



Essential Oils and Pesticides: How to face the future with EFEO

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Essential Oils and Pesticides

First Collective action by PASS Cluster

1. Facilitate the decryption of the certificate of analysis.
2. Establish a list of priority pesticides to be searched for in essential oils.
3. Direct users to reference databases to investigate and attempt to justify the results.
4. Create a guide in order to have a common argumentation support adapted to the essential oils sector, and to become a legitimate way of communication and argumentation between a supplier and his client, or between a client and his analysis provider for example.



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What are Pesticides?

- Synonym for plant protection products, or PPP.
- Covering: biocides, herbicides, fungicides, insecticides, acaricides, plant growth regulators, attractants and repellents.
- Contain at least one active substance.
- In Europe, under control of the European Food Safety Authority (EFSA)
- 423 actives substances corresponding to about 4.000 authorized formulations.




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Is the regulation on pesticides identical in Europe and in the rest of the world?



FAO: International Code of Conduct on Pesticide Management: Intent to harmonize but still chaos.

It is therefore common for the same phytosanitary substance to be banned on a given crop by the European Union, and authorized by a country outside the European Union.



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What are we referring to as pesticide residues?

- All the chemical substances resulting from the application of a pesticide
- For some PPP, only the active substance is the residue.
- For others, degradation products and metabolites are also concerned.
- An exact definition of the residue for each pesticide is published on the website of the European Union.



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Is it normal to find pesticide residues in essential oils from organic farming?

- Organic farming excludes the use of synthetic chemical substances
- Everyone expects not to find any pesticide residues in this product range.
- Not always the case. Due to incidental or old contamination
- Rarely associated with a fraud or a non-respect of the mode of organic production.
- As a reminder, organic farming is an obligation of means and not of results.



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Is there a maximum residue limit (MRL) in Essential Oils?

→ Essential oils are not included in the list of foodstuffs for which maximum residue limits have been set by European legislation.

→ In the USA, the Environmental Protection Agency, EPA, has ruled only for citrus derivatives.

→ Setting a MRL is closely linked to the good agricultural practice (GAP).

→ Establishing MRLs for Essential Oils is a highly questionable approach given the production mode, the different extraction techniques, all realized in the four corners of the world. Concentration factor is a key point.

→ Essential Oils enter in very small quantity in food flavors, cosmetics and can be used pure in aromatherapy. Dilution factor is a key point.



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Which pesticides should be sought first in essential oils according to raw materials and geographical origins?

→ 75 priority pesticides, have been identified by the PASS cluster.

→ Impossible to differentiate relevant lists of pesticides according to botanical and / or geographical origins.

→ Some important observations nevertheless can be formulated:

- About every other essential oil is contaminated by at least 1 pesticide.
- Expressed essential oils, such as citrus essential oils, appear to be subject to greater pesticide contamination
- Great diversity, between 50 and 100 molecules
- Sometimes more than 20 different pesticides in one sample.
- Several pesticides detected are banned in the European Union:
- Pesticide concentrations can reach several tens of mg per liter.



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Why do you get different results when you send the same sample to multiple labs?

- List of desired residues: Multi-residue lists can vary from one laboratory to another.
- The definition of the residue for each active substance: the metabolites and pesticide degradation products are not all marketed and can be expensive.
- The performance of the methods used.
- Limit of Quantification, LOQ, or RL for Reporting Limit.
- Limit of Detection.
- LOQ and LOD vary depending on the substance, the analytical technique or the type of sample (Matrix Effect).
- To be relevant and reliable LOQ and LOD must be calculated in the presence of matrix constituents.
- Sampling: Retention period and period of the year, increase the risk of degradation.
- Problematic pesticides.



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What Limit of Detection and Quantification is acceptable in the case of essential oils?

- As there is no MRLs in essential oils, this question remains delicate.
- LOQs of between 0.01 and 0.1 mg per kg can be expected
- Higher values of LOQ may be legitimate for certain substances in particularly complex matrices.



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What to do when several pesticides have been found in an essential oil?

→ Understandable reason for commercial disputes between partners.

→ Get informed about the substances found

- What is its spectrum of action? Insecticide, fungicide?
- Is it coherent with the plant produced
- What is its regulatory status in the country of production?
- Ensure the reliability of results
- Investigate all stages of production cycle to identify risk of cross-contamination,
- Ultimately the decision to refuse or not a batch belongs to the partners.
- No data or scientific studies on the relationship between pesticide residues and the risk of exposure of consumers, is published to date.



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And Now, What to do?

The PASS cluster has now achieved the first collective action and has succeeded in setting:

- A target list of pesticides whose relevance has been confirmed
- 4 Quantitative Methods validated (Mint, Lavender, Orange x2 ...)
- 1 Non targeted qualitative Method (Orange)
- A practical guide of dosage of Pesticides in EO and several publications ongoing

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Second Collective action by PASS Cluster

1. Development of a risk assessment / decision tool support

- Establishing a global cross database including information on
 - Pesticides and
 - Essential Oil typology:
- In order to assess the nature and extent of pesticide contamination in the different type of natural extracts and help to the interpretation and management of results.

2. Analyze the health problems of a sector at the level of the main production area: Lavender in France

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Finally, I would like to insist on the fact that, beyond legislation, our corporate, social, and environmental responsibilities should encourage us to constantly question the quality of raw materials that we produce or trade, and products that we sell.

Our goal will be achieved if we help the industry joining forces for future challenges.



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Non-target analysis of pesticides in EO

The 75 “priority” pesticides...  TOP 5 (recurrence)

75 priority pesticides and metabolites				
2,4,6 TCP	Cyhalothrin λ	 Endosulfan β	Lufenuron	Prochloraz
4,4 dichlorobenzophenone	Cypermethrin	 Endosulfan sulfate	 Malaoxon	Procymidone
Aldrin	DDD, o,p’-	Ethion	 Malathion	Profenodos
Atrazine	DDD, p,p’-	Fenpyroximate	Metalaxyl	Propargite
Azoxystrobin	DDE, o,p’-	Fenpropathrin	 Methidathion	Propyzamide
Bifenthrin	DDE, p,p’-	Fenthion	Omethoate	Prothiofos
Biphenyl	DDT, o,p’-	Fenthion sulfoxide	Paraoxon-methyl	Pyraclostrobin
Bromopropylate	DDT, p,p’-	Fenthion-sulfone	Parathion methyl	Pyrimethanil
Buprofezin	Deltamethrin	Fluazifop-p-butyl	Pendimethalin	Pyriproxyfen
Butralin	Diazinon	Flufenoxuron	Pentachloroanisole	Tebuconazole
Carbaryl	 Dicofol	Fluvalinate-tau	Permethrin	Tetradifon
Carbendazim	Dieldrin	Folpet	Phenylphenol, o-	Thiabendazole
Chlorfenvinphos	Dimethoate	Hexachlorobenzene	Phosmet	Triazophos
 Chlorpyrifos	Diphenylamine	Imazalil	Piperonyl butoxide	Trifloxystrobin
Chlorpyrifos methyl	Endosulfan α	Lindane	Pirimiphos-methyl	Trifluralin

... and 155 others

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Thank you for your attention

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