

Challenges In Plastics Recycling

Recycling plastic is a critical part of managing plastic waste, but it comes with several challenges. Keeping recycling streams clean is an important issue; a clean recycling stream is a recycling system that ensures that recyclable materials are sorted and recycled without contamination. This results in high-quality recycled materials that can be reused over and over again (e.g. in a closed-loop system).



Some of the main issues affecting clean recycling streams include:

- **Sorting** - Plastics need to be sorted by type and colour before they can be recycled. This sorting is often done by hand, which is labour-intensive and time-consuming. Different plastics have different chemical properties, so they can't be recycled together.
- **Contamination** - Many plastics are contaminated with food, oils, liquids, or other materials. For example, a plastic container with leftover food may not be recyclable until cleaned properly. This means that high concentrations of non-recyclable materials or food waste can get into the waste stream, reducing the quality of recycled plastic and making the recycling process less efficient and clean.
- **Diverse plastic types** - There are many different types of plastic, such as polyethylene (PET), polypropylene (PP), and polyvinyl chloride (PVC). Each of these has its own chemical properties. These plastics often get mixed together in products, making it difficult to recycle them as a whole. Mixed plastic products are often not recyclable and end up in landfills or incinerators. Prioritising the production of products made with one type of plastic will make plastic recycling easier and will help keep the recycling stream clean.
- **Composites and laminates** - Some products are made from layers of different materials, such as plastics combined with metals or paper. These materials are harder to separate and recycle, making them more challenging to process. Think about a juice box - a juice box contains paper, plastic and aluminium (the paper is used to shape the box and provides strength, polyethylene creates a liquid-tight seal to keep the juice dry and forms the layer where graphics and information are printed, and the aluminium is used to keep light and oxygen out to prevent the juice from spoiling). Again, reducing products that are made from multiple materials will prevent contamination in recycling streams.



Other issues affecting the effectiveness of recycling include:

- **Downcycling** - When plastic is recycled, it often loses some of its original quality, a process known as 'downcycling'. For example, a plastic bottle made from high-quality plastic may be recycled into lower-quality items like plastic lumber or clothing. Over time, the quality of recycled plastic diminishes, meaning it can't be used for high-quality products again.
- **Economic challenges** - Collecting, sorting, and processing plastics can be expensive. In some cases, it may be cheaper to produce new plastic from raw materials than to recycle used plastic, making recycling less economically viable. In addition, the demand for recycled plastic varies, and some countries (like China, which previously imported much of the world's plastic waste) have stopped accepting plastic waste. This has led to a backlog of plastic waste in some areas.
- **Limited recycling infrastructure** - Many areas do not have the proper infrastructure to recycle plastics effectively. For example, there may not be enough specialised recycling centres to process all types of plastic, or the technology may not exist to recycle certain plastic types efficiently. In addition, people often aren't fully aware of what can and can't be recycled, leading to contamination and lower recycling rates. Incorrectly disposed plastics may end up in landfills or incinerators instead of being recycled.
- **Lack of standardisation** - Plastic items are labelled with recycling codes (numbers 1-7), but recycling facilities do not accept all plastics. Different regions or countries have varying recycling systems, and the plastic that's recyclable in one area may not be accepted elsewhere. This inconsistency complicates the recycling process.

Solutions and alternatives - To overcome these challenges, solutions are being explored, including:

- **Improved sorting technologies** - This includes technologies like optical scanners and AI-powered systems to automatically sort plastics.
- **Better product design** - This includes making products with fewer mixed materials and using plastics that are easier to recycle.
- **Increased public awareness** - Educating people on how to properly dispose of plastic and reduce waste.
- **Development of new recycling methods** - For example, chemical recycling techniques that break down plastics back into their original monomers for reuse.

While recycling plastic faces many challenges, ongoing research and improvements in closed-loop technologies offer hope for more efficient and sustainable plastic waste management in the future.