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Coach	**Supervisor(s)**	**Funding**
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Mechanical recycling of plastic films, a correlation between recycled stream composition and recycling quality (processability and performance)

Aim

To predict the quality of recycled flexible plastics based on the composition of the recovered fraction

Justification

Plastics are necessary materials in our economy and daily lives. However, too often the way plastics are currently produced, used, and discarded, fails to capture the economic benefits of a more circular approach and harms the environment. Only in Europe, as high as 30,000,000 tons of plastic wastes are generated per year, of which 60% originates from the packaging sector. Packagings are divided into two main categories: Rigids and Flexibles. Flexible packagings, which mostly can be identified in form of films, consist of 40% of the plastic packaging waste. This means that one-fourth of the total plastic wastes are flexible packagings.

Blown film extrusion is a conventional technique for the production of flexible films, but very sensitive to materials' composition and characteristics, which hinders the mechanical film-to-film recyclability. Films are high in surface area to weight ratio, and their littering to nature has been causing growing public concern.

Circularity in the supply chain of plastic materials is one of the hottest topics in the industry. Previous studies suggest correlations between polymer characteristics, film blowing conditions, and final film properties. But how these findings can be adapted to mixed-polyolefin streams is yet to be known. The present research will investigate the flow properties of the polyethylenes while blended with polypropylenes, since these are the two major polymers that appear in the collected post-consumer films. The flow behavior will be linked to the extent of the processability in film blowing process and the influences of the polypropylene as a cross-contamination on the final performance of the film will also be assessed.

Program

It is the goal of this student project to valorize the possibility of film-blowing of mixed-polyolefin (MPO) streams and also to characterize the quality (both process- and properties- wise) of the blown films.

- Literature study on blending and recycling of MPO streams:
  - Polyolefins' chain architectures
  - Miscibility of PE-PP blends
  - Morphology and properties of PE-PP blends
  - Melt composition-rheology links in PE-PP blends
- Experimental:
  - Blending of film grade PEs and PPs
  - Characterization of the MPO melt rheology through an array of strain rates and temperatures
  - Processing of MPO fractions into film samples
  - Characterization of films' properties
- Modeling the links between composition, rheology, processing, and properties in MPO films