Assured Biosolids Limited (ABL) Biosolids Assurance Scheme (BAS) Position Statement on the potential impact of microplastics on biosolids recycling to agricultural land

Introduction

The increasing amounts of plastics produced globally each year, combined with their potential impact on the environment has resulted in a large amount of public and media interest. Much of the interest in the fate of plastics, including microplastics, has focused on the marine environment. However, there has been recent interest in the terrestrial environment that has included their concentration in biosolids (i.e. treated sewage sludge) and their potential impact when treated and recycled to agricultural land. Despite this interest, there are still large gaps in the scientific understanding of microplastics; for example there is no internationally recognised definition of what a microplastic is. Although the most commonly used definition in scientific literature is of synthetic polymers of less than 5 mm in diameter. In terms of the scale of the issue, it is estimated that between 75,000 and 300,000 tonnes of microplastics from all sources are released into the environment each year in the European Union (EU).

Microplastics are typically split between primary and secondary. Primary microplastics are plastics that were manufactured to be small in size. Secondary microplastics are plastics that have degraded from larger pieces to become smaller in size. Some microplastics ultimately find their way into wastewater; based on the limited studies undertaken on biosolids, it is thought that the main sources in biosolids are from tyres, fibres (from polyester, nylon and acrylic clothing – i.e. microfibres), cosmetics and exfoliants (i.e. microbeads), certain industrial processes and fragmentation or degradation of larger plastics.

Microplastics in biosolids and other sources

As with all aspects of microplastics, most of the data on occurrence is focused on the marine environment. Some studies have investigated the wastewater process, but these are limited and are not representative of the variations in wastewater and sludge treatment processes used in the UK. There is no doubt microplastics are present in wastewaters, but the available evidence suggests concentrations at all points in the system are highly variable. However, microplastics tend to be primarily (>90%) associated with solid fractions (e.g. deposited in sludge). Plastic production has continued to increase year on year, with over 400 million tonnes of plastic being produced annually. It is estimated that over 9 billion tonnes of plastic have been produced in total, with almost 80% in landfill or still in the environment (the remainder being recycled or incinerated). As such, despite not having accurate figures on microplastics in the environment, it would seem logical that the amounts of microplastics in wastewater have been increasing in recent years. Research is required to determine types and quantities of microplastics in UK biosolids that are recycled to agricultural land.

Biosolids are not the only potential source of microplastics introduced to agricultural land. Given that most non-farm organic materials recycled to land (e.g. compost and anaerobic digestate) contain plastics, it would be reasonable to assume they also contain microplastics. Other likely sources include irrigation (especially from surface waters), littering, atmospheric deposition and through degradation of plastics used in agriculture (e.g. covering crops, polytunnels, protective fleece, covering/wrapping silage, agricultural packaging such as feed and fertiliser bags). However, as with biosolids there is a lack of reliable data on the types and quantities of all microplastics that are being inadvertently introduced to agricultural land.

Potential risks associated with microplastics

Recent research on microplastics split concerns between physical and chemical effects. Physical effects are when the small size of microplastics block ducts, damage tissue or cause the plastics to accumulate in tissues or organs. Many studies have been undertaken and found microplastics in marine organisms (e.g. plankton, bivalves, fish, crustaceans), including experimental evidence of microplastics moving between levels in the food chain. There have been less studies in the terrestrial environment; however, studies have found microplastics in a wide range of animals including invertebrates and some mammals. Despite this, the fate of microplastic after ingestion is still largely unknown, particularly outside of the marine organisms. Similar to studies on airborne dust, the environmental impact of microplastics is likely to increase as their size decreases. Very little work has been undertaken into the impact of microplastics on the soil environment and soil health, apart from a handful of studies investigating potential effects on invertebrates. The lack of consistent sampling/analytical techniques means it is very difficult to compare studies, highlighting the need for standard testing methods to be developed.

Chemical effects can be split into direct and indirect effects. Direct effects result from the degradation of the plastic, causing the release of potentially harmful chemicals. Indirect effects are where potentially harmful chemicals absorb onto the microplastic and are released later. These chemicals are typically from additives used during the plastics production or from the environment. Some types of plastics have been shown to have high sorption capacity for a range of persistent organic pollutants. This is confirmed by studies which have found microplastics from beaches around the world containing a range of persistent organic pollutants (e.g. PAHs, dioxins and furans, PCBs, pesticides). It is unclear if microplastics are a source of chemical exposure in the marine and terrestrial food chains.

As detailed above, almost all the research has focused on the marine environment. As a result, there is little information regarding the possible uptake of microplastics, whatever the source, into agricultural crops and livestock, or the potential effects human health. Given the likely increase in types and quantities of microplastics, the level of public interest and the unknown impact, further research is required.

Controls on microplastics

As of January 2018, the UK Government banned the manufacture of cosmetics and personal care products containing microbeads. From the end of June 2018, the sale of cosmetics and personal care products containing plastic microbeads (including imports) has been banned. However, as detailed above there are multiple sources of microplastics, meaning for the majority of them, a ban on production/sale is not possible (e.g. microfibres, tyre fragments). Wastewater and sludge treatment operations include screening processes to remove larger material. However, screening processes are unlikely to work for microplastics. As such, the emphasis must be placed on prevention/reduction at source; this may include requirements for improved filtration in clothes washing machines and increasing public awareness.

The EU launched its Plastics Strategy in January 2018 following its action plan for the Circular Economy. As part of this, the EU Commission started the process to restrict the use of intentionally added microplastics (e.g. microbeads in personal care products) across the EU. The strategy also endorses an industry agreement between European industry associations connected with the production and maintenance of clothing, which aims to address the release of microplastics from textiles into the aquatic environment as well as calling for other cross-industry agreements.

The UK Water Industry is working with Government, the Environment Agencies, industry experts and other stakeholders to assess the sources, types, concentrations and impact of microplastics on the environment and human health. The UK Water Industry Research (UKWIR) is currently undertaking a study specifically looking at microplastics throughout the water and wastewater processes.

Conclusions

It appears that the types and quantities of microplastics entering the wastewater treatment have almost certainly increased, primarily due to the continued growing use of plastics in domestic products combined with a lack of consumer awareness of their fate. However, there is currently no evidence to indicate that recycling biosolids to agricultural land poses any significant risk from an environmental and human health perspective. As such, the UK Water Industry will to continue to beneficially recycle biosolids to agricultural land, which is consistent with a Circular Economy.

Due to a shortfall in information and the level of public and media interest, further research is required to generate a robust evidence-base including:

- Research on microplastics in wastewater sludge and biosolids and their potential impact on the environment and human health and;
- Reviewing new evidence as it arises and responding accordingly and;
- Regularly consulting with food chain stakeholders and keeping them and other interested parties informed on progress.

There needs to be a cross-sector approach involving not just the Water Industry, but all sectors (e.g. manufacturers, researchers and regulators) to understand the issues associated with microplastics and find sustainable solutions to this important issue. Assured Biosolids will review this position statement as further evidence becomes available.