

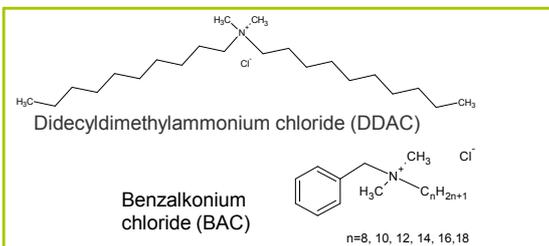
# Residues of Quarternary Ammonium Compounds (QAC) in Fruits and Vegetables

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## Introduction

Quaternary ammonium compounds (QAC) are surface active substances containing a quaternary cationic nitrogen atom, substituted by alkyl chains of varying length. QAC are enriched in cell membranes of living organisms and can impair cell membrane functions. Due to these characteristics, QAC are used as biocides, pesticides, disinfectants and additives for technical applications, furthermore as ingredients in human and veterinary medicinal products and cosmetics.



## Legal aspects

Some QAC have been listed in Regulation (EC) 1112/2002 of the European Union to be assessed as active substances for pesticide use. With Decision 2004/129/EC most of the QAC have not been included in Annex I of Regulation 91/414 of the EU which is now repealed by Regulation (EC) 1107/2009. Therefore, QAC are not authorized for the use in plant protection products within the EU. Only DDAC is approved within Regulation (EC) 1107/2009 as an active substance for plant protection products and authorizations are in place in some EU member states.



As no specific MRLs are established within Regulation (EC) 396/2005 the default MRL of 0.01 mg/kg according to Art (1) (b) of Reg (EC) 396/2005 is in force for residues of QAC in food and feed items listed in Annex I of that Regulation, no matter if the residue is caused by application of biocides or plant protection products.

## Analytical methods

Analysis was performed applying QuEChERS extraction and LC-MS/MS determination (ESI-positive mode) achieving satisfying recoveries.

LC-Conditions:

Column:

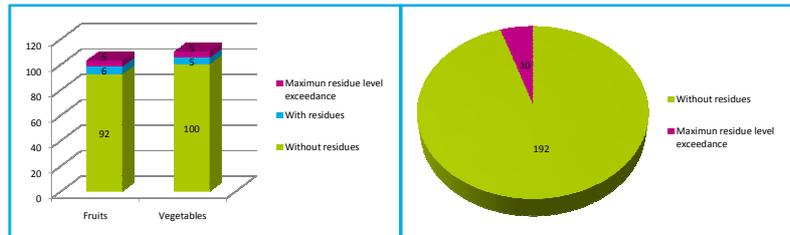
- Phenomenex Synergi 4u Hydro-RP; 150 x 2 mm

Mobile Phase:

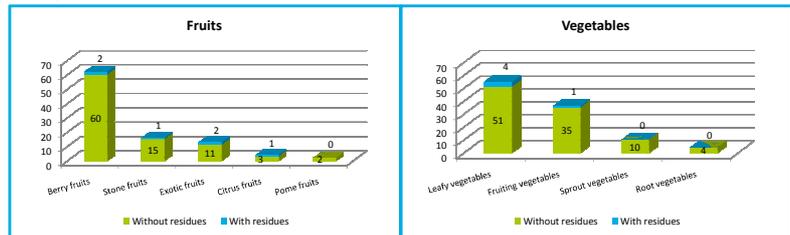
- A: 5 mmol NH<sub>4</sub>formiat in purified Water
- B: 5 mmol NH<sub>4</sub>formiat in Methanol

## Results

Since May 2012 a total of 202 fruit and vegetable samples have been analysed for QAC residues.



6 out of 97 fruit samples (6%) were found to contain residues of QAC, thereof 5 samples with amounts exceeding the default MRL of 0.01 mg/kg. The maximum amount detected was 0.16 mg/kg DDAC in a banana sample. 5 out of 105 vegetable samples (5%) were found to contain residues of QAC, thereof 5 samples with amounts exceeding the default MRL of 0.01 mg/kg and a maximum amount of 0.92 mg/kg detected in a parsley sample. Residue above the MRL were found for DDAC mostly (8 samples), but in 2 samples residues above the MRL were found for BAC.



Conventional as well as organic fruits and vegetables were affected by positive findings and exceeding MRLs. Residues of QAC were found in different food commodities coming from different countries of origin. Therefore a broader use of products containing QAC seems to be in place. A source of residues of QAC might be the use of biocides in food processing such as washing and packaging. Another source especially of residues of DDAC seems to be the use of plant strengthener products containing DDAC. Therefore, the product "Vi-Care" was recently deleted from the official list of plant strengtheners by the German food safety authority BVL. The product is not allowed to be placed on the market in Germany anymore.

## Summary

Residues of the QAC compounds DDAC and BAC have actually been found in a broad variety of fruits and vegetables exceeding the default MRL of 0.01 mg/kg in most cases. Conventional and organic produce was affected likewise. The residues might be caused by using QAC containing disinfection products in food processing like washing and packaging but also by applying plant strengtheners containing DDAC. To avoid exceeding MRLs QAC containing products should not be used either in cultivation nor in food processing.

## Reference

<http://www.cvuas.de>

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