

1. WHAT ARE HALOGENATED ORGANIC COMPOUNDS?

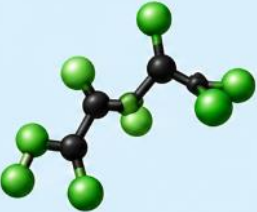
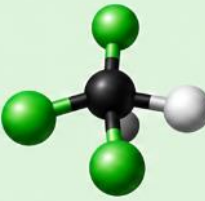
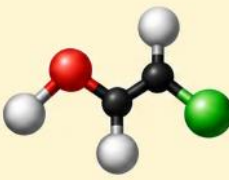
Food may contain measurable amounts of chemicals originating from the environment, processing operations or materials with which it comes into contact. These include certain halogenated organic compounds: an exceptionally broad family of molecules with very different origins, uses and behaviours. Understanding what they have in common, and above all what distinguishes them, is essential to understanding their relevance to food safety.

WHAT DOES 'HALOGENATED ORGANIC' MEAN?

In chemistry, an organic compound is generally a substance built around a carbon framework. An organic compound is described as halogenated when its structure contains one or more halogen atoms bonded to carbon. Halogens are elements in Group 17 of the periodic table: fluorine, chlorine, bromine, iodine and astatine. The first four are the most commonly encountered in compounds of environmental and food-related interest.

The term 'organic' does not mean that a substance comes from organic farming or is natural: it is a chemical classification. Likewise, 'halogenated' describes a molecule's composition, not its hazardousness. A compound may contain a single chlorine atom or many bromine atoms; it may be small and volatile or have a complex structure and low water solubility.

Img 1 – Main families of halogenated organic compounds

Chlorinated paraffins (SCCP, MCCP, LCCP)	Brominated flame retardants (PBDE, HBCDD, others)	Chlorinated solvents (trichloroethylene, tetrachloroethylene, others)	Chloropropanols (3-MCPD, 2-MCPD)
			
• Complex mixtures of many congeners • Persistent in the environment • They can accumulate in organisms	• Various congeners and chemical structures • Used in industrial products • They can be persistent and lipophilic	• Volatile • Industrial uses • Food contamination is often linked to specific situations	• They form during food processing • Present in free form or as esters • Studied mainly in refined oils and some processed ingredients

A CHEMICAL FAMILY, NOT A RISK CATEGORY

There is no single toxicological profile shared by all halogenated organic compounds. Even two molecules containing the same halogen can behave very differently in the environment and in the human body. The positions of atoms within the structure, the number of substituents, the type of bond, molecular mass and other properties all influence volatility, solubility, transformations and biological interactions.

It would therefore be incorrect to claim that all halogenated organic compounds are persistent, that all accumulate in fats or that all cause harm to health. Risk assessments must consider individual substances, sufficiently homogeneous groups or mixtures, using relevant evidence.

WHERE DO THEY COME FROM?

Many halogenated organic compounds are deliberately manufactured for industrial applications: solvents, chemical intermediates, technical fluids, material additives and substances used to reduce the flammability of certain products. Others may form as unwanted by-products of industrial processes or chemical transformations. Some organohalogen compounds are also produced naturally by living organisms and environmental processes; an artificial origin is therefore not a defining characteristic of this family.

The presence of a substance in an industrial facility or product does not automatically mean it will be present in food. Transfer depends on actual emissions and releases, environmental transport, degradation, entry into food supply chains and production or processing conditions.

WHICH GROUPS MATTER FOR FOOD SAFETY?

Families investigated by scientific authorities include chlorinated paraffins, used in various industrial applications, and several brominated flame retardants. In 2020, EFSA published an assessment of chlorinated paraffins in food and feed and has progressively updated its assessments of brominated flame retardants, including in 2026. These examples show that food surveillance focuses on identifiable groups rather than on a generic measurement of all halogenated organic compounds.

Chemically, this broad category also includes many organohalogen pesticides, PFAS, polychlorinated biphenyls (PCBs) and chlorinated dioxins. These families have dedicated sections in the Overorganic library; mentioning them here clarifies the classification without duplicating their treatment. The category also includes halogenated substances that may form during food processing, such as chloropropanols, and halogenated solvents that can cause contamination in particular circumstances.

WHY SOME SUBSTANCES PERSIST AND OTHERS DO NOT

Persistence is a substance's ability to resist transformation and degradation under specified environmental conditions. Some halogenated organic compounds are difficult to break down and may remain in environmental compartments for long periods; others react or degrade more rapidly. The presence of a halogen atom alone is not enough to predict a molecule's environmental fate.

Nor is bioaccumulation — the build-up of a substance in an organism in relation to uptake and elimination — universal. Certain lipophilic substances may accumulate in fatty tissues, whereas others are distributed differently or eliminated more rapidly. Biomagnification, when demonstrated, means that concentrations increase across successive levels of a food chain. It is distinct from merely detecting a contaminant in an organism.

OCCURRENCE, CONCENTRATION, EXPOSURE AND RISK: FOUR DIFFERENT CONCEPTS

Analytically detecting a molecule in food establishes its presence in the sample tested, within the capabilities and limitations of the method used. Concentration measures how much is present, for example in micrograms or nanograms per kilogram of food. Dietary exposure depends both on concentration and on the amount and frequency of food consumption, as well as other potential sources of intake.

Health risk arises from the relationship between exposure and the substance's toxicological properties, taking account of duration, individual susceptibility and scientific uncertainty. Detecting a substance does not necessarily mean that a significant risk exists. Conversely, the absence of a specific maximum level does not establish that a substance is harmless. Similarly, a 'not quantified' result does not guarantee a zero concentration: it may mean that the amount is below the method's limit of quantification.

HOW SCIENCE ADDRESSES SUCH A LARGE GROUP

Assessments by competent authorities combine occurrence data in food, consumption patterns, toxicological properties and degrees of uncertainty. EFSA, for example, examines different families of brominated flame retardants separately, and data availability varies greatly between substances. In its 2026 assessment of emerging brominated flame retardants, the information available for numerous molecules was still insufficient for a complete risk assessment.

Official controls and chemical regulation are essential tools for prevention. However, the substances actually sought in a laboratory depend on the analytical programme, available methods and surveillance priorities. No single test can comprehensively characterise every possible halogenated organic compound in a food sample.

KEY POINTS TO REMEMBER

‘Halogenated organic compounds’ usefully describes a structural feature, but the term is far too broad to indicate a food hazard on its own. To understand an analytical result, it is necessary to identify the substance or family, establish its measured concentration, consider possible exposure sources and consult the available toxicological evidence. The following chapters examine the main contamination pathways and the groups most relevant to food, avoiding generalisations that science cannot support.

SCIENTIFIC REFERENCES

- [1. EFSA \(2026\). Chemical contaminants in food and feed. General overview of food contaminants.](#)
- [2. EFSA CONTAM Panel \(2020\). Risk assessment of chlorinated paraffins in feed and food. EFSA Journal, 18\(3\), 5991.](#)
- [3. EFSA \(2026\). Brominated flame retardants. Topic page, updated 27 July 2026.](#)
- [4. EFSA CONTAM Panel \(2026\). Update of the risk assessment on emerging and novel brominated flame retardants in food. EFSA Journal, 24\(7\), e10187.](#)