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Comprehensive two-dimensional gas chromatography (GC × GC) analysis for end-of-life plastics sorting quality assurance

Aim

The aim of this project is developing a technique to check the quality of end-of-life plastics sorting. The comprehensive two dimensional gas chromatography (GC × GC) will be used to analyse the composition of the sorted end-of-life plastics pyrolysates.

Justification

The world plastic production exceeds 350 Mt/year. It is estimated that 40% of the used plastics have a lifetime below 6 months. The post-consumer plastics could be 'treated' by **landfilling**. The amount of plastics ending up in landfill is estimated at almost half the production volume, so around 175Mt annually. Alternatively, the end-of-life plastics could be collected, sorted and recycled.

The higher quality of end-of-life plastics sorting minimizes the post-processing cost and increases the efficiency of the pyrolysis process and upgrading of the pyrolyzate. On the other hand, the end-of-life plastics sorting machines are improving; and new technologies are being implemented such as image processing and artificial intelligence (AI).

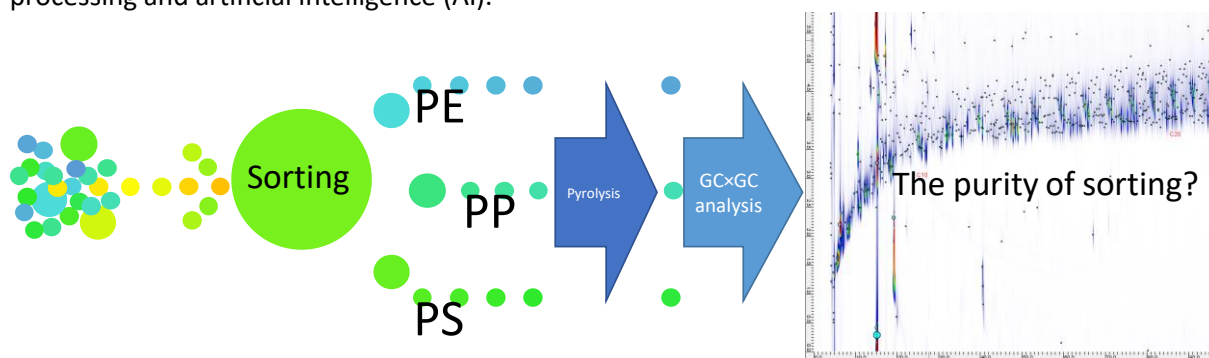


Figure 1: The proposed steps of assessing the quality of end-of-life plastics sorting process

To enable precise assessment of the end-of-life plastics sorting, the analysis can be performed for pyrolysates of individual virgin plastic types and synthesised mixture; the performed analysis can be used as a reference for comparison. this analysis can be used as a. The GC × GC analysis shows a fingerprint of each plastic pyrolyzate type. Such a criterion can be used to distinguish the purity of the sorted plastics. At the end of the project, a new methodology to assess the quality of sorting lines will be developed and the pixel-based analysis could be implemented to improve the post-processing.

Program

Main objectives in the project:

1. Literature study on end-of-life plastics sorting and pyrolysing
2. Pyrolysing plastics, starting with virgin plastics, mixed then blended waste plastics
3. Analysing the products using GC × GC
3. Measuring the purity of sorted end-of-life plastics based on the GC × GC analysis results