

Case Study 2: Authentication strategy for organic food products

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and Stakeholder Engagement**

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SUMMARY – case study realized within WP3

- ▶ Organic food, legislation, authentication needs
- ▶ Pesticides use – illegal practice in organic farming
- ▶ Pesticide metabolites as markers of the use of plant protection products
- ▶ Application of novel concept in organic foods authentication
- ▶ Impact of the novel solution obtained within the EU-China Safe project

Collaboration:



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Background of the investigation

ORGANIC PRODUCTS DEFINITION - LEGISLATION

Commission Regulation (EC) No 889/2008 laying down rules for the implementation of Regulation (EC) No 834/2007 on organic production and labelling of organic products with regard to organic production, labelling and control.

Organic production means:

- ▶ system of farm management and food production that combines best environmental practices (certification systems),
- ▶ production method in line with the preference of certain consumers for products produced using natural substances and processes.

Note: only production process and conditions are defined – not the product features (composition)!



Organic products authenticity?

Organic food is a rapidly growing market

→ **PRONE TO FRAUD**

- ▶ Economic fraud motivated by the prices of organic products that are significantly higher than conventional ones
- ▶ In globalized world the certification that provides the “added value” of organic products becomes very difficult to guarantee
- ▶ **To ensure the authenticity of foods commercialized as “organic”, robust and accurate methods to support the certification, control and traceability system are needed**



Challenges in organic products authentication



Considerations on which EU-CHINA SAFE project idea was based: → the use of synthetic pesticides is not

permitted (Regulation 2021/1165/EU authorising substances for use in organic production lists few natural compounds which can be use)

BUT it should be noted that organic foods are produced in a world where pesticides are commonly used. Hence, the risk of contamination with pesticides is always there: field, processing, transport,...

For practical reasons, the baby food level 0,01 mg/kg is generally taken as an action level for organic products.

Where the competent authority receives information about the presence of substance that are not authorised or detects such substance in an organic product, it shall:

- immediately carry out an official investigation,
- (provisionally) prohibit the placing on the market of the product as organic



Authentication problem addressed in the project: case study

Growing popularity of 'bio-wines' has raised the demand for control of „organic“ farming practices used in grapes production

As far as residue around 0.01 mg/kg is found, then, question arises:

➔ **Accidental contamination e.g. through atmospheric transport?**

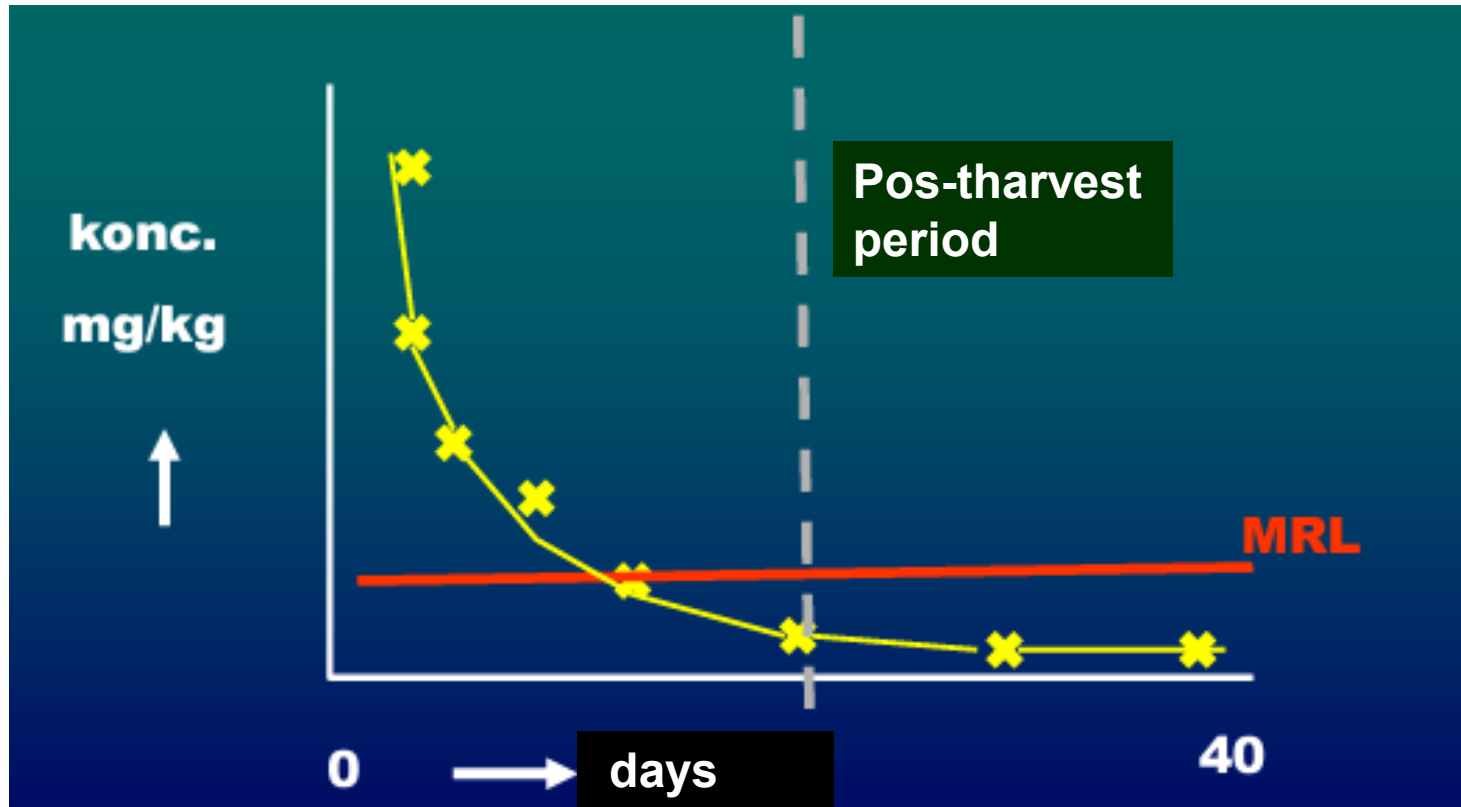
or

➔ **Illegal use of pesticide preparations in vineyard**



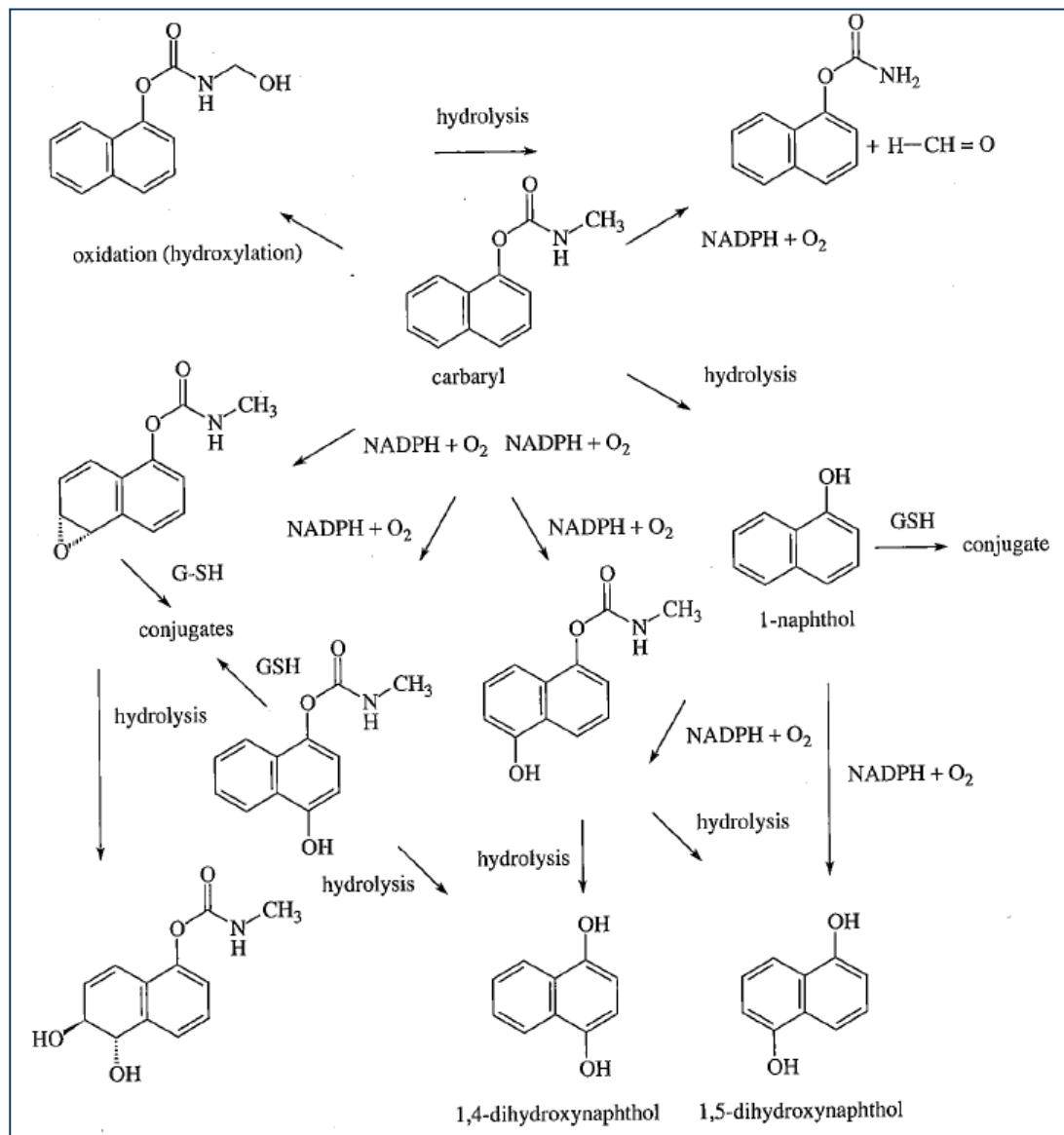
The dynamics of pesticide residues after application

Degradation due to various physico-chemical and biochemical factors

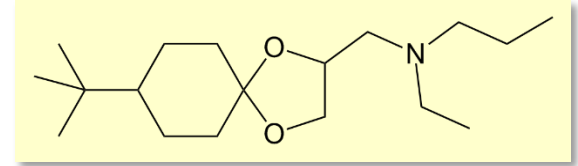
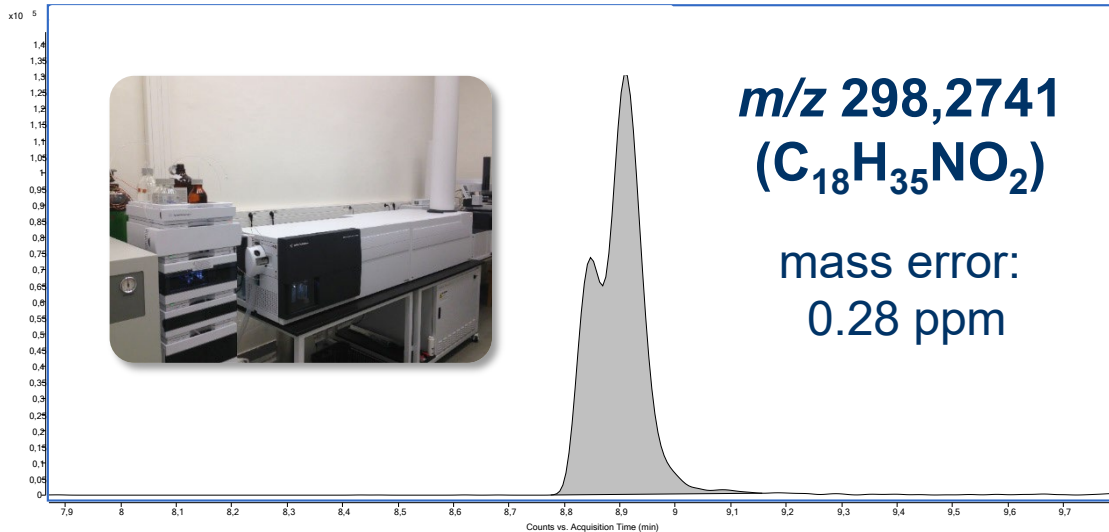


Challenges in pesticide metabolites analysis

- ▶ Number of metabolites originates from parent pesticide → very low conc.
- ▶ Most of them are fairly more polar compared to parent compound
- ▶ The dynamics of individual metabolites origination is not known
- ▶ *Analytical standards are not available*



Pesticide metabolites provide the evidence on exceeding 0.01 mg/kg limit!

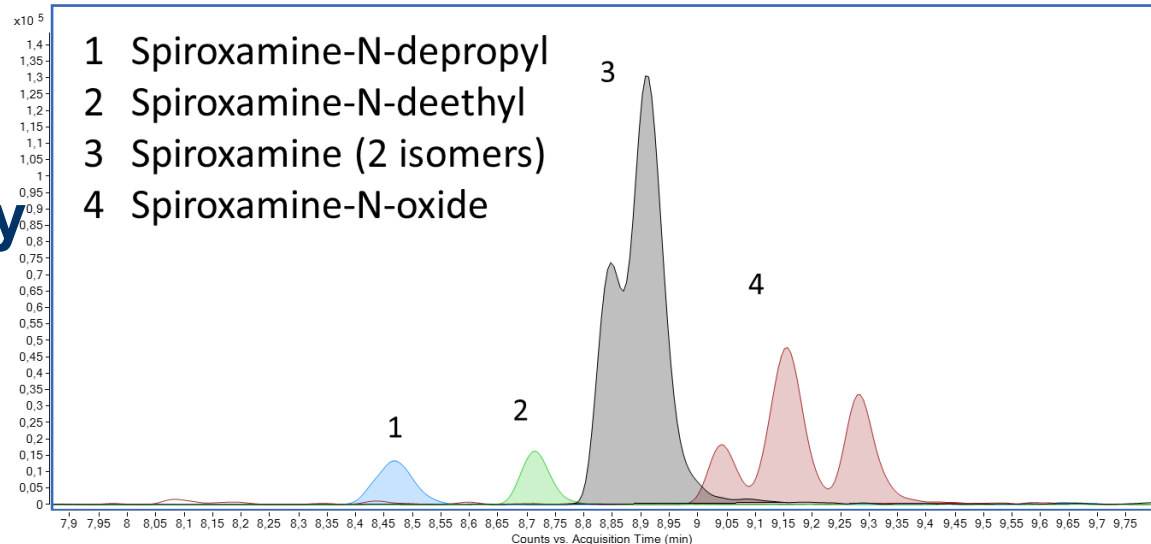


Spiroxamine – 0.01 mg/kg → „BIO“ MLR

1st step ✓

Spiroxamine + metabolites
→ this does not comply with „BIO“ MLR

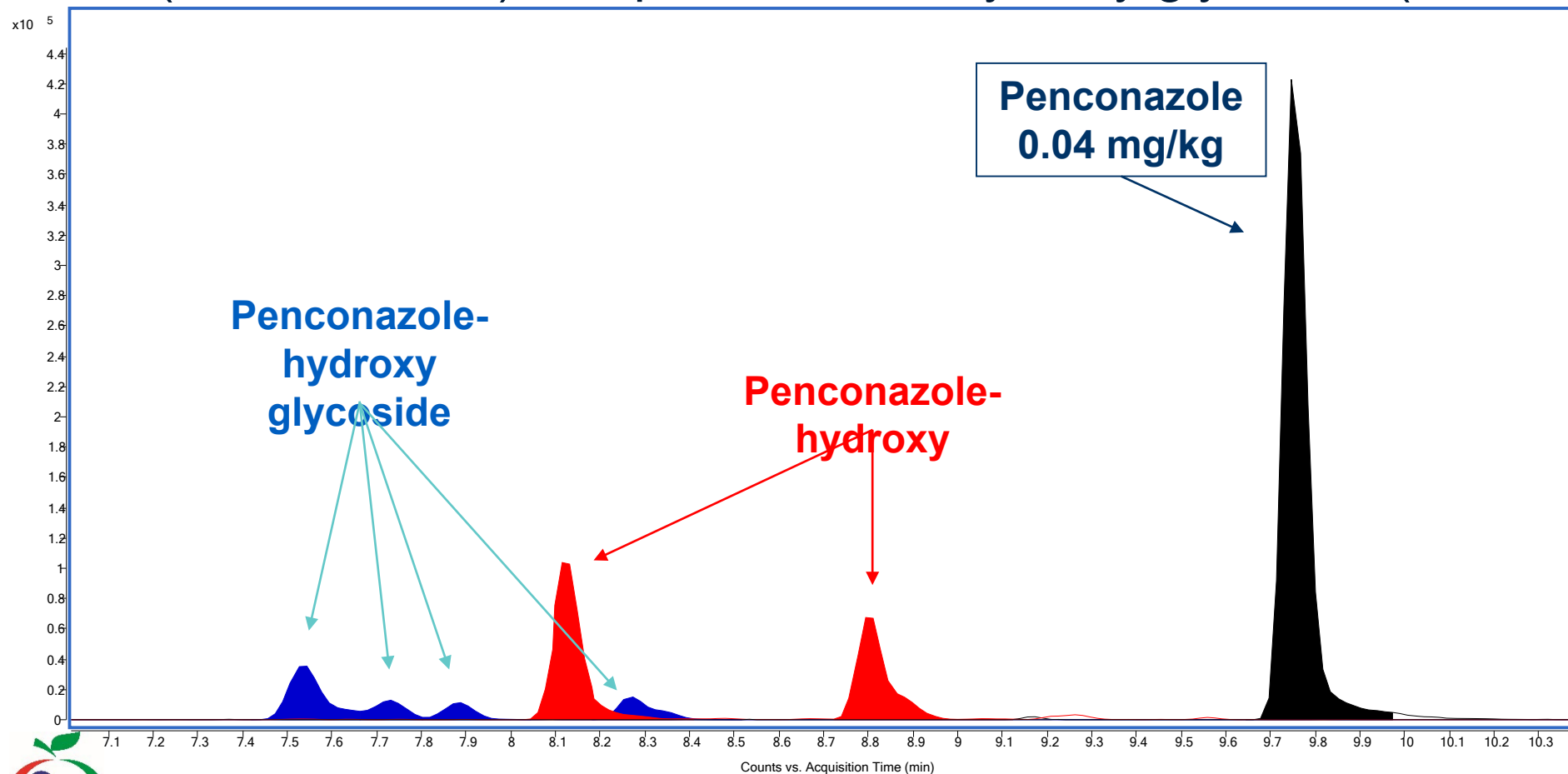
2nd step 



Metabolites of penconazole in grapes – search against extensive spectral library



EIC Penconazole (m/z 284.0721), penconazole-hydroxy (m/z 300.0665) and penconazole-hydroxy glycoside (m/z



ACS award: paper of the month

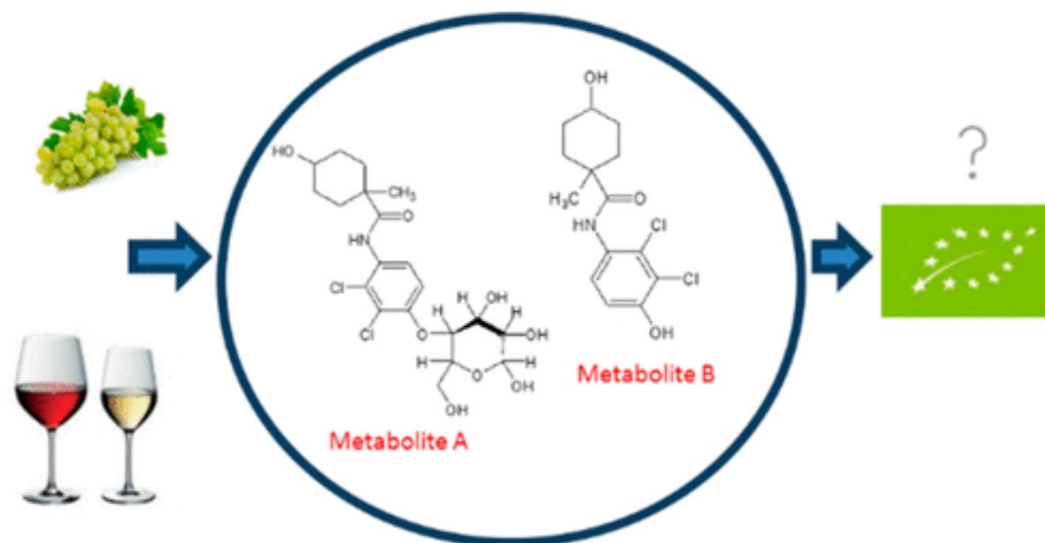
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2019, 67, 22m
6102 - 6115



Can Occurrence of Pesticide Metabolites Detected in Crops Provide the Evidence on Illegal Practices in Organic Farming?

*Schusterova D, Suchanova M, Pulkrabova J, Koourek V,
Hajslova J*



Monitoring of bio-wines at EU market

Samples analyzed for the presence of pesticides and their metabolites using LC-HRMS:

- 28 white bio-wines
- 29 red bio-wines



No pesticide residues / their metabolites detected in 72 % bio wines

- 19% of samples contained detectable pesticide residues together with some of their metabolites
- 7% of samples contained more than one pesticide (parent compound)
- **4% of samples contained only detectable pesticide metabolites**
- 1% of samples contained pesticide residues not registered in EU

The most frequently detected pesticides: fluopyramu, myclobutanilu a tebufenozidu and relevant metabolites:

fluopyram-hydroxy
myclobutanil-hydroxy
tebufenozide-hydrox



Illegal practices?



Conclusions, long term impact



- ▶ The simultaneous LC-MS analysis of parent pesticides and their metabolites represents a promising tool for tracing history of pesticide application on various crops
- ▶ Obtaining the evidence on an unauthorized application of plant protection products in organic production is enabled.
- ▶ This methodology was successfully applied on several food commodities (grapes, wines, apples and citrus fruits)
- ▶ The availability of new authentication strategy will support the credibility of organic crops and contribute to misdeclaration fraud.



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