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Mepiquat natural formation in cocoa commercial products

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Summary: *Mepiquat (MQ) is well-known products commonly used in agriculture as inhibitor of gibberellin biosynthesis. Several studies reported the natural formation of MQ in food heated under dry conditions. In this study cocoa products were analysed with IC-HQOMS to evaluate the presence of MQ.*

Keywords: *IC-HQOMS, Mepiquat, cocoa, chocolate*

Introduction

Chlormequat chloride (2-chloroethyltrimethylammonium chloride, CQ) and mepiquat chloride (1, 1′-dimethylbipyridinium chloride, MQ) are quaternary ammonium growth regulators usually used as chloride salt, which work on gibberellin synthesis inhibition. Several studies reported the natural formation of MQ in foods through a Maillard-type reaction that requires free lysine, a reducing sugar, and an alkylating agent, heated under dry conditions. Trigonelline, choline, and betaine have been identified as possible methylating agents [1,2]. Rarely, also the natural formation of CQ from choline is shown [3].
Theobroma cacao contains several alkaloids: mainly theobromine, caffeine and trigonelline. Moreover, also lysine is present in sufficient concentrations to be able to think that MQ can be produced during the roasting processes or the preparations of derivative products.

Experimental

In this study an IC-HQOMS method for a fast and sensitive evaluation of CQ and MQ was performed.
Cocoa powder and chocolate chips were cooked in oven at 160, 180 and 230 ◦C for 15 and 50 minutes, mimicking cakes, or biscuits cooking. These lab-cooked samples and other 24 representative cocoa commercial samples were extracted adapting the procedure of QuPPe-PO-methods and IC-HQOMS measured.

Results

The formation of MQ occurred both in cocoa and in chocolate drops starting from 180°C. At this temperature, the formation appears to be slow and visible only after 55 minutes of cooking (about 2 µg/kg), while at 230 ° C the formation is extremely faster and at 15 minutes there is already an amount almost equal to that detected at 55 minutes (about 8 µg/kg for cocoa and 7 µg/kg for chocolate drops).
The presence of either analyte was not detected in the commercial samples.

Conclusions

Cocoa can be a natural source of production of MQ, however temperatures and cooking times adopted in commercial processes are not sufficient to determine their formation. On the other hand, it would seem more plausible is the formation of MQ during the home cooking that most reflect what was operated in the laboratory.

References

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