**Publication Notes for Presentation Slides**

**Slide 1 – *Engineering the Future of ELT Recycling***

This presentation, originally delivered at the rCB Barcelona 2025 conference, outlines a systems-level approach to integrating mechanical tyre recycling (MTR) with pyrolysis. It demonstrates that the quality of recovered carbon black (rCB) and tyre pyrolysis oil (TPO) is fundamentally determined by feedstock engineering rather than by pyrolysis technology alone. Stable production of low-ash rCB requires consistent feedstock composition, which can only be achieved through coordinated development of both mechanical recycling and pyrolysis processes.

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**Slide 2 – *What is the State of Play?***

Future development of ELT recycling requires systematic tyre deconstruction. Individual tyre components are manufactured from distinct rubber compounds and should therefore be processed through dedicated recycling routes.

Traditional applications, including sports surfaces and moulded rubber products, will continue to coexist with advanced circular applications. Steel should be upgraded through chemical cleaning to enable its reuse in tyre cord manufacturing, while textile fractions should be directed towards high-volume applications such as SMAPOL or functional fillers (e.g. Elitex).

From a pyrolysis perspective, tread rubber is less desirable because of its elevated silica and ash content, whereas butyl innerliners introduce halogens that negatively affect downstream hydrocracking of pyrolysis oil.

In the medium term, until industrial tyre deconstruction becomes commercially available, stable feedstock quality should be achieved through controlled homogenisation using mixing silos. This approach, described in a patent application submitted by Recykl, enables consistent ash content despite the natural variability of ELT streams.

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**Slide 3 – *Evolution of Species***

No publication note required.

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**Slide 4 – *Evolution of Pyrolysis Feedstock***

This figure illustrates the evolution of industrial feedstock strategies adopted by European pyrolysis plants. Since 2021, pyrolysis operators have evaluated numerous

combinations of passenger car (PCR), truck (TT) and OTR tyres, together with various particle sizes ranging from 30 mm chips to 3–4 mm granulates.

Despite extensive experimentation, optimisation based solely on tyre proportions and particle size cannot eliminate fluctuations in feedstock composition because these originate from the inherent statistical variability of the ELT recycling stream.

The emerging concept of GreenFeed for pyrolysis therefore focuses on four key principles:

- consistent tyre category proportions reflecting market availability (e.g. 70/30 or 80/20 PCR/TT),
- feedstock homogenisation using mixing silos,
- progressive implementation of tyre sorting and deconstruction,
- progressive downsizing of the rubber granulates.

Application of above-mentioned principles not only stabilises ash content in rCB but also improves pyrolysis kinetics, increases supply security, allows for ash content regulation, and reduces downstream purification costs and overall CAPEX/OPEX requirements.

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**Slide 5 – *Simulated Deconstruction***

A statistical dataset comprising approximately two million end-of-life tyres was collected at the REGOM sorting facility. The database includes tyre dimensions, manufacturer, tread thickness, weight and other relevant parameters.

This information enabled quantitative modelling of expected rCB ash content under different feedstock preparation scenarios, including selective tread removal, complete tread removal and other deconstruction strategies. The analysis forms the basis for designing future feedstock engineering approaches for advanced pyrolysis applications.

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**Slide 6 – *Simulation – Removing Selected Treads***

Simulation results demonstrate that selective removal of treads from premium tyres significantly reduces the average ash content of the resulting recovered carbon black.

Although this strategy decreases the amount of material available for pyrolysis to approximately 75% of the original feedstock volume, the predicted average ash content decreases from approximately 23% to around 17%.

These findings provide quantitative evidence that selective sorting and deconstruction constitute effective methods for engineering pyrolysis feedstock quality and support the feedstock preparation methodology described in Recykl's patent application.

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**Slide 7 – *Final Note***

Feedstock engineering should be viewed as two complementary optimisation processes.

Sorting and tyre deconstruction determine the average ash content achievable in recovered carbon black, whereas homogenisation through controlled mixing determines the consistency of production.

Industrial experience indicates that feedstock averaging can realistically achieve ash-content tolerances of approximately ±0.5–1.0%, while sorting and deconstruction primarily control the mean ash level. Both approaches are therefore essential for producing consistent high-quality rCB.

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**Slide 8 – *Pyrolysis Feedstock Excellence Index***

The Pyrolysis Feedstock Excellence Index is proposed as a practical framework for evaluating feedstock quality based on two parameters: average ash content and process consistency.

The diagram illustrates anonymised industrial data collected from several European pyrolysis plants.

Publicly available production data from Contec Poland indicate an average ash content of approximately 23.7% with a process variability of approximately 3.6% (6σ) using unsorted, non-homogenised 25 mm feedstock containing a 70/30 PCR/TT mixture.

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**Slide 9 – *Current Industry Position***

Current industrial practice remains focused on identifying an optimal combination of passenger car, truck and OTR tyres. However, statistical analysis suggests that no universal tyre ratio can eliminate feedstock variability.

The desired transition towards low-ash, highly consistent rCB production can only be achieved through systematic feedstock engineering. In the short term, this requires homogenisation and controlled averaging of feedstock. In the longer term, industrial tyre sorting and deconstruction will become essential components of advanced ELT recycling systems.

**Slide 10 – *Classification of Mechanical Tyre Recyclers***

A classification system for mechanical tyre recyclers is proposed to communicate feedstock preparation capabilities to pyrolysis operators.

The framework considers the degree of tyre deconstruction, sorting methodology, homogenisation strategy and feedstock dosing approach. Such classification provides a transparent indication of the expected consistency, ash-content stability and overall quality of feedstock supplied for pyrolysis, enabling improved process control and more predictable recovered carbon black quality.