

# **Popular Science Summary**

## **Multilayer Plastic Packaging Design and its Recycling Challenges**

Sonika Singh

LTH, 2020

Multilayer plastic packaging is one of the most popular type of food packaging since 1960s when cellophane was renovated to use as food wrappers. It's the kind that your potato chips, candies, baby milk powder and lentils are packed in. Packaging and food industry had not gravely thought of its waste management up until recently. In 2018, China imposed a ban on plastic waste import from Europe and The USA, creating a paradigm shift in waste plastic management industry, brands and consumers perception. Around the same time, consumer awareness raised about marine pollution, creating huge pressure on brands to change their packaging policies. Ocean waste is still a challenge and plastic multilayer packaging from the UK are still found at shores of The Philippines and Indonesia. Plastic recycling industry is non-uniform and highly based on the material type. So far glass, cardboard and plastic water bottle (made of poly-ethylene terephthalate or PET) recycling streams are more advanced than multilayers or other kinds of plastic. In fact, multilayer type of packaging is almost non-recyclable in Europe as of 2019.

My master thesis explored the reasons for non-recyclability of multilayer plastic packaging and one of the reason is lack of design guidelines. Recyclable by design is a popular approach for building an object such that it is recycled at end of life in an existing recycling infrastructure. Recyclability by design guidelines ensures this. An object is part of a 'Circular Economy' only if it is recycled in closed loop; this means the recycled material should be used to design the same object that it was once made of. Now, this is a challenging task, especially with plastics. Since, when plastics are recycled (using both mechanical and chemical recycling process) their molecules dis-integrate and loose structural quality. Hence, you can find water bottles with only a certain percentage of recycled content in them.

Multilayers are considered a contaminant in recycling stream due to different layers of plastic and metal bound together, which is not separable in a profitable business model. But, it can be made recyclable with advanced recyclable by design guideline that takes recycling infrastructure in consideration. Now, as mentioned earlier, the design guidelines for multilayers are low in number and at a nascent stage compared to other material design guidelines. In the study, a comparison was made among existing plastic multilayer packaging design guidelines with existing infrastructure in EU to understand the reasons of their ineffectiveness. Interviews with stakeholders like packaging developers, packaging suppliers and recyclers were conducted to understand their perspective about lack of recyclability of multilayers and future trends.

The study found that majority of the western European countries have fast developing poly-ethylene (PE) recycling stream and uniform recycling technologies. The comparison among existing design guidelines for multilayers revealed high inconsistency and lack of scientific evidence for their suggestions.

Data collection and analysis also revealed lack of regulation, standardization of design and lack of communication as major reasons for ineffective recyclable design of plastic multilayers.

Based on the collected data, a new design guideline is recommended for plastic multilayer packaging based on PE recycling stream available in Europe. The suggested design guideline aims to prevent plastic multilayer from ending up in a landfill, incinerator or oceans. The guideline suggests using same material with different structural orientations for different layers. It also suggests eliminating metal or metallized layer that interferes with plastic waste sorting process in recycling centers. PE, though makes perfect sense to be used as a prominent material for future plastic multilayers, may not be able to provide the barrier properties as good as current conventional packaging. Hence, its use should be restricted to colder climates and low humidity countries of Northern Europe.