safety.

INTRODUCTION

Mycotoxins and Their Significance

Mycotoxins are a group of natural occurring toxins that are produced by different filamentous fungi genera such as Aspergillus, Penicillium, Fusarium, etc. (Binder et al., 2007). The word mycotoxin literally is derived from Greek word “myke” meaning fungus and word “toxicum” meaning toxin. These contaminants can develop on different food and feed commodities during different stages including...
Reference on Mycotoxins Occurrence, Prevalence, and Risk Assessment in Food Systems

pre-harvest, harvest and storage. In fact, mycotoxins are a large group of secondary metabolites which are in center of concerns because of their outbreaks in animal and human diseases and economic losses due to their pathologic disorders in plants and animals. It has been estimated that post-harvest losses is globally 50% because of fungal and bacterial infections (Piotrowska, 2014). Mycotoxins consist from various types of toxins that represent numerous and diverse chemical and physical properties. Human are in exposure to mycotoxins directly through consumption of contaminated agricultural products or indirectly by consumption of animal products product containing mycotoxins or their metabolites. When animals consumed contaminated feedstuffs, mycotoxins will be transferred into milk, meat, egg and other products (Bhat et al., 2010).

In addition, mycotoxins generally have a potential resistance against most processes, so the toxins remain in processed food and feed. Ingestion of mycotoxins in high quantities or over a long period of time poses a health threat to consumers. The most affecting mycotoxins in animal feed and food are aflatoxins, ochratoxins, trichothecens, fumonisins and Zearalenone (Armando et al., 2012; Richard, 2007).

The first discovery of aflatoxin was in 1960s when they recognized as toxic substances produced by fungi. Aflatoxins (AFs) can be produced both before and after harvest depending on the environmental conditions. AFs are mostly produced by Aspergillus flavus and A. parasiticus. A. flavus only produce type of B of AFs, however, A. parasiticus produce types B and G (Pitt, Taniwaki, and Cole, 2013). Aflatoxin is classified as class 1 carcinogenic and mutagenic mycotoxin affecting 25% of global crops (Williams et al., 2004; Marin et al., 2013).

Some agricultural products such as peanuts, maize and cottonseed (in the USA) are the most affected products by the Aspergillus species compared to tree nuts, rice, and spices. Aspergillus fungi contaminate peanuts due to insect damage, drought stress and high soil temperature in field (Pitt, Taniwaki and Cole, 2013; Atungulu, Mohammadi-Shad and Wilson, 2018). AFs are commonly found in food crops, particularly maize, groundnuts, oilseeds, and tree nuts, depending on drought stress, rainfall, crop adaptability to weather, pest damage, and agricultural practice (Khlangwiset, Shephard, and Wu, 2011). Aflatoxin can be produced during food storage, transportation, and processing. Humans are mainly exposed to aflatoxin by maize and groundnuts consumption due to susceptibility and high consumption rates of these products (Khlangwiset, Shephard, and Wu, 2011). A. flavus and A. parasiticus contaminate maize and groundnuts by dispersing from soil, organic matter, and alternative hosts to developing commodities. Fungal infection and aflatoxin concentration raise up during crop development when the weather is hot and dry and during maturation/harvesting when the conditions are warm and humid (Kachapulula et al., 2017). One of the most safety hazards in the world is A. flavus and subsequent aflatoxins contamination in peanuts.

Aflatoxin B1 (AFB1) can be formed in a wide variety of water activity and temperature. However, when temperature and water activity are lower than 20 °C and 0.85, respectively, the growth of A. flavus is slow down. The optimum temperatures and water activities for A. flavus growth and subsequent AFB1 production in peanuts are 37 °C and 0.98, 28 °C and 0.96, respectively (Liu et al., 2017). If dairy animals ingested contaminated feed AFB1, after 12-24 hours, AFM1 (the metabolite of AFB1) will be appeared in milk (Sadia et al., 2012; Bilandžić et al., 2016). Different percentage of AFM1 contamination has been found in raw and processed milk in different countries (Li et al., 2017; Sadia et al., 2012; Michlig et al., 2016; Kos et al., 2014; Elzupir and Elhussein, 2010; Mohammadi Shad and Atungulu, 2017). Feeding cows and buffalos with less contaminated feed with AFB1 leads to good quality of milk. AFM1 incidence also depends on weather conditions. It was seen higher incidence of AFM1 in milk collected during cold weather (fall) than warm weather (spring) (De Roma et al., 2017). As it is mentioned, the mold growth on dairy products is a serious problem. The most mycotoxigenic mold grown on cheese is Penicillium
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