

PP/PE/MULTILAYER FILM SEPARATION BY
DENSITY SORTING

CENTRISORT

PP/PE/MULTILAYER FILM SEPARATION BY DENSITY SORTING

Different plastic types can be separated by their different density in fields of gravity

- PP: 0.900 – 0.915 g/cm³
- PE-LD: 0.915 – 0.935 g/cm³
- PE-HD: 0.940 – 0.970 g/cm³

- PS: 1.040 – 1.090 g/cm³

- PET: 1.330 – 1.400 g/cm³
- PVC: 1.200 – 1.400 g/cm³

Water

Saline Solution

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Comparison of forces driving the density separation process:

Separation Tank -> 1 G

Hydrocyclone -> up to 20 G

Centrifuge -> up to 1,000 G

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Benefits of separation centrifuges:

- moderate space requirements
- moderate liquid volume
- combined separation and drying of regrinds
- high selectivity
- low impact of particle size and shape on selectivity

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Disadvantages of separation centrifuges:

- high maintenance costs due to wear and tear repairs
- need of spare rotor, to achieve high availability
- relatively high energy consumption due to continuous acceleration of cycled liquid
- high investment costs

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- 2003 – 2004 separation of PP/PE hard plastic mixes at sat. Recyclingtechnik GmbH
- Production of highly purified PP and PE regrinds
- Unstable process. Impurities clinging to the surface of input material accumulated in the liquid, continuous removal of impurities was not efficient
- Market for PP/PE mixes was stable
- Little demand for PP/PE separation

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- 2014 restarting the separation of PP/PE hard plastic mixes in new business cooperation
- Production of highly purified PP and PE regrinds
- Stable process
- Impurities clinging to the surface of input material still accumulated in the liquid, continuous removal of impurities was not installed

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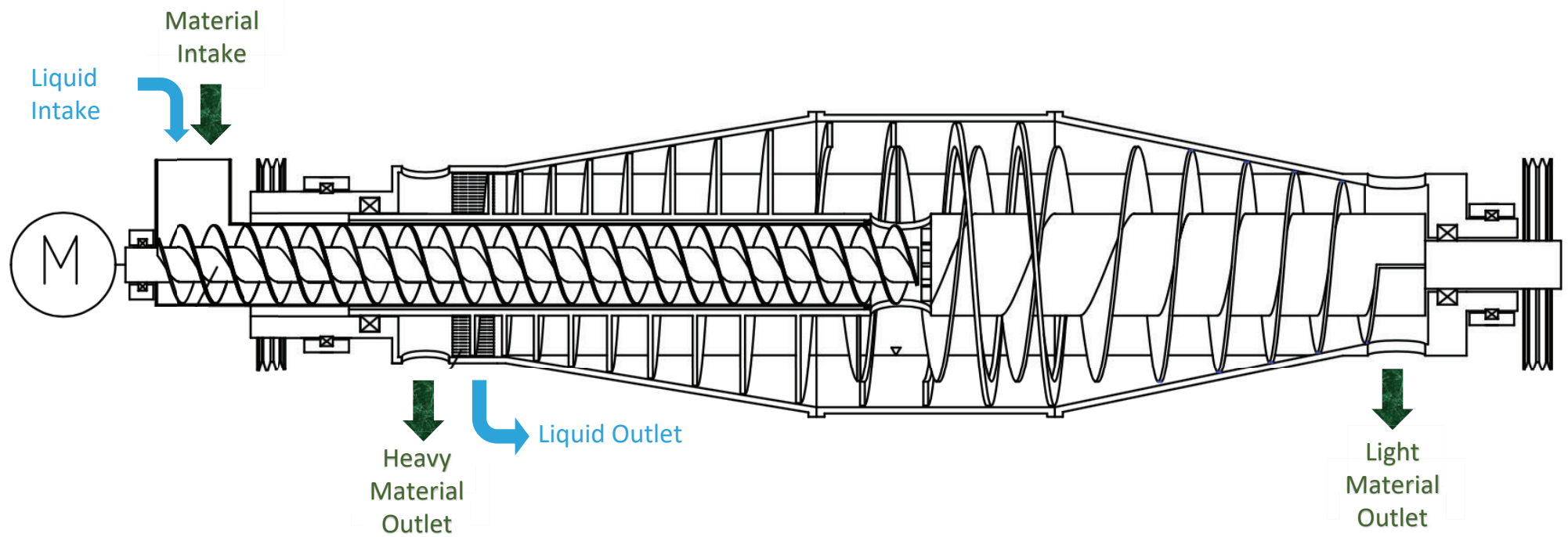
- Known separation centrifuges use pumps for hydraulic feeding a liquid/plastic blend into the machine. The volume of pumped liquid adds up to 90 m³/h
- Adjusting a homogenous liquid/plastic blend is crucial and needs lots of experience
- Acceleration of up to 90 m³/h of liquid consumes a high amount of electrical energy
- Liquids other than water cost up to 5,000 €/m³. The system liquid volume and liquid recovery rates are crucial for the economics of density separation with liquids different than water

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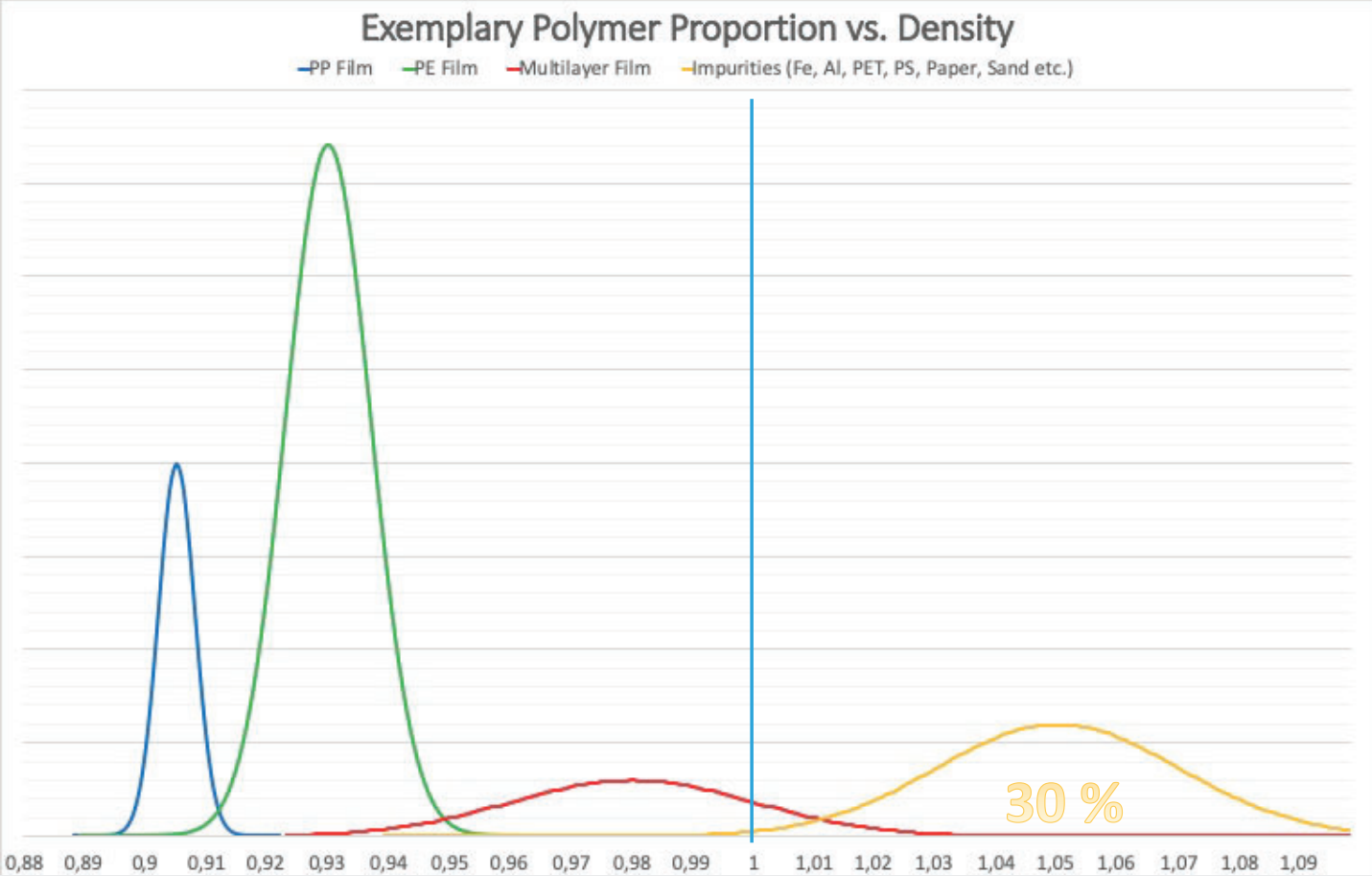
- New technology to reduce the liquid volume flow drastically, by using a screw conveyor to feed plastic regrind mechanically into the centrifuge, instead hydraulic feeding
- Simplifying the liquid flow inside the machine, to stabilize the process
- Cleaning processes for circulated liquid have to handle much smaller liquid volumes
- Patent is claimed for the technology reducing the liquid volume flow and simplifying the liquid flow

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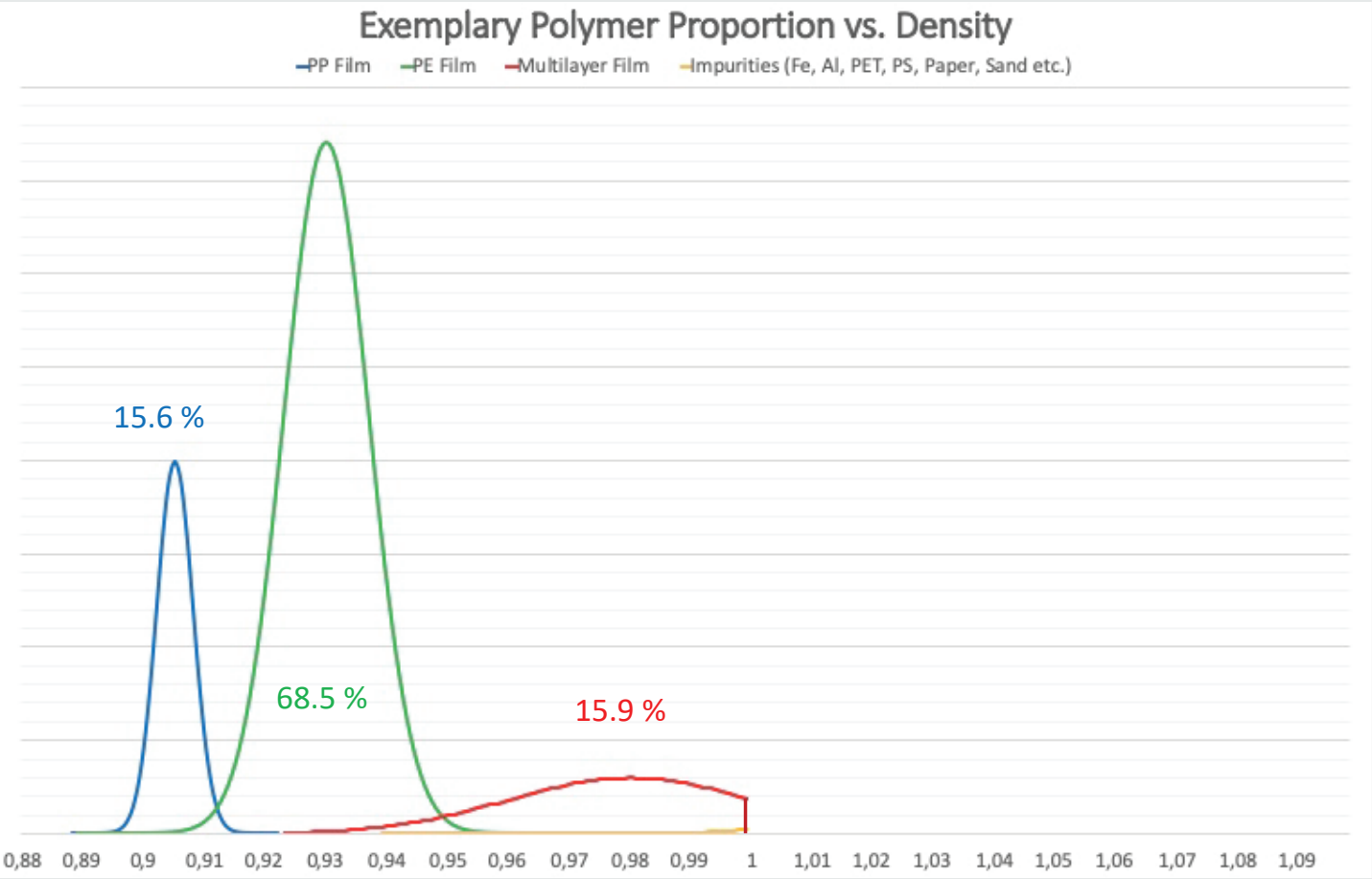
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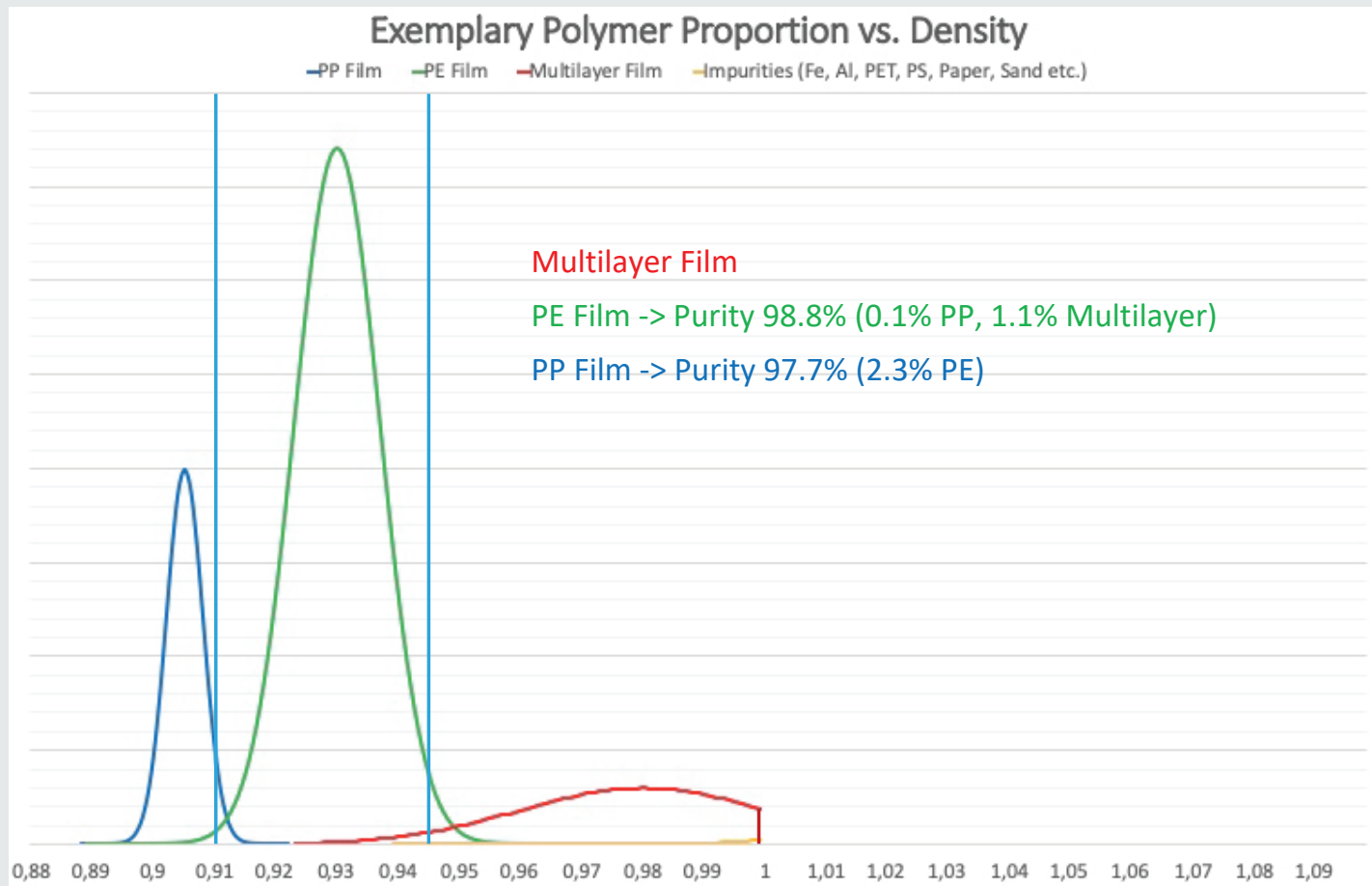
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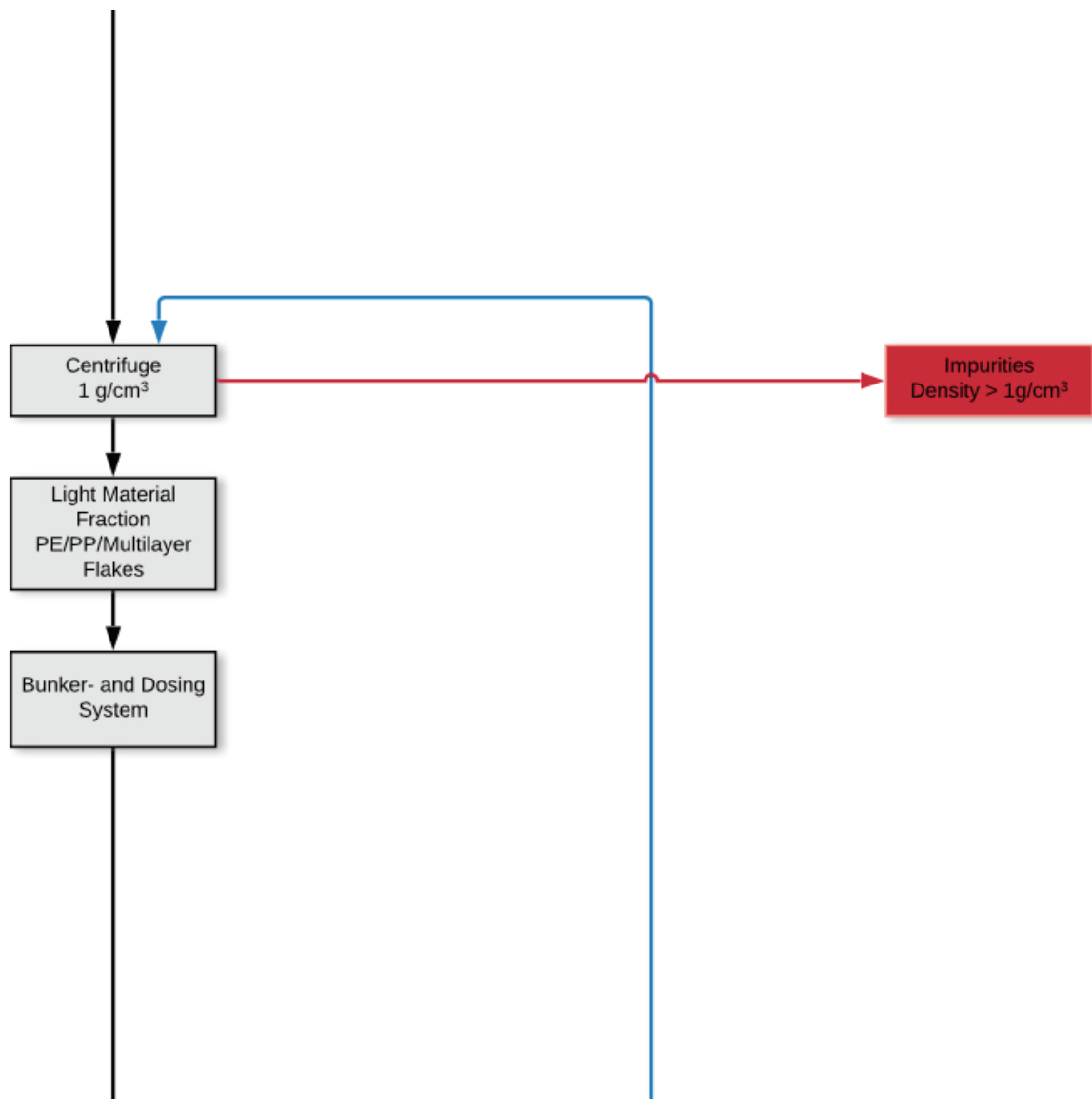


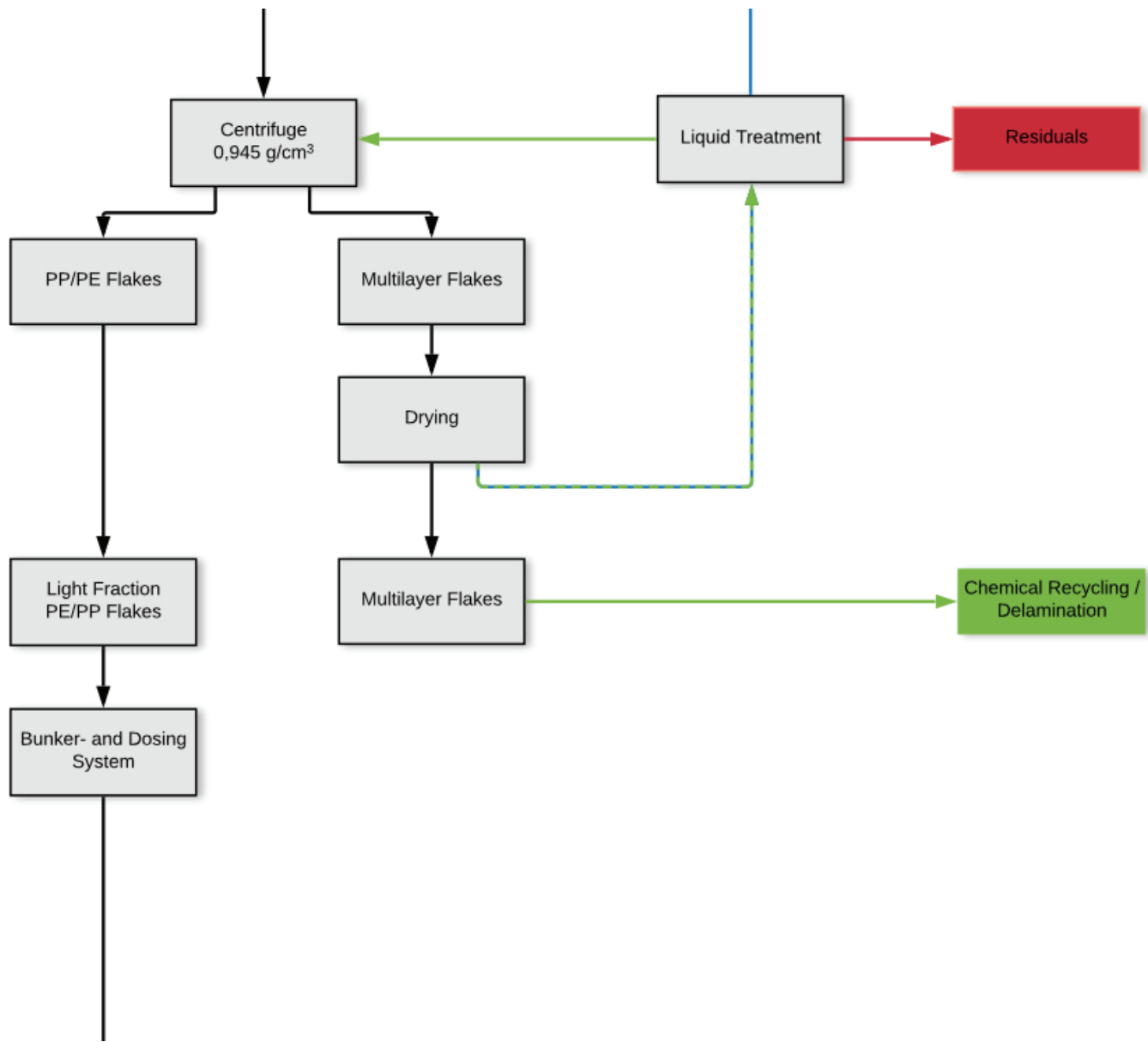
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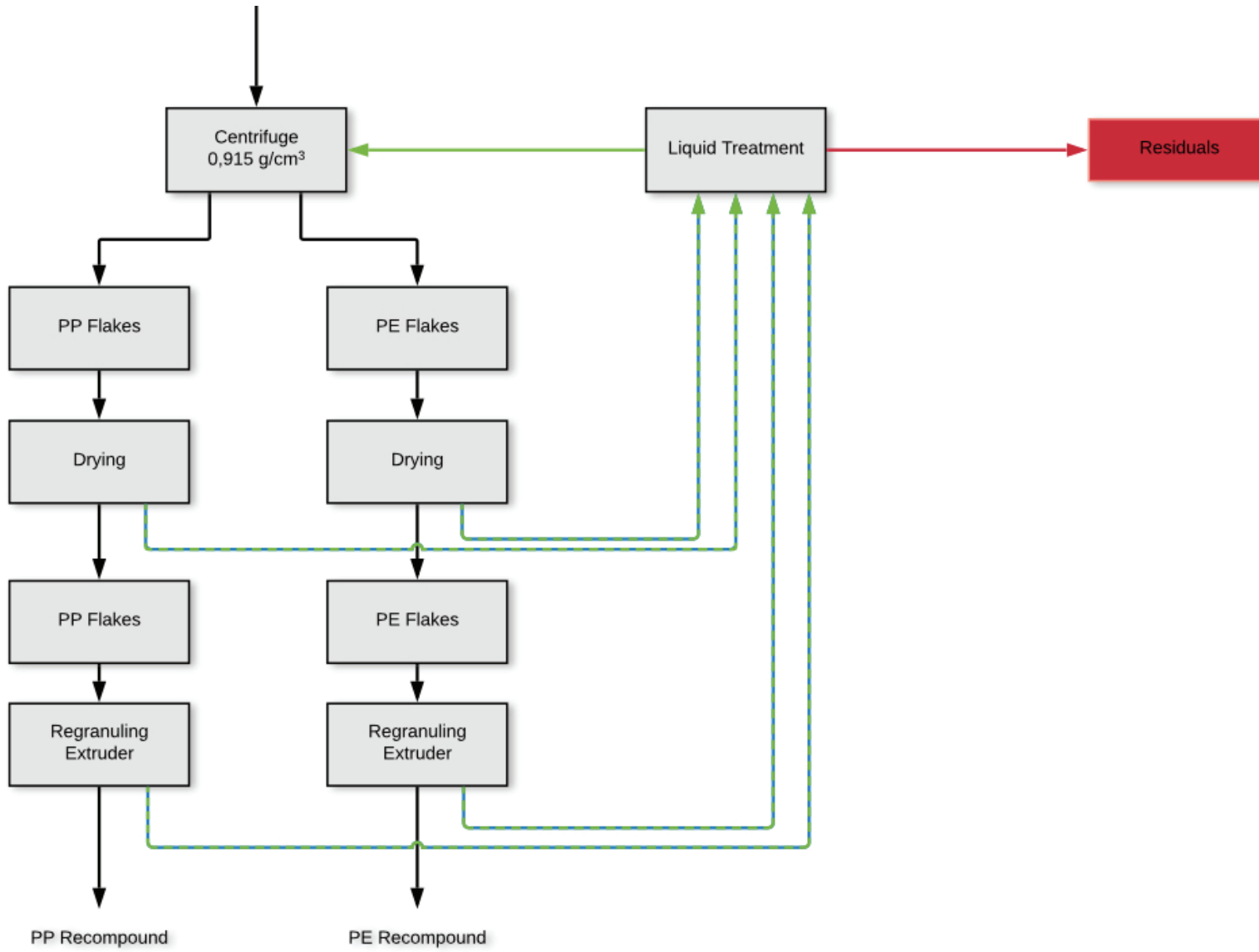


PP/PE/Multilayer Film Separation by Density Sorting

- High quality recycling of flexible packaging can not be achieved with today's established sorting technologies
- Compounds of material mixes, even with compatibilizers will only have a limited market
- Following you will see a proposal for processing and separating flexible plastic packaging, using the patented technology







PP/PE/Multilayer Film Separation by Density Sorting

We are looking for a partner to participate in the following project:

Project step 1:

- Test operation of a Censor CZ-4 (900 mm drum diameter) with patented feeding system.
- Continuous processing of 1.000 kg/h PP/PE hard plastic mix
- Experiences from PP/PE hard plastic mixes as foundation for project step 2.

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Project step 2:

- Modification and test operation of a Censor CZ-4 (900 mm drum diameter) with patented feeding system, liquid management system and system for density adjustment ($< 1\text{g/cm}^3$)
- Continuous processing of 1.500 kg/h PP/PE hard plastic mix
- Test operation for density separation of PP/PE/Multilayer Films
- Providing of cleaned flakes for further processing and sampling for market preparation

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Project Step 3:

- Modification of a Sharples decanter (1.400 mm drum diameter) into a separation centrifuge with a plastic film processing capacity of 2.000 kg/h
- Continuous processing of PP/PE/Multilayer Film mixes

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Project step 4:

Production of two centrifuge models:

Centrisort 900 -> 900 mm drum diameter
throughput: 2,000 kg/h hard plastic mix or 1,000 kg/h film flakes

Centrisort 1.400 -> 1,400 mm drum diameter
throughput: 2,000 kg/h film flakes