1st International EIMPack Congress

Processing of plastic packaging waste – from material following the DKR specifications to milled goods

Lisbon, 29th – 30th November 2012

Dipl.-Ing. Michael Jansen

Table of content

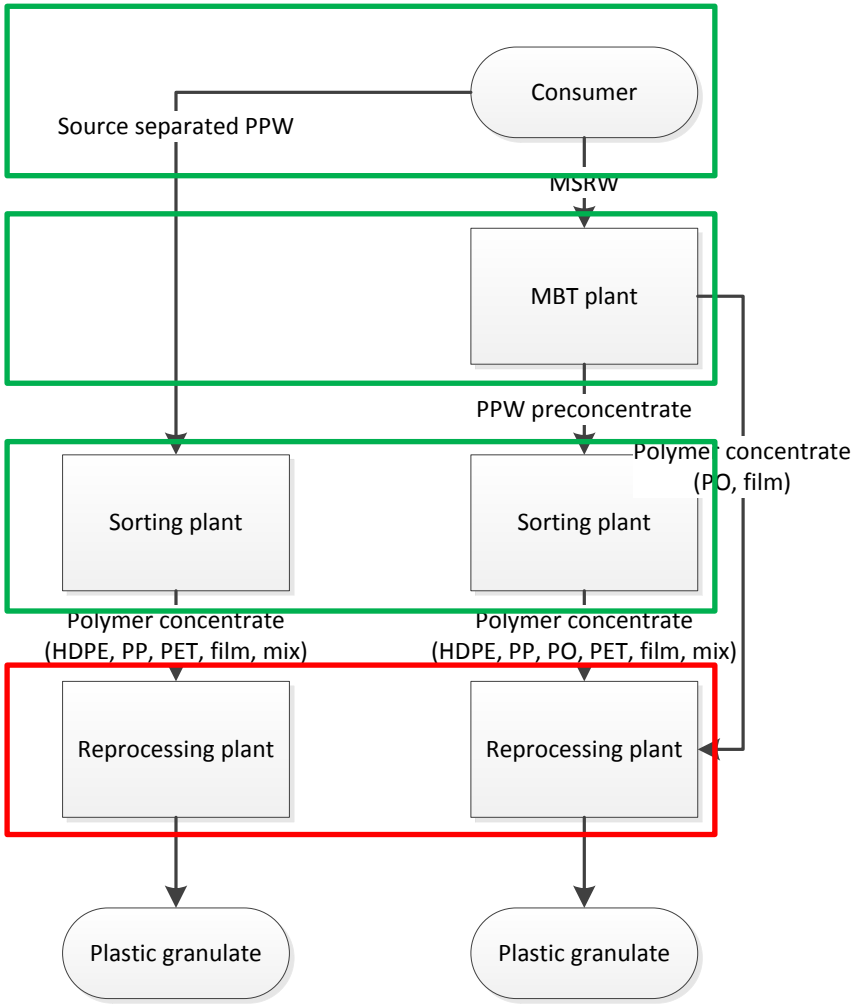
TOC

Legal basis

- Article 11(2a) of Directive 2008/98/EC of the European Parliament sets a recycling quota for plastic packaging waste (PPW) of 50 % by 2020
- Recent developments in several member states allow for alternative collection schemes to source separation
  - For example in Spain, France, Austria and the Netherlands
- The calculation of the quota is based on the input of certified recyclers (Certification now on EU-level with EuCertPlast)

The PPW recycling chain

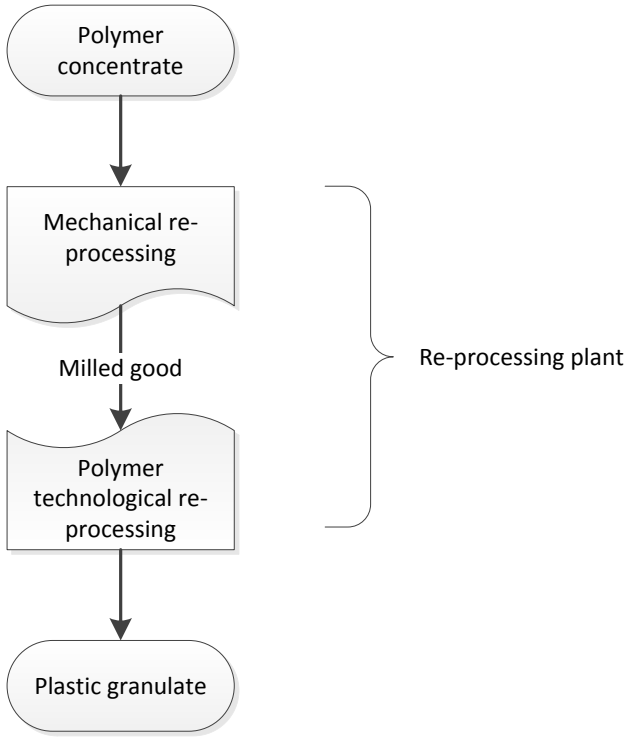
- Studies regarding the source of the plastic packaging waste, success of the source separation and potential in the MSW
- Studies regarding recovery in MBT plant
- Efficiency of sorting plants issue of past publications
- Reprocessing has not been described so far



INTRODUCTION

Development of recycling process

- Production of granulates often includes addition of additives to influence properties
- Process was split into two parts
  - Mechanical re-processing is subject of studies of the RWTH Aachen
  - Polymer technological re-processing is subject of studies of the TU Eindhoven
- Due to certain requirements to the milled good process stages were set



METHODOLOGY

Requirements to the mechanical process

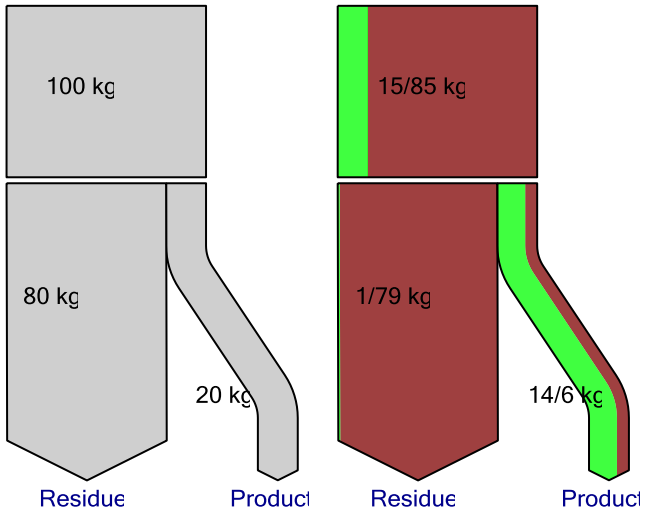
- The milled good needs to be clean, i.e. no surface adhering contaminants (mechanical properties, odour)
- Certain polymers have to be removed (e.g. PVC during PET recycling; certain combinations are allowed e.g. HDPE + PP)
- The milled good needs to be dry (foaming during remelting due to evaporation of water)
- Paper, metals, stones, etc. have to be removed to prevent high wear rates, blocking or breakage of machines
- Energy consumption should be as low as possible
- Yield should be as high as possible

➢ Comminution, Screening, Washing, Density media separation, Drying (centrifugal, thermal)

METHODOLOGY

Goals of the experiments

- Obtain a mass balance
  - Recovery of mass
  - Yield of recyclable material
- Measure energy consumption of each stage
- Measure water use and estimate treatment costs
- Compare source separated and recovered samples, i.e. work with real waste samples instead of artificially generated ones



Recovery: 20 % Yield: 93 %

METHODOLOGY

How to calculate the yield?

Issue

- The potential in the input is difficult to measure (multi-material packaging, e.g. PET-bottle with PE-lid and PP-label)
- The losses in the process stages are difficult to measure due to particle size and colour

Workaround

- Screening was believed to have the largest impact on the yield
- Other losses of recyclable material were assumed to be negligible
- The sink-float-split observed during density media separation was transferred to screening
- Other methods were checked but were found to be less precise

METHODOLOGY

Origin of sample material and DKR-no.

Sample number	Source		PE 329	PP 324	PO 321	PET	Film 310	Mixed plastics 350
	MSRW	Source separation system						
1	x		x	x	x	328-3		x
2	x		x	x		325	x	x
3.1		x	x	x		328-1	x	x
3.2		x	x	x		328-1	x	x
4.1	x				x		x	
4.2	x				x		x	
5		x	x	x		328-2	x	x

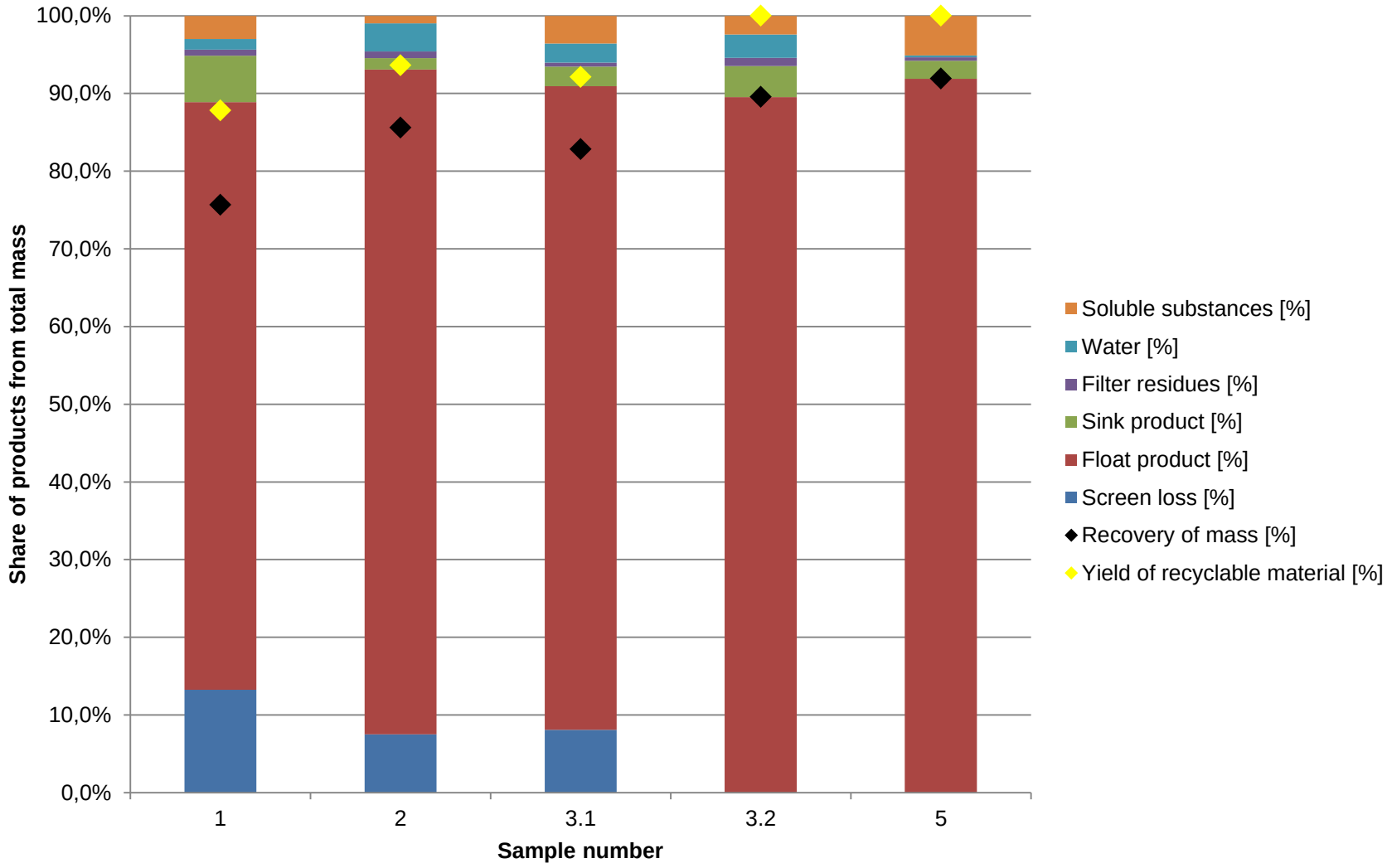
Screening vs. No screening

Hot washing vs. Cold washing

n = 22

METHODOLOGY

Mass balances HDPE samples

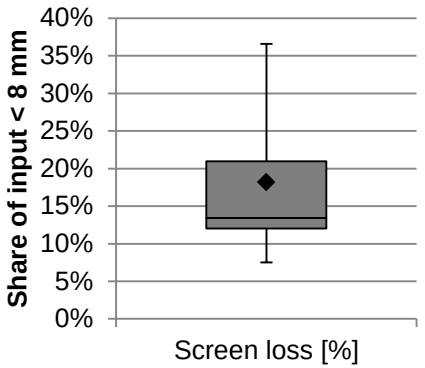


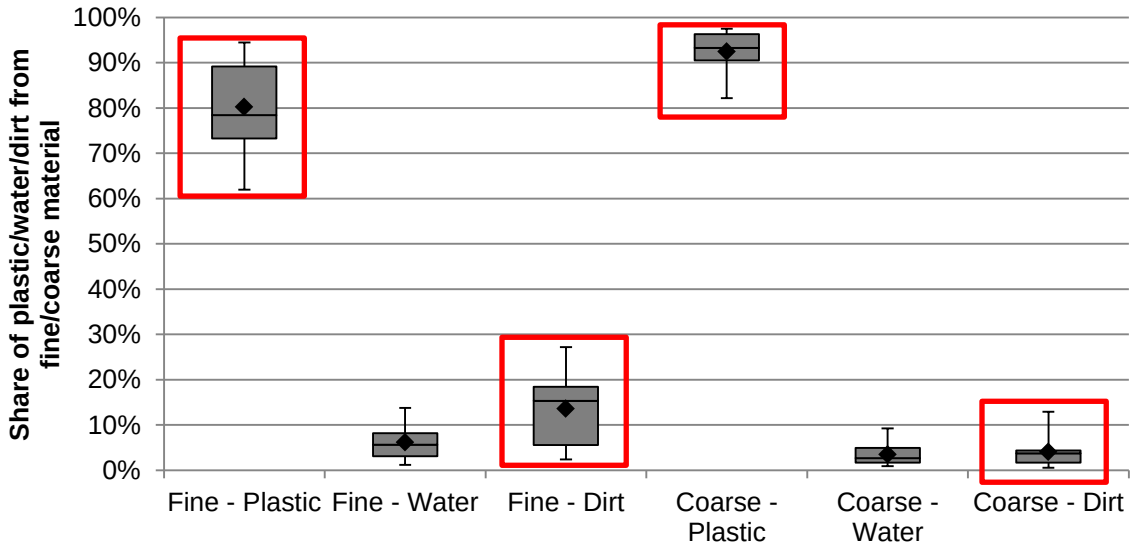
RESULTS

Screening

- Screening is able to reduce the amount of dirt in the intermediate product
- High losses of plastic with a 8 mm screen deck

➢ Screening is suggested but with finer screen deck

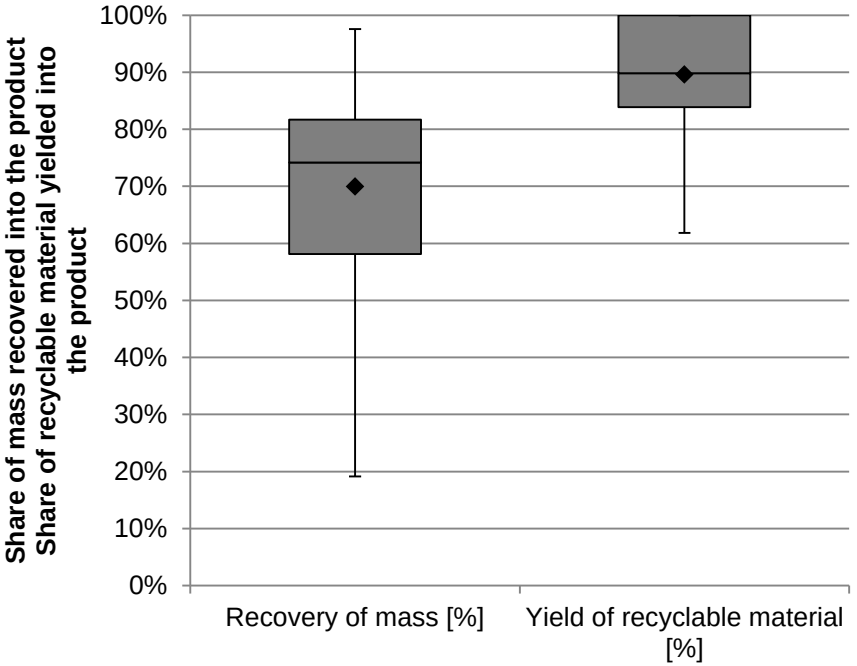


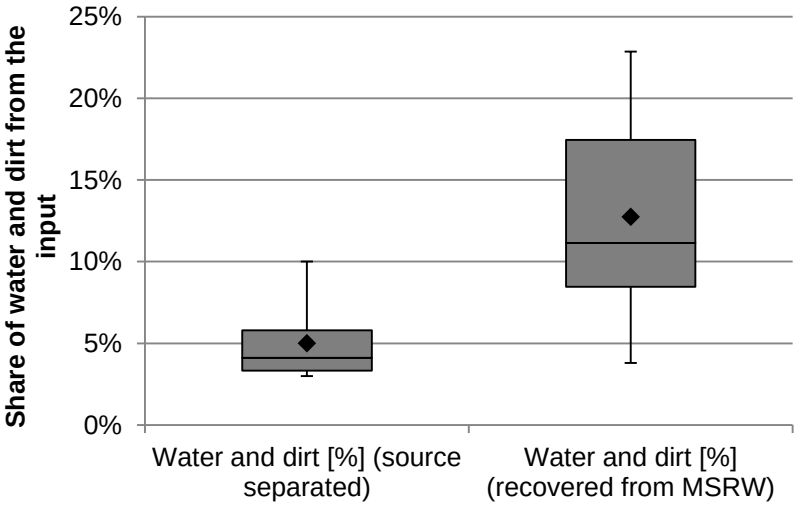


RESULTS

Recovery and yield

- Around 75 % of the input got recovered
- Around 90 % of the recyclable material yielded into the product
- Recovered samples are dirtier
- Therefore lower recovery but the same yield

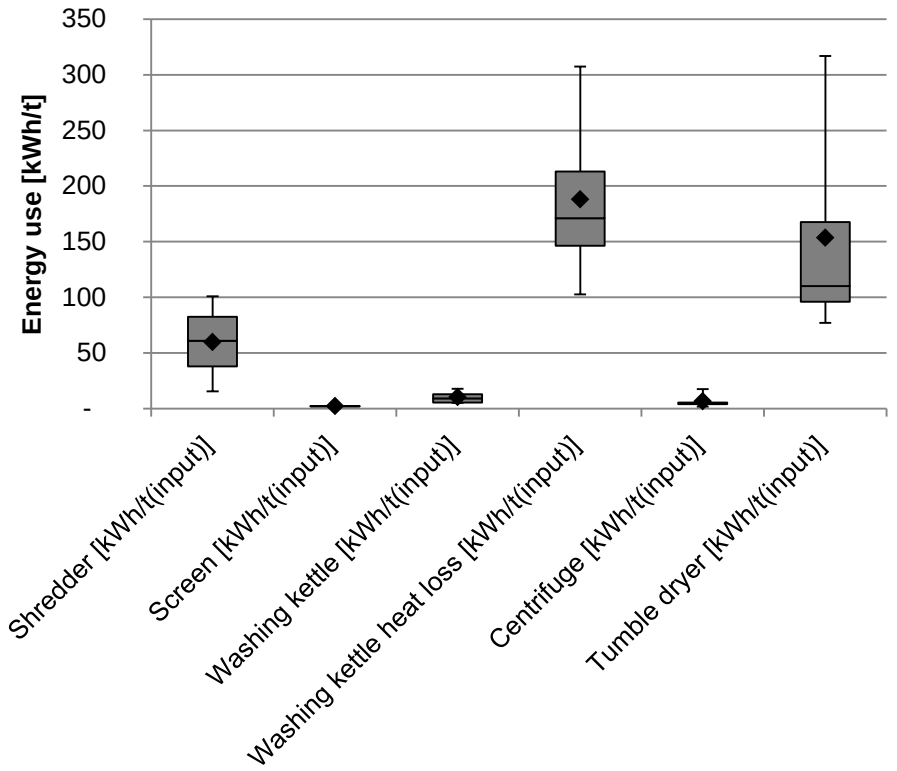


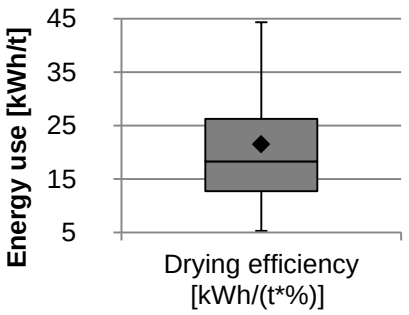


RESULTS

Energy use HDPE samples

- Main consumers are the shredder, the hot washing stage and the thermal drying stage
- Heat loss is strongly influenced by the calculation model for wash water management
- 18 kWh/Mg were used to remove 1 % of moisture from the product
- Drying equipment in the lab different to industrial equipment

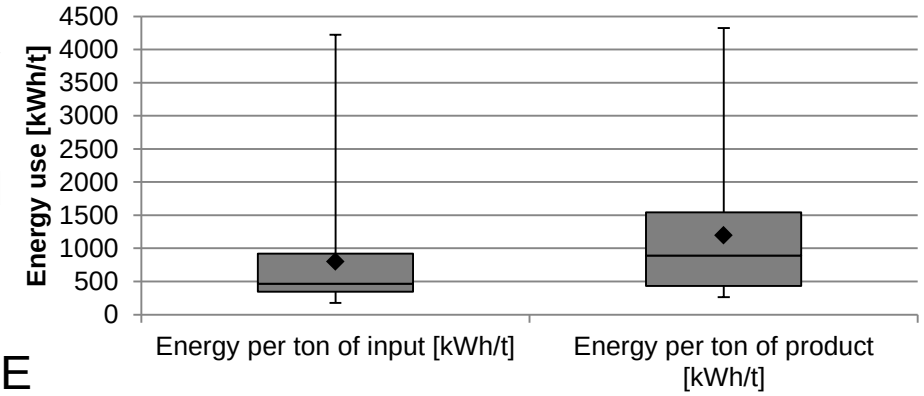


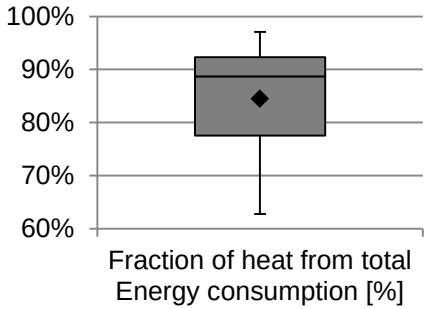


RESULTS

Total energy use

- Around 500 kWh/Mg energy investment for processing
- 90 % of the energy provided has to be heat
- Huge variations between different polymers (e.g. LDPE >> HDPE)
- Potential for optimisation due to process design and equipment selection





RESULTS

Conclusions

- For the first time re-processing of PPW was studied under consideration of recovery, yield, energy use, water use and waste water quality
- It was proven that recovered and source separated PPW can be treated (and in a similar manner)
- Recovery of around 75 % is possible (recovered PPW is app. 7 % dirtier)
- Yield potentially as high as 90 % (no matter of the origin of material)
- Around 500 kWh/Mg have to be invested (mainly for shredding, hot washing and drying)

Any Questions?

Thank you for your attention!

Dipl.-Ing. Michael Jansen
Department of Processing and Recycling (I.A.R.)
RWTH Aachen University
Wüllnerstraße 2
D-52062 Aachen

www.iar.rwth-aachen.de

QUESTIONS