

A microplastic-free future for seed treatments

Croda, September 2022



As new microplastics legislation transforms agriculture, what does the future hold and how do we get there?



incotec

the seed enhancement company

CRODA

Table of contents

Foreword	3
Why are microplastics a problem?	4
Why go microplastics free?	5
Understanding what the new legislation means?	6
What exactly is a microplastic?	7
Where are we now?	8
Croda and Incotec: Our microplastics journey and what we learned along the way	9
What the industry needs to do now	10
For companies developing new seed treatments	12
For companies who buy seed coatings	13
For everyone	14
How can we help you?	16

With thanks to the following for their input into the report

- Erik Jan Bartels, Managing Director, Incotec
- Marta Dobrowolska-Haywood, R&D Manager, Incotec
- Clare Liptrot, Global Product Safety & Regulatory Affairs Manager, Croda
- Jane Lawson, Senior Product Safety & Regulatory Specialist, Croda
- Niels Louwaars, Managing Director, Plantum, The Association for the Plant Reproductive Materials Sector
- Amalia Kafka, Technical Manager, Sustainable Seed Technologies, Euroseeds

Foreword

A proposal by the European Chemicals Agency (ECHA) to ban microplastics from seed treatments and coatings is soon likely to become an EU Directive. Whilst details are still being finalised, this will represent a significant imperative for change. Polymers falling under these rules are widely used in seed coatings, and their makers will have just a few years to find biobased or similar alternatives.

Our conversations to date show mixed awareness in the industry of this legislation, what it says, and its implications. We see some innovations in the market that are likely to replace certain seed treatments soon, but others where that journey has not even started.

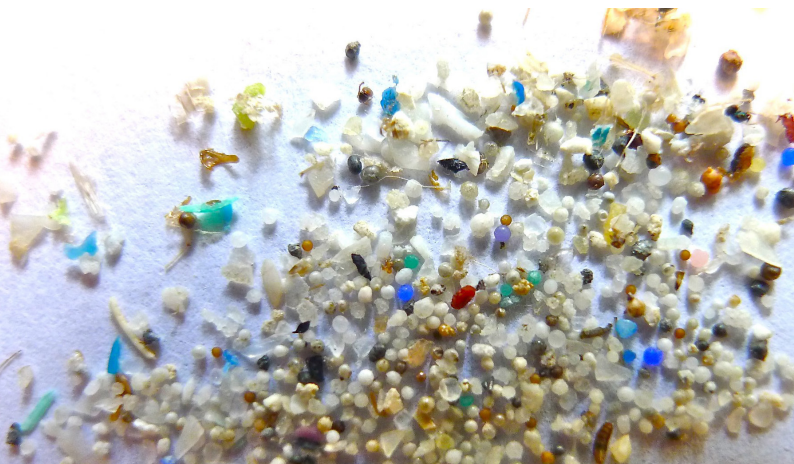
As a company that has been close to the legislative process, and one which has begun our journey to a microplastic-free portfolio, our aim with the whitepaper is to share our understanding of the legalisation, and our recommendations for what companies can do about it.

Whilst we acknowledge this will present real challenges, we also see it as a big opportunity to play our part in

tackling microplastics, and to spur innovation that we expect to eventually lead to better products.

There are many seed products that will need replacing in short timeframes and no one company can do this alone. So, as well as sharing our learnings so far, this is a call to arms for collaboration and partnering to work together to address this challenge.

We welcome feedback and thoughts and we hope it will start many important discussions.



Why are microplastics a problem?

Microplastics – plastic fragments less than 5 mm – are becoming a major environmental and health concern. These fragments shed off products and enter the air, sea and soil – where they can take hundreds of years to degrade, with no existing way to get rid of them.

They are breathed in or eaten by animals and humans. A study by [WWF](#) suggested that the average person around the world may be ingesting as much as five grams of microplastics - equivalent to a credit card - every week. This year, microplastics have been found in human [blood](#) and [lungs](#).

Whilst long term health risks need further study, it is thought microplastics may inflame the lungs, cause cancer, disrupt hormone function causing weight gain, and act as vectors for microorganisms and toxic chemicals. Any such problems are likely to rise as environmental levels of microplastics increase.

Microplastics in agriculture

Seed coatings and treatments stick to seeds and provide vital protection against pests and diseases. They help get the utmost out of seed. In doing so, they reduce the need for chemical plant protection products and fertilisers, which have negative environmental impacts.

But many seed coatings and treatments rely on petroleum-derived binders to attach useful additives

– such as nutrients and insecticides – onto seeds. Coatings are usually a liquid formulation that contain the binder and the desired additives, which dries around the seed. These binders are polymers with poor biodegradability in soils; in other words, a microplastic.

Polymer coatings are also used in other plant protection products, such as coatings for fertiliser pellets that allow a breakdown at a predictable rate for controlled release.

When planted, these coatings breakdown, creating small plastic particles. These end up in the soil, where some research shows they can alter plant performance, soil properties, and the composition and activity of microbial communities and inhibit the growth of earthworms which in turn affects plant nutrition and soil physiology. At current levels they do not seem to be phytotoxic in themselves – though they may be at higher levels in future – but they can act as carriers of plant pathogens. Many of these fragments end up in sewage sludge or leach into rivers, and so to oceans, animals, and humans.



Why go microplastic free?


The seed industry is not the biggest contributor to microplastics (that accolade goes to the wear from tyres). Agriculture accounts for about 10% of total microplastic release, and seed treatments 1%. But 1% of a huge problem is still significant, and there are good reasons why we need to act now.

Firstly and most obviously, we have to. Upcoming legislation will require that seed companies eliminate all intentionally added microplastics – covering many seed treatments – possibly as early as 2028 if current proposals are accepted.

Secondly, there is a moral imperative. All contributions to microplastics matter. Many of us in the agriculture and chemicals industries have sustainability goals (including Croda) - promising to care for human health, ecosystems, and the environment. We cannot stand by these credibly if we are not tackling microplastics.

Thirdly, customers are demanding it. Whilst end users may not be as concerned about seeds as they are about cosmetics (an industry which has had to rapidly change its formulations), this could quickly change. Rules and cultural norms change all the time. Already people buy products based on water use, bees, rainforests, and fertiliser use. As new trends emerge, retailers put pressure on growers, who put pressure on seed and crop protection companies. Consumers care about their food but do not necessarily understand the nuances of the food growing process. Should they start blanket demands for microplastic-free foods – even if those seem a little unfair on seed manufacturers – the industry needs to be ready.

Moving now allows the seed industry to get ahead of the game. It ensures we are prepared, whatever this or future legislation holds. It ensures we can make credible claims about our sustainability credentials and serve all markets. And it pushes us to innovate to develop new sustainable alternatives that sooner or later will supersede polymer-based treatments, and which may turn out to be better.



“...1% of a huge problem is still significant, and there are good reasons why we need to act now.”

Understanding what the new legislation means?

Before we consider the way forward, it is important to establish where we are. In this section we will cover the upcoming legislation, the most significant driver of change, and what the imperatives are.

In January 2019, the ECHA proposed a wide-ranging restriction on microplastics in products in the EU/EEA. In December 2020, it published its final opinion on restrictions on 'intentionally added microplastics'.

There has been some delay, but it is expected to be finalised and adopted into new EU legislation in 2022 or 2023. The current proposal argues for imposing a five-year transition period to remove microplastics from seed coating binders (by January 2028) and an eight-year

period for plant protection products (by January 2031). There are indications that France, a major agricultural producer, might implement the restriction a year early. It is likely similar regulations will be adopted elsewhere in the world within similar timeframes.

2019

ECHA proposed a wide ranging restriction on microplastics in products in the EU/EEA.

2028

Current proposed date by which microplastics will have to be removed from seed coating binders.

2031

Current proposed date by which microplastics will have to be removed from plant protection products.

What exactly is a microplastic?

Eliminating intentionally added microplastics depends on what exactly a microplastic is, and unfortunately this is far from clear.

An intentionally added microplastic is described by the ECHA as a polymer-containing solid or semi-solid particle, 5mm or less in at least one external dimension. This is the definition in the proposed Annex XV restriction report and is likely to be the basis of the final definition. Exemptions apply to particles that are sufficiently biodegradable, biobased, or water soluble.

In this report, when we say ‘microplastic free’, we refer to this definition, and we expect this to be the minimum standard in the future. Not all current claims to be microplastic free are based on this definition, and so some current ‘microplastic-free’ products may still need to change when the new rules come in.

In order to prove a seed treatment or coating is microplastic free, companies will need to show that it meets one of three criteria: (a) water soluble; (b) 100% extracted from nature without chemical modification; or (c) biodegradable in a way that does not produce harmful chemicals.

Some things will obviously be impacted by the new rules. Polymer-based binders that do not biodegrade will need to change. But what should they change to? The exact definition matters as it affects where growers, seed treatment, and crop protection companies need to focus strategic decisions, investment, and R&D.

The current draft still leaves room for questions.

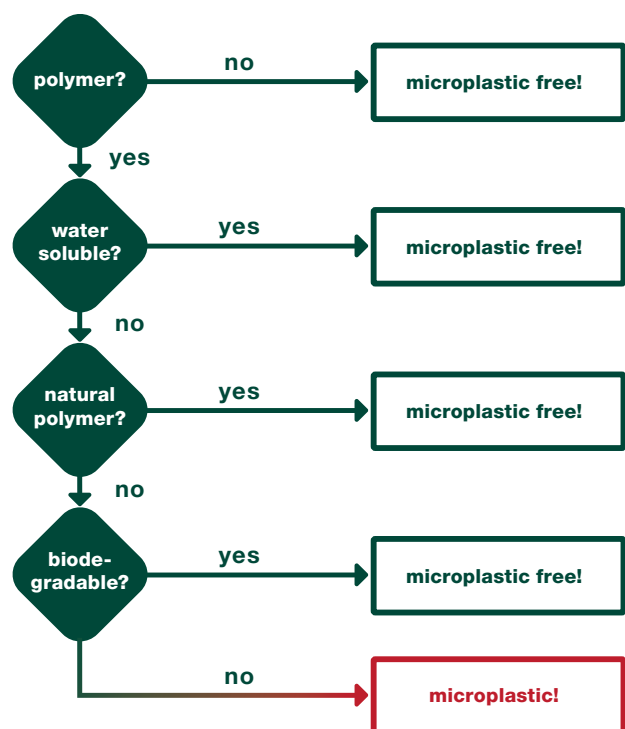
Polymers that dissolve in water are unlikely to contribute to microplastic concerns, and so should not be a problem. But there is a need to agree a threshold for demonstrating solubility, which is under discussion and will likely be added to the final restriction.

Products based on natural raw materials such as starch or sugar should be fine since they are inherently biodegradable. But even small chemical modifications, can turn these into microplastics, as defined by the rules – for example, many biobased plastic alternatives use

chemical crosslinking to give a material the functionality of plastic, including low biodegradability. This may then count as a microplastic if it does not biodegrade fast enough.

Agreement is still needed on what level of biodegradability is acceptable. The latest proposal includes standard methods that are used to assess the biodegradability of chemicals (using OECD and ISO methods).

Finally, microplastic free is not necessarily the same as biodegradable or biobased. But, biodegradable and natural materials (biobased but not chemically modified in any way) will always be classified as microplastic-free.





“

Whilst some alternatives are already on or close to market, others may still be at the start of this process.

Where are we now?

Reactions to the legislation have understandably been mixed, as different companies have different priorities, customers, and resources.

It's easy to call on industry to embrace a microplastic-free future – a position we at Croda and Incotec support – but in reality this is challenging. When the seed industry began developing treatments and coatings, microplastics were not an issue, so lots of work went into creating high performing synthetic materials. Polymer coatings have benefitted from decades of research to chemically optimise them for binding, low abrasion, compatibility with active ingredients in seed, no detrimental effect in seed, as well as colour coding. Starting again is a big ask.

Perhaps the biggest area of contention is the transition period. When we spoke to Amalia Kafka of Euroseeds for this report, she raised concerns that five years may not be long enough and 11 was more realistic to allow a smooth transition. She felt the timeframe would not allow companies to develop polymer alternatives, formulate them into new products, do testing and gather regulatory data, and register them. Whilst some alternatives are already on or close to market, others may still be at the start of this process, which may take many years.

There is clearly a trade-off. Going microplastic free is a good thing and legislative pressure will spur important innovation. But if it is impossible to meet the deadline for some products, we will simply lose access to them after the deadline. That may come with higher environmental costs, such as increasing the use of pesticides.

Right now, we cannot say for certain what the transition period will be but the requirements for microplastic-free seed treatments and coatings is coming. Timescales may change, but they are likely to be demanding. In terms of requirements, it seems unlikely anything other than minor changes and exemptions will now be added to the legislation. And even if some products escape this round, future rules, or pressures, will continue to push against microplastics. Anyone involved in the value chain around coated seeds needs to be moving away from microplastics.

Croda and Incotec: Our microplastics journey and what we learned along the way

When the new legislation was announced, we, like many in the industry felt a little put upon. Seed coatings are hard to reengineer and make a relatively low contribution to global microplastics. They offer sustainability benefits by reducing waste and the need for more harmful plant protection products. Our initial reaction was to push back.

But we realised that however small as a proportion, seeds do contribute to overall microplastic levels. Products containing microplastics do not align with our company goals to be sustainable – a goal we know many in our industry share. Our shareholders and employees want us to invest in sustainability, and to ensure we are still in this market in ten years' time. Our customers will want more sustainable options either to meet their sustainability goals, or as the legislation bites, even if they are not all asking for them now.

***So, four years ago we started
our journey to replace all
synthetic polymers in our
seed treatments.***

We began by looking across our entire portfolio, product by product, in the context of the directive text. We engaged with customers who were leading the sustainability agenda to understand what changes were needed to meet their needs.

We looked at every product and asked the three questions: is it (a) water soluble; (b) 100% natural, or (c) biodegradable.

Some were, many were not. For a few we could swap out ingredients quite easily. But many required us to change formulations significantly.

This meant a big change in the way we formulate. In our labs, we played around with a range of chemistries, created new formulations, and applied them to seeds.

In our test facilities, we trialled promising formulations to assess the key parameters for seed treatments: adherence of the treatments to seeds, easy flow of coated seeds through equipment, prevention of unnecessary waste, and potentially harmful dust emissions.

These tests were repeated numerous times to identify the best formulations. Only treatments that meet all these tests will be accepted by the market.

Within two years we had developed new microplastic-free coatings for corn and sunflowers seeds, and a vegetable seed coating. We are working on other crops including rice and soya which are derivatives of current solutions, as well as oil seed rape, which is more complicated – its smaller size needs a high volume of treatment, so needs to be formulated to dry quicker.

We are now working with clients to do testing at scale in their facilities. Lab tests can show with 70-80% certainty that the treatments deliver, but to be sure we need testing at different temperatures in climate chambers. And then seed companies themselves will need to test first in large-factory conditions for fouling, drying, temperature changes, etc, and then in soil. This whole process can take two to four years, which is why moving well ahead of the legislation is important.

What the industry needs to do now

We conclude with thoughts and recommendations from our learnings so far, but also intend this to be a starting point for discussion about where we need to go as an industry. One of Incotec's strategic pillars is 'Intrinsic Sustainability', which requires the business to focus on reducing microplastics and increasing biobased content. We want to support ourselves and others to deliver that.

For seed companies, coatings companies, and growers, the starting point must be to acknowledge that change is coming and microplastics are on their way out.

There may be battles still to fight around definitions, exemptions, timelines, and trade-offs, but the long-term direction is towards a microplastic-free seed industry.

As a major global supplier of seed treatments and a large speciality chemicals company, we can help drive the industry forward. But we can only do this in collaboration. We hope the remaining insights will spur conversations as we collectively aim to solve the microplastics problem.



Intrinsic sustainability

One of Incotec's strategic pillars is 'Intrinsic Sustainability', which requires the business to focus on reducing microplastics and increasing biobased content.



For companies developing new seed treatments

- Whilst the directive is not yet final, it is recommended to start planning for it as soon as possible, as many companies already have.
- Companies making seed treatments should read the legislation and speak to experts to understand the criteria; look at their portfolios to assess what falls short; and make a plan to replace them.
- All-natural, water-soluble, or biodegradable polymers are a good solution for replacing microplastics. Aiming high in terms of solubility and biodegradability is sensible. Even if this legislation ends up with some exemptions or lower thresholds, more stringent rules or norms could come in the future.
- New innovations may take years to develop and then need to be viable for at least 10 years, so any new research should completely avoid anything that could be classed as a microplastic, now or in future.
- For existing products that are close to thresholds (eg rate of biodegradability), some 'wait and see' may be merited with regards to whether the legislation will require them to change, especially if there are more pressing priorities.
- The industry should strive for replacements that mirror the quality of existing products, showing equivalent quality according to existing performance criteria – flow, dust-off, germination – but also working with seed companies to monitor real-world performance over time. We may also want to investigate alternative sustainable approaches, such as more targeted treatments that reduce overall need.



For companies who buy seed coatings

- Articulate your needs and concerns to seed enhancement companies to ensure they can develop products that suit your changing requirements. Most will focus on drop-in replacements, but new microplastic-free approaches may also present new functionalities, and this may be an opportunity to direct goals towards more targeted products.
- Collaborate closely on testing to understand and assess testing data, and work with them to validate new innovations in your facilities.
- Keep in mind that microplastic-free treatments will have different formulations which may need different factory setups and settings – for example they may dry at different rates necessitating changes to airflow or temperature. It is important to work closely with the seed enhancement company to get this right – it would be a shame if good innovations were rejected because the treatment process was not recalibrated from the settings for the old treatments.
- Scan the market for innovations that may offer promise of meeting your needs. Some will come from small companies or universities who have promising ideas but not the tools to test and scale them, but who can work with you, or your suppliers, to do so.
- Use validation data in targeted ways in your marketing to highlight the quality of microplastic-free seed treatments you select, as well as their sustainable credentials. Some growers will be drawn primarily to sustainability, some will want to tick the legislative boxes. Those outside Europe who are not bound by the legislation may need more convincing that it's worth making a change. Align value to customer need and challenges to ensure uptake.



For everyone

- If you have major concerns about unfair impact of the legislation, there may still be room to tweak. Pleas to protect pure commercial interests are likely to fall on deaf ears. But the drafters have proven reasonable where there are legitimate trade-offs to be considered – for example where restrictions could force companies to adopt alternatives that will have greater negative environmental impact. It is important that the industry shares concerns and lobbies together to ensure the legislation does not end up creating perverse results.
- We need to work together and share best practices. There is no need to wait for the legislation to become reality. Croda would welcome the opportunity to provide forums for sharing information, or to take part in forums established by others, and we welcome any approaches to collaborate on helping the industry go microplastic free.
- It is vital that all sides make informed decisions in light of incoming change. That means understanding the legislation, assessing portfolios and future needs, filling gaps, and doing testing. Occasionally that decision may be to do nothing for now, but that should be a conscious decision based on priorities, not an absence of one.
- We should take these changes as an opportunity to set ourselves up to innovate in a more volatile world. Microplastics will not be the last challenge. More change will come from ever more sustainability rules and pressures. We should all use this journey to establish processes and mindsets that make innovating easier in the face of future environmental demands.
- Finally, we must embrace change and not defend the status quo. The pressure to change is serious, as are the consequences of inaction. This can't all be done in a day, but every day we delay starting will create more microplastics.
- The seed industry has the chance to completely eliminate its own microplastic contribution within a few years, which would be a small but significant dent in the global problem. And one industry's commitment can create momentum and lessons for others, gradually moving to a place where we can remove this invisible but serious threat.

“

**We must embrace
change and not defend
the status quo.**





How can we help?

In recent years, Incotec/Croda has developed significant expertise on the upcoming legislation, assessing whether products contain microplastics, and developing microplastic-free products including seed treatments. We welcome the opportunity to share this expertise and start discussions with all interested parties.

To discuss the topics raised in this paper, please contact:

marta.dobrowolska-haywood@croda.com



www.incotec.com

CRODA

www.crodacropcare.com