

1. WHEN AN ANALYSIS DOES NOT TELL THE WHOLE STORY

Imagine buying a beautiful bunch of grapes. The berries are intact, their colour is appealing, and there are no visible signs of deterioration. Everything suggests a good-quality product.



But there is one question our senses cannot answer: are there residues of substances used to protect the vines against disease?

To find out, we need a specialised laboratory.

Today, analytical chemistry has remarkably sensitive instruments capable of detecting minute quantities of many different substances. In many cases, it is possible to identify the molecule present with precision and measure its concentration.

Yet even a correctly performed analysis can leave a fundamental question unanswered: where did the substance we found come from?

To understand the problem, we need to become familiar with two particular groups of fungicides: dithiocarbamates and phosphonate-based compounds.

Fungicides are substances used in agriculture to prevent or control diseases caused by fungi and fungus-like organisms, including those responsible for downy mildew. They have helped protect numerous crops, reducing production losses and improving the keeping quality of harvested produce.

Their use, however, can leave residues in agricultural products. For this reason, European legislation regulates authorised substances, sets maximum residue levels and provides for food controls.

So far, the picture seems fairly straightforward.

But consider dithiocarbamates.

For many years, one of the main approaches used to test for their residues has involved chemically transforming the sample. Under certain conditions, these substances release a compound known as carbon disulfide, with the chemical formula CS_2 .

By measuring how much CS_2 is formed, the laboratory can obtain an indication of the presence of residues attributable to dithiocarbamates.



There is, however, a complication.

Some vegetables, particularly members of the Brassicaceae family such as cabbage and broccoli, naturally contain sulfur compounds that can also contribute to the formation of CS_2 during analysis.

Consequently, the presence of CS₂ does not necessarily demonstrate that the plant was treated with a dithiocarbamate fungicide.

The laboratory has made no mistake: it has measured what the method was designed to measure. It is the interpretation of that result that requires greater care.

A different but equally interesting situation concerns fosetyl-aluminium and phosphonates.

These substances can give rise to phosphonic acid, a compound that may persist in plants and soil. The difficulty is that phosphonic acid can originate from different sources, including other substances used in agriculture.

Its presence in food therefore does not always make it possible to reconstruct which product was used or when the treatment took place.

It is rather like finding footprints in the sand: we can recognise their shape and measure their size, but we cannot always establish who left them.

This does not mean that analytical tests are unreliable. On the contrary, it means that we must understand precisely what information they provide and what questions require further investigation.

This distinction matters for another reason: detecting a substance, identifying its origin and assessing its health risk are three different tasks.

Assessing risk requires more than knowing that a residue is present. We must consider its toxicity, its concentration, the amount of food consumed and the pattern of exposure.

In the following chapters, we will explore what dithiocarbamates and phosphonates actually are, why they have been used in agriculture, what we know about their effects on health, and the difficulties involved in measuring their residues in food.

Because food safety depends not only on the precision of laboratory instruments, but also on our ability to interpret their results correctly.

1. EFSA (2023). Review of the existing maximum residue levels for dithiocarbamates according to Article 12 of Regulation (EC) No 396/2005. EFSA Journal, 21(5), 7987. [View the EFSA publication](#)
2. EFSA (2021). Reasoned opinion on the joint review of maximum residue levels (MRLs) for fosetyl, disodium phosphonate and potassium phosphonates according to Articles 12 and 43 of Regulation (EC) No 396/2005. EFSA Journal, 19(8), 6782. [View the EFSA publication](#)
3. European Commission (2024). Commission Regulation (EU) 2024/2619 of 8 October 2024 amending Annexes II and III to Regulation (EC) No 396/2005 as regards maximum residue levels for fosetyl, potassium phosphonates and disodium phosphonate. [Read the official text on EUR-Lex](#)