



# Openbare Samenvatting

## Circular Plastics NL onderzoeksprojecten en showcases

### 1. Algemene gegevens

Projectnummer :

CPNL231001

Projecttitel:

Monitoring Quality in Plastic Recycling (MoQuP-R)

Rapportageperiode:

01/01/2025 – 31/12/2025

### 2. Samenvatting

#### 2.1 Openbare samenvatting van de projectvoortgang en resultaten vanaf de start van het project

The project consists of four work packages (WPs) focused on improving quality monitoring in plastic recycling covering sorting, washing, and mechanical recycling.

##### *WP1: Sorting, pretreatment, and reprocessing*

Extensive literature research was carried out on sorting kinetics, sensor systems, control methods, and physical separation principles for both objects and flakes. Several sorting and reprocessing facilities were visited to observe and discuss current control strategies. Measurement-system analyses were performed on waste-object stream analysis using four systems at NTCP, including optical and multi-sensor (NIR) technologies. Additional analyses were conducted on flake sampling and automated flake identification.

A study into dual-energy X-ray transmission for plastic analysis was started, and a feasibility model was developed. Preparations for practical trials in 2026 are underway. Variability and measurability of categorised plastic packaging are being investigated by comparing scanned data with quality measurements. Two combined washing and reprocessing trials using HDPE and PP bales produced three qualities of recycled plastics for further testing.

Key findings include:

- Plastic composition remains the most critical control parameter in sorting and reprocessing.
- Combining RGB and NIR sensors on an acceleration belt gives the most reliable on-line stream analysis. Vision-only AI systems struggle with minor fractions.
- Flake analysis is reliable for rigid or film materials but requires prior separation when mixed.
- Current on-line techniques cannot determine individual flake or object mass; X-ray transmission could theoretically address this, although existing system designs are unsuitable.
- Differences in HDPE reprocessing qualities appeared mainly in rheological properties, rather than in MFI or strength.

#### *WP2: Mechanical Recycling*

A slit die attached to a single-screw extruder was validated for accurately assessing shear stress, shear rate, viscosity, and pressure at the operating point. These parameters support monitoring recycle quality during extrusion.

A proof-of-concept in-line detection system, measuring particle size, temperature, humidity, VOCs, NOx, and other compounds, was tested on a twin-screw compounder. Early results show sensitivity to processing and composition changes, though process fluctuations currently limit quantitative accuracy. Higher-grade sensors will be procured. Engineered recycle-mimicking materials and sorted recycled compounds are under ongoing characterisation.

#### *WP3: Model Application*

Outputs include analysis of recycling-chain operations, mapping of quality parameters, refinement of application-property matrices for the RecyQMeter, and development of data-collection templates. Multiple workshops improved data quality and addressed model limitations.

#### *WP4: Knowledge Dissemination*

Activities followed the existing dissemination plan, including Advisory Committee meetings, partner updates, and the creation of publication manuscripts, with initial drafts from WP1 completed in December.