Air monitoring in PACA Region
genotoxicity of pesticide 'cocktails' 

E. Quivet1, V. Tassistro2, M. Désert1, A. Armengaud3, T. Orsière2

1 Aix Marseille Univ, CNRS, LCE, Marseille, France (contact: etienne.quivet@univ-amu.fr)
2 Aix Marseille Univ, Aixen Provence Univ, CNRS, IRD, IMBE, Marseille, France
3 Air PACA, Regional Network for Air Quality Monitoring of Provence-Alpes-Côte d’Azur, Marseille, France

Context
Chronic exposure to pesticides is suspected to have multiple impacts on human health (hematopoietic cancers, neurodegenerative and fertility disorders…). These pathologies are often considered to result, at least in part, from long-term exposures to compounds whose effects, in terms of physiological disorders, are particularly delayed. Although genotoxic effects of each pesticide have been investigated before market authorization, the genotoxic properties of pesticide mixtures are poorly documented. Indeed, human population are frequently exposed to a combination of chemicals including pesticides, and the contribution of these mixtures to an increase risk of cancer, neurodegenerative and / or fertility disorders should be addressed.

Pesticide monitoring
This work characterizes the genotoxic potential of various mixtures of pesticides defined from atmospheric concentrations of pesticides monitored in 2014 in the French Provence-Alpes-Côte d’Azur Region.

Sampling: 50 pesticides; 120 samples
- high-volume sampler (10 m³ h⁻¹ for 48 h)
  - gas-phase (polyurethane foams - PUF)
  - particle-phase (Total Suspended Particulate ; quartz fibre filter)

Cell culture
Cells: Human bronchial epithelial BEAS-2B
Culture medium: LHC-9 (37°C, 5% CO₂)

Individual pesticides: no to moderate cytotoxic effects after 2-h and 24-h incubation
Pesticides cocktails: moderate to severe cytotoxic effects after 2-h and 24-h incubation
Concentration range to be used in the micronucleus assay: 1.5 to 12.5 µM

Cytotoxicity test
1. WST-1 test: to define the concentration ranges to be tested in genotoxicity

Genotoxicity tests (in vitro)
2. Comet assay: detection of DNA damage
3. Micronucleus test: indication of chromosome damage

Summary of results
Most of the MIX tested induced a positive response in the comet assay, that is primary DNA lesions.
Among the 7 MIX tested, 3 of them clearly induced chromosome losses (MNC+) whereas 2 induced chromosome breakage

Conclusion and outlook
Some pesticide mixtures lead to:
- Primary DNA lesions (Comet Assay) and chromosome damage (Micronucleus).
- Chromosome damage consisted in both losses of whole chromosomes or chromosome breaks.
The results could be used to define pesticides that could be used at the same place in the same period and those that could be carefully used one after the other.

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