Towards increasing rates of municipal sorted plastic waste

TALLINN, ESTONIA

TALLINN, the capital of Estonia, is a vibrant and diverse city with the population of 460 000 people, representing over 140 nationalities. Tallinn is known for its forward-thinking approach to public services, and the city offers free public transport to its residents, making it an environmentally friendly and convenient place to live.

Tallinn is an important promoter of the smart and circular consumption model and a creator of a system for circular products and services that support it. Tallinn operates resource-efficiently by reducing primary material consumption, increasing waste recycling, and actively promoting reuse, providing businesses and residents with various opportunities to participate in the circular economy.

Most of the existing municipal systems do not support sufficient volumes and quality for collection and sorting of plastic waste, thus, enhancement of the systems for separately collected plastic waste and sorting capacities are urgent. This pilot targeted enhanced plastic waste sorting capacities by applying portable near-infrared (NIR) spectroscopy tool “trinamiX”. The pilot results establish the foundation for increasing plastic waste recycling rates.

Interreg Baltic Sea Region

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CIRCULAR ECONOMY BALTIPLAST

Challenges and actions

Introduction of innovative techniques for identification of polymer (resin) type is crucial to ensure higher levels of recyclability in the plastic waste management chain. Implemented **pilot activities**:

- **Evaluate** existing plastic waste collection and sorting system at the municipality.
- **Deploy** near-infrared (NIR) spectroscopy tool in the selected municipal systems/entities.
- **Identify** composition of plastic waste by classifying plastic waste items according to the polymer type (PET, HDPE, LDPE, PP, PS, etc.).

Target groups and timeline

The basic framework of pilot implemenation took **6 months**.

Target groups
Municipal administrations departments
Municipal waste management companies/operators

Results

The results showed that separately collected plastic waste system ensures higher amounts and better quality of waste in comparison to waste collected from mixed municipal solid waste (MSW) streams. This implies that **better and more harmonized separately collected packaging waste systems are prerequisites for the enhancement of polymer type identification and increase in plastic waste recycling rates.**

The use of technologies such as near-infrared spectrometry significantly improves polymer type identification, reducing the percentage of unidentified plastics in comparison to the visual recognition method.

Calculating scenarios for CO2 emissions' reduction

The results include direct emissions from the production of polymers, transportation to the end-of-life (EoL) facility (recycling/incineration/landfill), and EoL treatment (recycling/incineration/landfill). It has been calculated by TalTech – Tallinn University of Technology.

Mixed municipal solid waste:

1. **Current situation**: 5.13 t CO_2 eq per ton of material. EoL distribution: 81.3% incineration, 18.7% landfill.
2. *Scenario 1*: 3.94 t CO_2 eq per ton of material. Five recyclable polymers (HDPE, LDPE, PP, PVC, PET) are recycled first. Residuals are transported to incineration (81.3%) or landfill (18.7%).
3. *Scenario 2*: 1.76 t CO_2 eq per ton of material. Additionally, 80% of the secondary plastics are used in the production stage.

Separately collected waste:

1. **Current situation**: 3.61 t CO_2 eq per ton.
2. **Trinamix Current situation**: 3.46 t CO_2 eq per ton (better sorting with the tool).
3. *Scenario* **Trinamix improved sorting**: 1.28 t CO_2 eq per ton (better sorting with Trinamix and 80% secondary plastics used in production).

Piloting the solution

On 24-25 April 2024, **packaging waste analyzing took place in Tallinn Waste Center** (Paljassaare põik 5). The pilot was carried out in cooperation with Kaunas University of Technology and Tallinn University of Technology. 2x10 bags of plastic and metal packaging waste (2x1500 litres in total) were mixed homogenuosly and smaller amount of waste samples were taken randomly and analyzed (10 bags, 1500 litres both days).

All plastic materials in representative waste samples were analysed by PP09 with trinamiX device. Plastic waste was devided into plastic types and labelled with respective plastic type name. In apartment buildings following plastic types were analysed: HDPE, LDPE, PP, PVC, PS, PET-A/PET-G, PA, composites and not identified and in private households HDPE, LDPE, PP, PVC, PS, PET-A/PET-G, PA, ABS, PVDF, PLA, composites and not identified were mapped and analysed. In total, **48,3 kg** of plastic and metal packaging waste from private households and **57,5 kg** from apartment buildings was analyzed. **TrinamiX device detected most of the plastics materials correctly, even bioplastics was detected**.

During the second half of 2024, Tallinn planned and organized a **second technical pilot** (the first pilot was carried out in the beginning of 2024) for packaging waste sorting. The pilot took place on 12 November 2024 in Tallinn Waste Center and was carried out in cooperation with Kaunas University of Technology, Stockholm Environment Institute (SEI) Tallinn and TalTech.

Tallinn was responsible for organizing the packaging waste to be sorted. In Estonia there are three Packaging Producer Responsibility Organisations who are responsible for collecting and recycling the packaging waste and between whom the Estonian (and Tallinn's) packaging market has been divided equally. Out of three organisations, one contributed to the pilot and collected plastic packaging: TVO OÜ (Tootjavastutusorganisatsioon OÜ).

In total **300 litres** of plastic packaging waste were collected that originated from Tallinn private households. Collected packaging waste was kept and later analyzed in Tallinn Waste Center.Two bags of plastic and metal packaging waste (2x150 litres in total) were mixed homogenuosly and smaller amounts of waste samples were randomly taken and analyzed. All plastic materials in representative waste samples were analysed by Kaunas University of Technology with trinamiX device. Plastic waste was divided into plastic types and labelled with respective plastic type names. The following plastic types were analysed: HDPE, LDPE, PP, PVC, PS, PET-A/PET-G, PA, composites and not identified. TrinamiX device detected most of the plastics materials correctly, some food packaging labels did not match with what was written on the packaging and what the trinamiX device detected. Most of the materials were labeled as HDPE and PP and the device detected them correctly.

Tallinn in cooperation with other partners gathered the data, analysed it in cooperation with Kaunas University of Technology and shared the information to the producer responsibility organization who took part of the technical pilot.

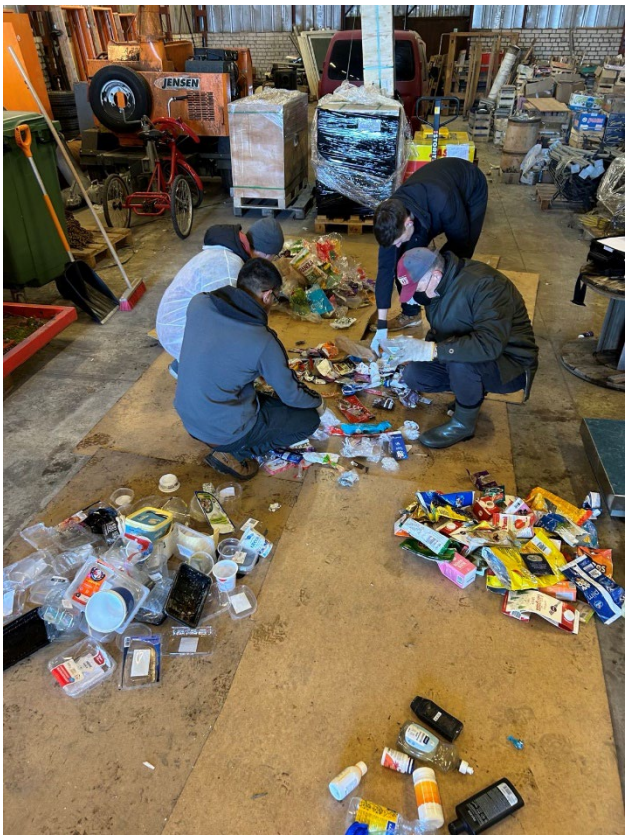
The results were gathered and summarized in cooperation with other partners: Kaunas Technical University, SEI Tallinn and TalTech.

Enablers

+ **Strong support from the stakeholders** and interest of target groups
+ **Transnational cooperation** with the targeted municipalities supported pilot implementation

Barriers

– **Demand for human resources** to manage the development process
– **Financial constraints** might pose a risk



Key takeaways

The municipal administrations and waste management operators should strengthen partnerships with innovative private and public businesses working in the areas of post-consumer plastic recycling and added-value products development.