

CHAPTER 5

CONTAMINANTS ARISING FROM OIL REFINING

WHEN PURIFICATION GENERATES CONTAMINANTS

Refining vegetable oils removes odours, pigments, unwanted components and impurities, producing oils with more uniform technological characteristics. However, some high-temperature stages may generate process contaminants. The problem is therefore not the same as pollution of the soil in which the crop grows.

The most extensively studied compounds are 3-monochloropropane-1,2-diol (3-MCPD) and its esters, 2-MCPD and its esters, and glycidyl fatty acid esters. These are different substances requiring appropriate analytical methods and toxicological assessments.

THE ROLE OF HIGH TEMPERATURES

Contaminants may form during particular refining stages, especially high-temperature deodorisation. Lipid precursors, chlorine-containing compounds, plant operating conditions and treatment duration all influence their formation. It would be wrong to claim that all refined oils have the same concentrations.

Historically, higher concentrations have been observed in some palm oils and fats; other vegetable oils may also contain these contaminants. Variation between manufacturers and processes makes it essential to base assessments on actual analytical data, rather than treating food categories as homogeneous.

3-MCPD: EFFECTS AND ASSESSMENT

EFSA's assessments have considered particularly the kidney effects and effects on male reproductive function observed in experimental studies. In 2018, EFSA updated the group tolerable daily intake for 3-MCPD and its esters to 2 micrograms per kilogram of body weight per day.

This is a toxicological reference value for exposure, not a legal limit in micrograms per kilogram applying to every food. Groups with high consumption of certain products, particularly in early life, may require specific attention.

GLYCIDYL ESTERS: A DIFFERENT CONCERN

Glycidyl esters can release glycidol during digestion. In EFSA's assessment, glycidol is treated as a genotoxic and carcinogenic substance. Risk management therefore cannot be

reduced to comparison with the tolerable intake established for 3-MCPD: specific consideration must be given to reducing exposure.

Wider toxicological data gaps remain for 2-MCPD. A lack of data proves neither that it is harmless nor that its toxicity is identical to that of 3-MCPD.

INDUSTRIAL AND ANALYTICAL CONTROL

Prevention relies on optimising industrial processes, managing precursors and adopting conditions that reduce formation. Analysis requires validated procedures, often including controlled cleavage or conversion of esters followed by instrumental determination of the relevant products.

Regulation (EU) 2023/915 sets maximum levels for certain categories involving glycidyl esters and 3-MCPD. The applicable version and precise category must be checked, distinguishing oils, fats, infant formulae and other products. Unrefined oil cannot automatically be declared superior in every aspect of health: commercial quality and safety require multiple assessments.

SCIENTIFIC AND REGULATORY REFERENCES

- EFSA (2016), Process contaminants in oils and foods [↗ Source](#)
- EFSA (2018), Updated safety level for 3-MCPD [↗ Source](#)
- Regulation (EU) 2023/915 [↗ Source](#)