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Physical Quality and Mycotoxins in Corn Silo, Used in Dairy Cattle Feeding in Tizayuca, State of Hidalgo, Mexico

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Abstract

The world dairy market currently requires a quality product that is safe for public health. The national production of bovine milk reached 11, 394, 663 liters, of which, 70% is consumed as fluid milk. The livestock production unit (UPP), known as the Tizayuca Agricultural Complex, Hidalgo, Mexico (CAIT), has 25,000 head of bovine milk-producing cattle, Holstein Friesian and Jersey breeds. The cattle feed mainly on maize silo, alfalfa and commercial feed, which are susceptible to contamination by fungi and mycotoxins. In Mexico there is regulation for total aflatoxins in cereals and aflatoxin M1 in fluid milk for human consumption (NMX-F-712, 2005). Therefore the objective of the study was to analyze the physical characteristics of the silo as color, particle size odor, the identification of mycoflora and an analysis of multiple mycotoxins (aflatoxins, ochratoxin A and zearalenone). The study was conducted during the months of March to July in three CAIT stables. Macroscopic characteristics of corn silage were found outside the physical parameters of quality, *Fusarium, Geoctrichum, Phialophora, Mucor, Scopulariopsis, Arthrobotrys, Aureobasidium* and *Aspergillus* and Aflatoxin B1, Ochratoxin A and Zeralelone were identified. The presence of fungi and simultaneous contamination of mycotoxins in the corn silo is concluded.

Introduction

In Mexico, the milk production is the third most important activity (SIAP, 2015). In the year 2015, which reached 11, 394, 633 liters, of which 71.0% of the milk produced is for human consumption as fluid milk.

The Tizayuca Agricultural Complex (CAIT), located in the state of Hidalgo, Mexico, have an animal population of 25,000 head of cattle milk producer, Holstein Friesian and Jersey breeds, is one of the most representative livestock production unit (UPP). The state of Hidalgo has a milk production of 417,750 liters per year, contributing the 3.66% of the national production. The CAIT livestock feed program is based on forage (maize) and alfalfa supplemented with commercial feed. The maize plant is crushed and stored in a silo, which is distributed daily; under the climatic conditions prevailing may cause the development of a mycoflora undesirable such as mycotoxigenic fungi, identified as *Aspergillus flavus* and *Fusarium monliforme*. The content of total aflatoxins in balanced feed and aflatoxin M1 in fluid milk for human consumption is regulated (NMX-F-712, 2005) [1-3].

Within the analytical methods to determine mycotoxins, we select Thin Layer Chromatography technique (TLC) (Official Methods of Analysis of the Association of Official Analytical Chemists (AOAC)) [4].

Material and Methods

Approximately 500g of alfalfa, bales fed to cattle and 500g of maize silage, were collected directly from the silo at three different heights (1.40m, 2.5m and 3.5m), monthly during 5 months (March to July 2016) from stables 120, 189 and 219 at (CAIT). The samples were taken to the Laboratory of Toxicology for analysis [5-8].

Chemical analysis of mycotoxins

The modified Stoloff technique was used. The modification consisted of a smaller sample size (25g) and a longer extraction time (15min) [9]. Identification of mycotoxins was performed under ultra violet light and the fluorescent spots and standards are marked, and the intensity of the fluorescence by crosses (+ light, ++ moderate and +++ marked) is determined.

Identification of fungi

According to Becerril et al. 2013. Briefly the technique consists en sowing in petri dishes with czapek medium, using

the striation technique, under to incubate at temperature of 24 °C, for 11 days. The micro morphological characteristics of the colonies. Characteristics such as colony color, surface appearance, consistency and the presence of exudates. The micro morphological characteristics of the colonies. A drop of lactophenol blue is deposited in the center of an object holder, is observed the optical microscope of clear field to 40x, for the determination of fungi gender [10-12].

Results and Conclusion

Table 1: Analysis of macroscopic characteristics of maize silage.

Characteristics	Result	Remarks
Color	Dark brown (Not uniform in exterior and interior). White Sections.	Material over ripe, air intake. Slow filling of the silo. Presence of fungi.
Odor	Sour alcohol (vinegary).	Acetic fermentation. Wet material.
Texture	Firm.	Adequate processing (compaction), the structures of the original forage and the parts of the plant are appreciated.
Moisture	Does not moisten hands by being compressed inside the cuff.	With a normal pressure the silage is kept loose
Presence of fungi	Positive.	Presence of fungi in more than one section of the silo.
Size of particle	10-15 cmparticle.	
pH	3.6	

The results obtained from the analysis of the physical characteristics of maize ensilage are presented in Table 1. The color of the silage was brownish green and with the presence of mold. This indicates an air intake, a slow filling of the silo. In the case of particle size, the silage was found to have a particle size between 10-15cm, with color dark brown, and white Sections [13]. A presence of fungi, odor sour alcohol (vinegary).

The results obtained from the sowing were the identification of the following fungic genera: *Fusarium*, *Geoctrichum, Phialophora, Mucor, Scopulariopsis, Arthrobotrys, Aureobasidium* and *Aspergillus*. The results obtained from the multiple qualitative analysis of mycotoxins by thin-layer chromatography (TLC) are presented in Table 2. It can be seen that all samples of both maize and alfalfa silage were positive for more than one mycotoxin [14].

Table 2: Análisis cualitativo de micotoxinas por Cromatografía de Cromatografía de Capa Fina (TLC).

Sample	Color	Intensity	Result
Soil	Blue Intense	+++	Aflatoxin B1
	Lemon green	++	Ocratoxin A
1.40m	Blue Intense	+	Aflatoxin B1
	Lemon green	+++	Ocratoxin A
2.5m	Lemon green	+	Ocratoxin A
	Bluish Green	+++	Zeralenone
3.5m	Bluish Green	+	Zeralenone
Compound	Intense Blue	+	Aflatoxin B1
	Intense Blue	+	Ocratoxin A
	Lemon green	+++	Zeralenone

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