Natrium Capital Limited

A NEW FLAKE OF PAINT

The Challenge of Paint Microplastics

Recent research indicates that the degradation of painted surfaces makes Paints and Coatings a contributor to secondary microplastic pollution. Over time, it is likely that this 'new' environmental challenge will be addressed by a combination of regulation, innovation and consumer pressure.

The paints and coatings industry, with origins stretching back millennia, has consistently adapted to public health and environmental pressures, from the phase-out of lead pigments to the adoption of low volatile organic compound (VOC) formulations. Today, the sector faces a less clearly defined challenge: microplastics. Recent estimates suggest that paint microplastics, caused by the abrasion of the surface of paints, may account for approximately 1.9 million tonnes of microplastic emissions annually (source: Earth Action).

Some within the industry question the emission pathways and modelling behind these figures and highlight the sustainable material benefits paint provides. However, this issue is attracting increasing scientific and regulatory attention. The debate now turns to reaching a clearer consensus on the scale of microplastic impact, the mechanisms of particle release and, crucially, whether these emissions pose measurable risks to human and ecological health. The sector may soon face a familiar challenge: maintaining performance while reducing environmental cost.

INTRODUCTION

For millennia, paints have served as tools of communication, decoration and preservation. As societies advanced, so too did the chemistry. What began as mineral pastes has evolved into complex formulations of resins, pigments, solvents and additives.

THE CHEMISTRY OF PAINT

Paint is a liquid or semi-liquid formulation that forms a solid, adherent film upon drying or curing. Beyond aesthetics, it serves as a functional barrier, protecting surfaces from corrosion, UV radiation, moisture and mechanical wear.

Main Components of Paint:

(1) Binders (Film-forming agents)* Polymeric resins that form the continuous film, binding pigments and adhering to surfaces by creating tiny particles suspended in liquid. Examples: alkyd resins, acrylics, epoxy resins, PVA.

(2) Solvents (Carriers) Liquids that dissolve or disperse binders, pigments and additives, adjusting viscosity for application. These evaporate during drying. Examples: water, white spirit, toluene, alcohols.

(3) Pigments (Colour & Opacity) Finely ground solids that provide colour, opacity and sometimes UV resistance. Examples: titanium dioxide, zinc oxide, iron oxide, pthalocyanine green.

(4) Additives (Performance Modifiers)* Enhance specific properties: drying time, flexibility, microbial resistance etc. Present in small but essential quantities. Examples: driers, biocides, plasticisers.

***Main source of microplastics**

Today, paint coats everything from household interiors and road markings to marine vessels and aircraft fuselages. Valued at over $220 billion in 2024, the global paints and coatings industry is not only vast, but deeply embedded across industrial supply chains.

Over the past century, the industry has responded to multiple toxicity and pollution concerns, notably eliminating lead-based pigments, shifting from solvent to waterborne systems and expanding the use of powder coatings. These transitions were driven by a combination of scientific innovation, regulatory pressure and changing consumer expectations and priorities.

Today, a new challenge is emerging: microplastics. As coatings degrade, through flaking, weathering or abrasion, they release tiny polymer fragments into the environment. Based on theoretical modelling, one study suggests that paints may account for over half of all microplastics entering the world's oceans and waterways. Although the evidence of the extent and the harm caused by paint microplastics is only beginning to emerge, microplastics are an issue that the paint industry will need to address going forward.

A CENTURY OF REFORMULATION

To understand how the paints and coatings industry will deal with the increasing issue of microplastics, it is worth examining how it has already evolved. Over the past century, the sector has successfully undergone a series of fundamental transformations, each driven by a combination of innovation, regulatory change and shifting consumer expectations. These changes have not only reshaped chemical formulations, but have also significantly improved the industry's ESG (environmental, social and governance) profile and proven that the industry has the capacity to adapt.

The Phase-out of Lead Paints

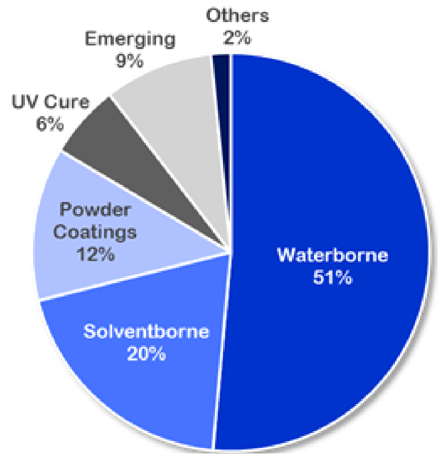
Lead-based pigments, though long known to be toxic, dominated paint formulations for centuries. Their use persisted well into the 20th century, despite health concerns dating back to the 2nd century BC, when the Greek physician Nicander of Colophon first described symptoms consistent with lead poisoning.

By the late 1900s, mounting evidence confirmed lead's severe health risks, especially to children. This spurred regulatory bans: the US prohibited residential use in 1978, the UK in 1992. Although there is still work to be done in eliminating lead in certain paints, safer alternatives such as titanium dioxide are now used in over 90% of white paints.

Solvent to Waterborne Paint

Another major focus has been volatile organic compounds (VOCs). Common in oil-based paints, VOCs act as carriers for polymer binders but evaporate during drying, contributing to air pollution, smog formation and health risks. In response, regulations are increasing pressure on manufacturers to reduce VOC emissions by setting limits on both content and release.

2024 Segmental Analysis of Paints and Coatings



Source: BBC Research in Paints & Coatings Industry Magazine

Waterborne coatings emerged as the solution. Using water as the primary solvent, often over 80% of the carrier phase by volume, these formulations use acrylic or vinyl polymer emulsions to form films as water evaporates. Early challenges included reduced durability and poor adhesion to substrates, but innovations in emulsion chemistry, cross-linking and nanoparticle additives have largely closed the performance gap.

Waterborne paints now dominate the decorative segment, especially in Europe and North America, where VOC caps are strict. Products routinely meet thresholds below 5 g/L, qualifying as 'zero VOC' under UK and US labelling standards. The segment is forecast to exceed $114 billion by 2027, driven by regulatory alignment and growing demand for low-emission, consumer-safe alternatives.

Powder Coatings

Waterborne paints addressed emissions, but not the carbon costs of shipping liquid-heavy formulations. Powder coatings represent a further leap – eliminating solvents entirely. Applied as dry, electrostatically charged particles, they fuse into durable coatings when heated, with no VOC emissions and minimal overspray waste.

Adopted widely in household appliances, automotive parts and metal construction, powder coatings offer high material efficiency, strong mechanical properties and lower hazardous waste. However, their application is largely limited to thermally stable, conductive surfaces, primarily metals and application requires high capital investment.

Powder spraying

THE MICROPLASTICS ISSUE

Microplastics have recently risen up the environmental agenda, prompting growing public concern and a steady stream of headlines. Globally, an estimated 3 million tonnes of primary microplastics enter the environment each year, with a further 5.3 million tonnes of microplastics degrading into secondary microparticles (UNEP, 2018). While their presence is well-documented, the extent of their harm remains uncertain and contested.

INTRODUCTION TO MICROPLASTICS

Definition (EU REACH, 2023)
Solid synthetic polymer particles that are:

- ≤ 5 mm (or ≤ 15 mm if fibrous)
- Solid at ambient temperature
- Insoluble in water
- Non-biodegradable in the environment
- And has ≥ **1% polymer by weight** (either per particle or has a surface coating).

Primary Microplastics
Intentionally manufactured at small scale for commercial use (e.g. microbeads in cosmetics plastic pellets known as 'nurdles').

Secondary Microplastics
Formed through wear, degradation or fragmentation of larger materials (e.g. textiles, tyres and dried paint films).

ARE MICROPLASTICS HARMFUL?

Microplastics have now been detected in human blood, lungs, placentas, reproductive organs and even brain tissue. The combination of widespread exposure, detection in vital organs, known toxicity of certain plastic additives and evidence of inflammation in lab studies is creating concern that microplastics could contribute to chronic diseases over time.

That being said, we don't yet know how microplastics behave inside the body and current studies to assess this vary widely in methods and reliability. **In particular, there is very limited casual evidence to link microplastics to specific health issues and we do not yet know how much exposure is harmful.** The need for more robust evidence has been recognised by the WHO and the European and US Environmental Agencies.

Paints as a Source of Microplastics

Paint Degradation

Though designed for durability, paints and coatings are not immune to wear. Once applied, polymeric binders, typically acrylics, alkyds, epoxies or polyurethanes, form solid films that resist moisture, oxidation and decay. As these coatings degrade, they shed polymer-containing fragments. These polymer fragments are microplastics and are arguably a major contributor to microplastic pollution. A 2022 estimate by Earth Action, based on theoretical modelling, suggests that paint may account for up to 1.9 million tonnes of annual microplastic emissions into the oceans and waterways, with marine paints, architectural and general industrial coatings representing the largest shares. This is equivalent to around 58% of synthetic oceanic microplastics, exceeding contributions from tyres or textiles. The World Economic Forum (WEF) warns the true figure could exceed 2.25 million tonnes, equivalent to 225 billion empty plastic bottles.

Case Studies: Paint as a Microplastic Source

Graffitti

A 2025 journal article in the Oxford Academic highlights various localised measurements of paint microplastic concentrations in the environment:

- German recreational boat facilities were estimated to release 370 million particles annually from antifouling paint.
- Sediments near a graffiti wall in Berlin contained 290,000 microplastic particles per kilogram – the highest terrestrial concentration recorded.
- Surface waters off Japan held up to 4,661 paint-derived particles per cubic metre; microfragments have been found in herring, porpoises, turtles and marine worms.

Industry Position on Paint Microplastics

While some studies point to paint as the dominant source of microplastic pollution, industry bodies urge caution. The European Council of the Paint, Printing Ink and Artists' Colours Industry (CEPE) and the World Coatings Council have challenged the reliability of impact estimates, including the widely cited figure that paints contribute up to 58% of synthetic microplastics in the ocean.

In a 2022 literature review, the World Coatings Council noted that most studies rely on modelling rather than direct empirical measurements. Key variables, such as degradation rates, release pathways and polymer mobility, are often based on unfounded assumptions. CEPE has also highlighted that many studies omit real-world mitigation measures, such as responsible product use, wastewater treatment or controlled disposal.

Boat hull with marine overgrowth

At the most basic definitional level, the issue is complex. While dried paint films do contain synthetic polymers, their polymer content per particle is lower than most conventional plastics. Questions persist around how particles are defined, how polymer content is measured in composites and whether cured paints fall under the criteria set by, for example, EU REACH legislation. CEPE also underscores the important, broader function of coatings. Durable paints extend product life, reduce corrosion and lower long-term environmental impact. In shipping, for example, antifouling paints can reduce fuel consumption by up to 40%. These performance benefits, CEPE argues, must be weighed against emission profiles. Biodegradable or polymer-free alternatives, while promising, can compromise durability, resulting in more frequent repainting and shorter service lives.

In response to growing scrutiny, CEPE has launched two independent studies on marine and façade degradation to generate empirical data under real-world conditions. Until such data is available, many industry stakeholders urge a measured approach, focused on methodological rigour rather than modelled extrapolations.

NAVIGATING A NEW ERA FOR PAINTS

The paints and coatings industry is already seeing early signs of change due at least in part to microplastics concerns. As with previous environmental challenges, progress going forward is likely to be driven by **regulation, innovation and consumer demand.**

Regulation

So far, regulation has largely focused on primary microplastics, such as microbeads in cosmetics. Secondary microplastics, including those from paint degradation, have received limited focus, but some policy signals are emerging.

- The EU Green Deal and REACH Regulation (EU 2023/2055) now require labelling and reporting of intentionally added (primary) microplastics.
- ESG reporting frameworks are beginning to consider polymer persistence as a material metric. The European Chemical Industry Council's (Cefic) 'Framework on Persistence Assessment for Polymers and Microplastics' is one such example.
- Proposed taxation models could also play a role going forward.

Innovation

No green alternative yet matches the performance requirements of marine, aerospace or heavy-duty infrastructure coatings. Closing the gap will require targeted R&D and policy incentives that balance durability with environmental integrity. That being said, several early stage solutions are in development:

- Bio-based resins derived from e.g. itaconic acid, lignin or epoxidised soybean oil
- Algae-based polymers, offering biodegradability with carbon efficiency
- Encapsulated additives designed to minimise wear and flaking
- Self-healing coatings that slow mechanical degradation

Mineral-based systems, such as potassium silicate binders ('liquid glass') are also gaining attention. These UV-stable inorganic coatings form crystalline structures that shed significantly less polymer material, although their applications are currently limited to architectural and heritage projects.

Consumer Demand and Preference

Meanwhile, consumer awareness is beginning to shift. As the presence of microplastics gains more mainstream attention, demand for cleaner coatings is likely to grow. Brands that blend aesthetics with sustainability are already carving out niche markets, particularly in architectural applications. As this trend accelerates, informed consumer preferences may begin to influence standards across the value chain.

This growing awareness may also bring about legal pressure. Historically, consumer-led litigation has played a pivotal role in driving product reformulation and phase-outs, even without definitive scientific consensus. These precedents suggest that consumer-led litigation could also become a catalyst for change in the paints and coatings sector.

CONCLUSION

While the evidence and research is still emerging, a number of theoretical studies suggest that paints and coatings are a meaningful contributor to microplastic pollution. This is not simply a matter of emissions, but of how materials are designed and managed across their lifecycle. Just as the industry once phased out lead pigments and high-VOC solvents, it now faces a new challenge. Adaptation will likely be driven by innovation, regulation and shifting consumer demands.

ABOUT NATRIUM CAPITAL

Natrium Capital Limited is the specialist Chemicals Mergers and Acquisitions (M&A) boutique which sets a new standard in advice. Led by Alasdair Nisbet and staffed by bankers, all of whom are also scientists, Natrium Capital provides strategic and M&A transaction services focused on the chemical industry, covering, amongst others: plastics, fine and specialty chemicals , paints and coatings, inks, adhesives, personal care ingredients , food ingredients, chemical distribution, engineering materials, biotechnology and clean technologies.

Headquartered in London (UK), Natrium Capital advises on both sell-side and buy-side transactions, including carve-outs and complex global cross-border deals. The team has advised on transactions with a combined value of over $100bn.

Select Paints and Coatings Deals of Natrium Capital

UNDISCLOSED	UNDISCLOSED	c. €3bn	$8bn	UNDISCLOSED
ADVISOR TO	ADVISOR TO	ADVISOR TO	ADVISOR TO	ADVISOR TO
adenia	DOW	WILBUR-ELLIS	AkzoNobel	ROHM AND HAAS
and Founding Directors Abhay and Pradnya Salunkhe on the sale of Cresta Paints to	in the sale of its Powder Coatings Business to	on the merger of Connell, its Asian Speciality Chemical Distribution business with	on the acquisition of	on the sale of its European automotive coatings business to
UHURU INVESTMENT PARTNERS	AkzoNobel	CALDIC	ICI	Mäder Advanced Coating and Composite Solutions

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