Study of the presence of the insecticides malathion and deltamethrin in corn for direct or indirect consumption, harvest 2020

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Introduction

The industrialization of corn is one of the agroindustrial activities that in Argentina generates a high added value, since it allows obtaining a large number of products that are consumed directly or are inputs from other industries. The applications of agrochemicals in the storage of corn grains, cause greater problems of residues in the grains than the applications in the crop. However, in most cases following the recommendations for use, according to GAP, the residues are below the Maximum Residue Limits (MRLs). In Argentina, MRLs are established by SENASA. The insecticides approved for use in grains stored by SENASA, belong to the organophosphate and pyrethroid families. The presence of pesticide residues in products for human and animal consumption might affect their safety, and is one of the aspects of agrochemicals that currently concern the most due to the sensitivity of public opinion regarding the quality and safety of food.

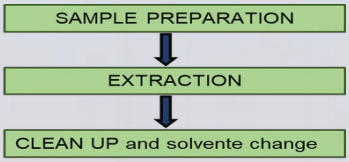
Objetive

The aim of this study is to detect, identify and quantify the presence of insecticides, malathion and deltamethrin in samples of corn grain treated during storage

Materials and methods

Samples: 5 different types of samples were used: untreated corn, corn after 24 hours of application, broken kernels, sieve rejection and marlo rejection. Total number:50.

Treatment samples: A standardized methodology (SANTE/12682/2019.UNE-EN 15662 AENOR) was selected and verified for both active principles in corn samples. The methodology is based on the extraction and purification technique using the dispersive SPE-QuEChERS method and detection by gas chromatography with a negative chemical ionization mass spectrometry detector.



Conditions	GC-MS (NCI) Shimatzu QP2010
Column	SLB®-5ms 60 m x 0,25mm x 0,25µm
Flow	Total 128,4 ml/min
Carrier-ionization gas.	Helium - Methane
Temperature program (T °)	Oven: T° ramp. Inyector: 250 °C. Modo: splitless. Interface: 310°C
Requirements for identification SANTE/12682/2019 Rev. 0	Adquisition SIM. Minimum number of ions: 3 ions with ion ratio ±30% (relative).

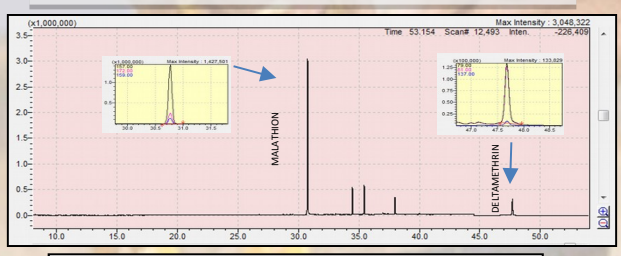
Optimized analytical parameters: The following parameters were evaluated for each analyte: linearity, intraday and interday precision, recovery percentages, detection (LOD) and quantification limits (LOQ).

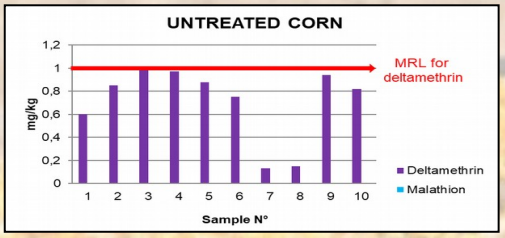
Results and discussion

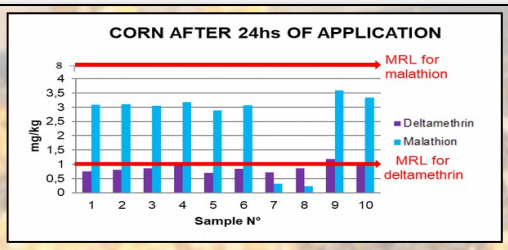
Parameters optimized

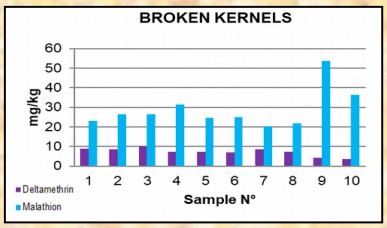
	DELTAMETHRIN	MALATHION
Linear regression analysis	0.01-1.3 mg/kg	0.01 - 0.6 mg/kg
Detection limits (LOD)/ Quantification limit (LOQ)	0.04 / 0.12 mg/kg	0.02 / 0.06 mg/kg
% recovery	95	88
Matrix effect (Quantification)	YES	YES

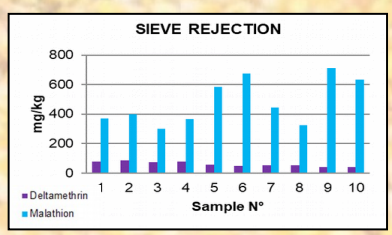
Chromatographic profile in simple corn

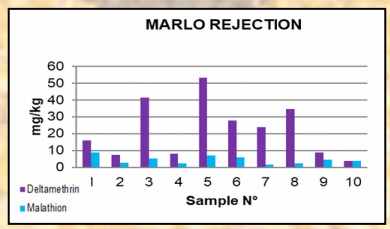












* The analytical methodology complied "*Fit for purpose*" because analytical parameters were aceptable for corn samples after validation.
* In the initial corn samples, the presence of deltamethrin was detected below the MRL, while after the application, deltamethrin and malathion were detected. Only one sample exceeded the value of the established MRL for deltamethrin. Deltamethrin and malathion were detected in the other three types of samples destined for the animal feed industry.

Conclusion

*** The results obtained showed not only the importance of analytical measurements as an instrument for subsequent monitoring insecticide applications in grains destined for human and / or animal consumption but also the importance of monitoring pesticide residues after harvest and grain storage as well.**

*** The presence of higher concentrations of both insecticides in broken kernels, sieve rejection and marlo rejection demonstrated the potencial risk in using them as raw material for balanced feed.**

*** The high concentrations of insecticides detected in broken kernels, sieve rejection and marlo rejection could represent a risk of environmental contamination if they are not properly disposed.**