

Product recalls

When chemistry goes unchecked

Andrew Parsons uncovers the science behind product recalls

What is a product recall?

Chemistry is at the heart of everyday products – whether it is the medicine you take, the food you eat or the shampoo you use. But when the chemistry goes wrong, the results can be dangerous. A product recall happens when something for sale in a shop is pulled back due to safety risks.

From contamination and incorrect formulations to unstable compounds or banned substances, chemistry is often the root cause. This is why chemists are essential in spotting what went wrong, using powerful analytical techniques like chromatography or spectroscopy to uncover the truth. Real-life product recalls show how chemistry directly impacts public health and safety, and why getting the chemistry right really matters.

Chemical causes of recalls

One major cause of product recalls is toxicity. For example, lead-based paints have been found in some imported toys. Lead ions, specifically Pb^{2+} , are highly toxic, especially to children.

Incorrect composition is another issue. For example, medicines may contain the wrong concentration of an active ingredient, posing overdose or inefficacy risks. In cosmetics, substances like methanal (formaldehyde, HCHO) or phthalates, which can be irritants and/or disrupt hormone function, may exceed legal limits.

Sometimes, chemical instability leads to spontaneous reactions. Lithium-ion batteries, used in phones and laptops, have been recalled due to thermal runaway – an exothermic reaction caused by internal short circuits.

Case studies

Real-life product recalls reveal just how dangerous poor chemical control can be.

Melamine in baby formula

In 2008 melamine (1,3,5-triazine-2,4,6-triamine), an industrial chemical with a high nitrogen content ($\text{C}_3\text{H}_6\text{N}_6$), was illegally added to baby formula in China to fake higher protein levels. As a result, thousands of infants suffered kidney damage due to melamine crystal formation.

Antifreeze in medicines

In multiple cases worldwide, diethylene glycol (DEG) (Figure 1), a toxic antifreeze chemical, was wrongly added to medicines instead of safer compounds like glycerol. Because they are chemically similar (Figure 2), only advanced analytical techniques can detect the difference.

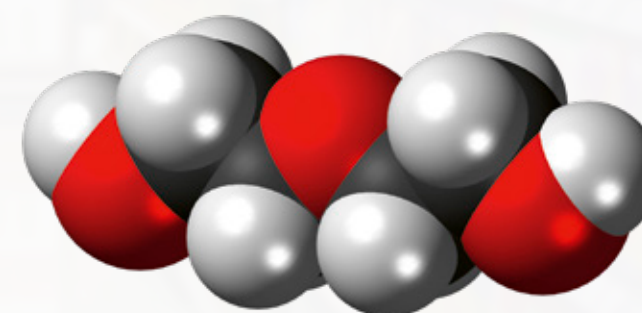


Figure 1 A space-filling model of diethylene glycol (2,2'-oxydiethanol), showing its zigzag molecular shape. Oxygen atoms are shown as red spheres, carbon atoms are black, and hydrogen atoms are grey

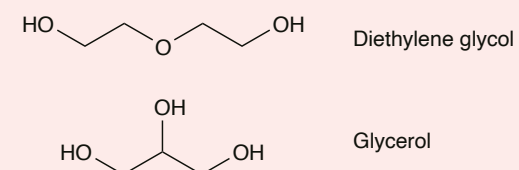


Figure 2 Diethylene glycol ($\text{C}_4\text{H}_{10}\text{O}_3$) and glycerol ($\text{C}_3\text{H}_8\text{O}_3$) both contain multiple hydroxyl groups and have similar structures

Carcinogenic dyes

In the early 2000s carcinogenic Sudan dyes, vivid industrial pigments, were illegally added to spices like chilli powder to boost colour.

Chemical byproducts in drinks

As recently as 2025, Coca-Cola recalled several drinks after high levels of chlorate (chlorate(V), ClO_3^-), a chemical byproduct from water treatment, were found. Chlorate can affect thyroid function and blood oxygen levels.

A toxin in cosmetics

3-(4-*tert*-butylphenyl)-2-methylpropanal, better known as Lilial (Figure 3), was once a superstar ingredient in cosmetics, prized for its sweet floral scent. But behind its pleasant aroma lurked a serious health risk: Lilial was classified as a reproductive toxin and subsequently banned across the EU. This led to widespread recalls starting in 2022, affecting everything from shampoos to deodorants. In early 2025 reports from countries such as Hungary and Italy documented the withdrawal of over 140 products containing Lilial, including items like perfumes and shower gels.

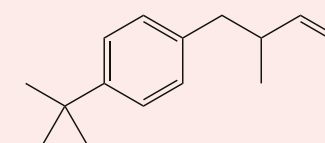
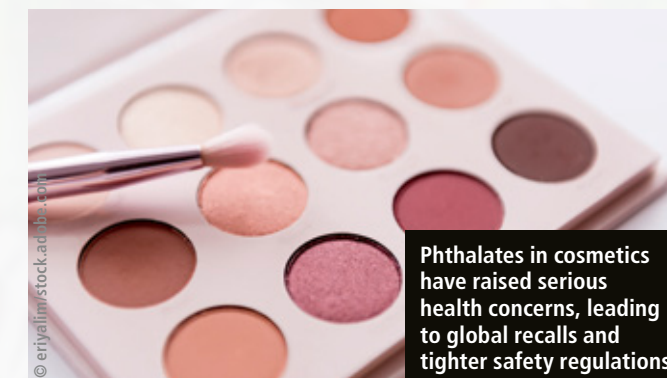


Figure 3 The skeletal structure of Lilial. Only one enantiomer contributes to its signature floral scent, and yet it is typically sold as a racemic mixture because it is cheaper to produce



Phthalates in cosmetics have raised serious health concerns, leading to global recalls and tighter safety regulations

Why this matters

Chemical product recalls are powerful reminders that the theories you learn in the classroom have direct consequences for real-world safety and regulation. When substances are banned or pulled from the market – often due to toxicity or environmental harm – it highlights the critical importance of risk assessment and chemical regulation. These recalls show that chemistry is not just theory – it is essential for protecting people and the planet.

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