THE WASTE-TYRE DIALOGUE

A REVIEW OF PATHWAYS AND REGULATORY GAPS

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Contents

1. INTRODUCTION

1.1 BACKGROUND

India's tyre industry is currently among the largest globally, in terms of both production and consumption. Over the past few years, India's tyre production has seen a consistent rise, from **192 million units in 2018 to 217 million units in 2022.**[1] The scale of production is driven primarily by a robust domestic demand, with an estimated 194 million tyres (equivalent to an estimated 2.4–2.6 million tonnes by weight) used within the country in just 2024.[2]

The high volume of tyre production inevitably results in significant volumes of end-of-life tyres (ELTs) generated. By 2024 estimates, India generates around 1.6 million tonnes of ELTs annually.[3] It is also a major importer of waste tyres, increasing from around **0.3 million tonnes in 2021** to **1.4 million tonnes in 2024**.[4] UK-origin tyres alone account for nearly 50 per cent of these imports. The total ELT volume handled within India in 2024 is estimated to be close to **3 million tonnes**, encompassing both domestically generated and imported waste.

When scientifically processed, these ELTs could serve as a valuable resource, offering multiple recovery pathways. For instance, approximately 20 per cent of a tyre's composition is steel, which is sent to smelters for reuse. Fibre and nylon components comprise about 15 per cent of a tyre,[5] and can be repurposed for the production of clean-up materials such as oil-absorbent pads and mats or can be used as alternative fuel resources in cement plants. The remaining bulk—rubber—is recovered and recycled as well. A portion of it is used to produce tyre-derived fuel (TDF), where shredded tyres are processed in the absence of oxygen. Rubber can also be converted into mulch for landscaping and playgrounds, or processed into crumb rubber for use in road surfacing, speed breakers and athletic tracks.[6] With further refinement, crumb rubber yields rubber powder—a fine, high-performance material used in the manufacture of plastics, adhesives, sealants and even new rubber-based products.[7]

These products are produced largely through three processes, i.e. **pyrolysis, crumb rubber production and reclaim rubber production** (see *Figure 1: Major ELT recycling pathways in India*).

Figure 1: Major ELT recycling pathways in India

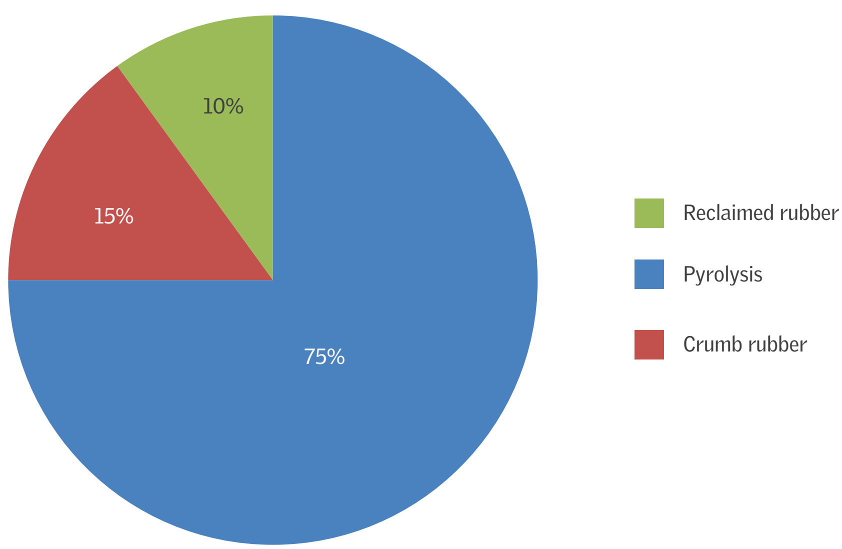
Source: Material Recycling Association of India

Among these processes, pyrolysis is currently the dominant route, accounting for approximately 75 per cent of total waste tyres processed in the country (see *Figure 2: Percentage contribution of recycling pathways to ELT recycling in India*). This method involves the thermochemical decomposition of tyres in the absence of oxygen, to extract oil, carbon char and steel. Its widespread adoption is largely driven by low upfront capital requirements, simpler technological needs and a high market demand for the tyre-derived oil.

Following pyrolysis, **crumb rubber production** constitutes the **second-largest recycling route**, handling around **15 per cent of ELTs**. This method mechanically reduces tyres into varying particle sizes—from coarse shreds to fine rubber granules. These outputs serve multiple end-uses: they are either sent to pyrolysis units (batch/continuous) for further processing, or used in the manufacture of crumb rubber modified bitumen (CRMB) for road construction. Smaller fractions of crumb rubber also find niche applications in sports surfaces, rubberized flooring and crumb rubber, with even finer particle size used, to a limited extent, in the manufacture of new tyres as fillers.

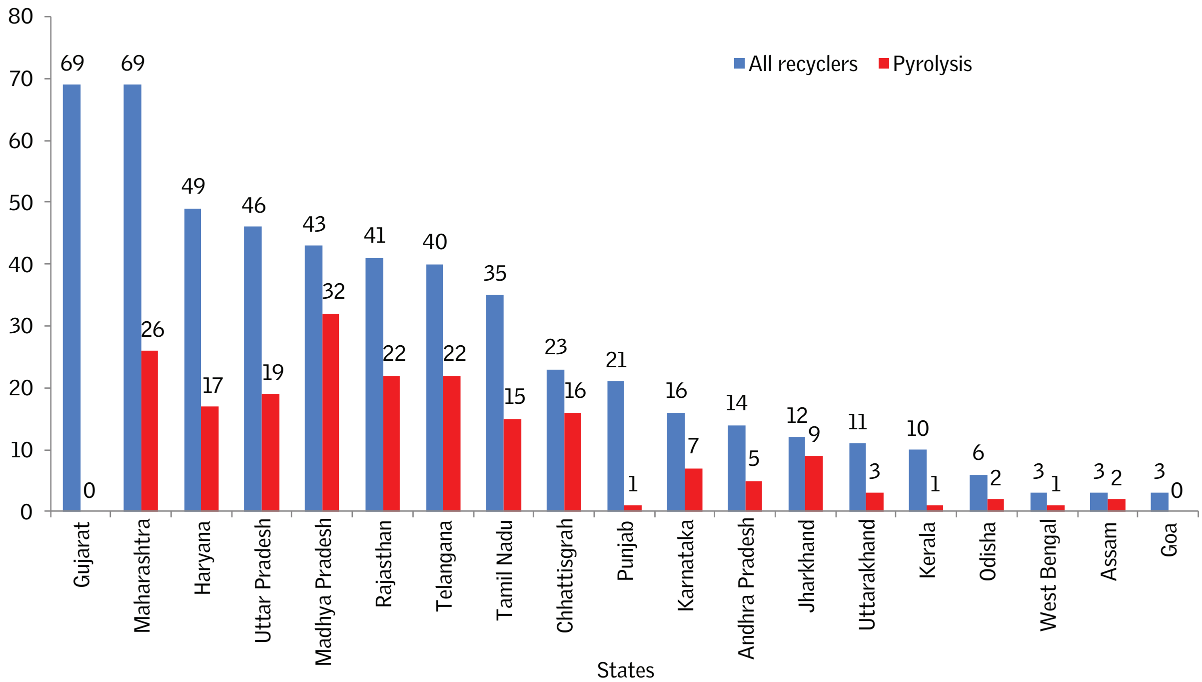
Last, **reclaim rubber production** accounts for approximately **10 per cent of ELTs** processed in the country. Through devulcanization, a process that selectively breaks the sulphur cross-links in rubber polymers, reclaim rubber restores elasticity and workability, making it suitable for reuse in tyres, conveyor belts, mats and moulded goods.

Figure 2: Contribution of various ELT recycling pathways



Source: Provided by MRAI (2024), compiled by Centre for Science and Environment

Figure 3: Statewide distribution of EPR-registered recyclers in India



Source: Data from CPCB, compiled by the Centre for Science and Environment

Currently, a total of 517 tyre recycling units are registered with the Central Pollution Control Board (CPCB), according to the Extended Producer Responsibility (EPR) portal. While these units are widely spread across the country, the major hubs are concentrated in Gujarat, Maharashtra, Haryana and Uttar Pradesh (see *Figure 3: Statewide distribution of EPR-registered recyclers in India*). Madhya Pradesh, however, shows major domination of the pyrolysis units, accounting for 74 per cent of the recycling units in the state. A total of 200 pyrolysis units are currently registered on the EPR portal.

These widespread recycling activities, however, also bring with them a unique set of environmental challenges, the impact of which needs to be addressed. Pyrolysis—currently the dominant method of recycling tyres in the country—has been widely criticized for the safety concerns and high pollution load associated with its operational protocol, especially in batch-type units. This recycling process releases high levels of toxins particularly particulate matter (PM), volatile organic compounds (VOCs), carbon monoxide (CO), and sulphur and nitrogen oxides

(SOx/NOx) during the thermal degradation of tyres in the reactor, particularly in traditional batch-operated units. In addition to these air pollutants, these units often carry safety risks. Since batch reactors are loaded and unloaded after each cycle, there have been instances of explosions often linked to poor sealing of the reactor, or premature opening of the reactor before it has completely cooled down. Further, improper storage of the recovered pyro oil, particularly in makeshift drums near heat sources, increases the likelihood of fire.

Although not as much as pyrolysis, the other recycling pathways—crumb rubber manufacturing and reclaim rubber manufacturing—also have a few environmental issues associated with them. For instance, the mechanical shredding in crumb rubber manufacturing releases airborne rubber dust containing carbon black, which causes respiratory issues in the absence of adequate dust-control systems. Similarly, during the autoclave-based devulcanization process, reclaim rubber manufacturing emits fumes and particulates. Across the sector, inadequate housekeeping, limited use of pollution control equipment, and direct worker exposure to fine particulates are common, particularly in small and medium-scale facilities.

In comparison to the other recycling pathways, pyrolysis seems to have greater risk inherent in its operational process. This is also reflected in the government's regulatory interventions in the past decade, as most of these are targeted towards pyrolysis.

1.2 Regulatory and policy landscape governing tyre waste in India

For the management of these end-of-life tyres (ELTs), the government developed two Standard Operating Procedures (SOPs), in 2015 and 2024, as well as an Extended Producer Responsibility (EPR) policy in 2022. The first SOP for the recycling and pyrolysis of waste pneumatic tyres was issued by the Ministry of Environment, Forest and Climate Change (MoEFCC) in 2015. The SOP laid out the minimum required facilities and operating practices for the production of reclaim and crumb rubber from waste tyres along with distinct guidelines for batch pyrolysis vs. continuous pyrolysis units. The SOP also allowed import of waste tyres for the purposes of crumb rubber manufacture, tyre pyrolysis oil manufacture as well as for usage in co-processing in cement kilns.

However, the 2015 operational protocol was objected to in the National Green Tribunal (NGT) in 2019 by Social Action for Forest and Environment (SAFE), a civil society, which highlighted that the handling of ELTs was not in compliance with the environmental protection laws in India (OA 400/2019). In response to this petition, the Tribunal directed CPCB to examine the compliance status of existing tyre pyrolysis oil (TPOs) units. Subsequently, CPCB submitted its findings, highlighting that out of total 757 TPOs, 216 units were found non-complying out of which 190 units were issued immediate shutdown notice. The findings also highlighted that out of 757 TPO units, 749 were operating on a batch process and remaining on continuous process.

Subsequently, in 2020, CPCB conducted a detailed study in collaboration with NEERI and IIT Delhi to evaluate the environmental performance of different types of TPO units—specifically, to assess whether only continuous units should be permitted, or if existing batch/advanced batch automated processes could be acceptable. The study found **that both advanced batch automated process (ABAP) and continuous process demonstrated acceptable compliance with work-zone emission limits and did not significantly affect ambient air quality**. Traditional batch units, however, were found to require substantial retrofitting and pollution control upgrades.

Consequently, in 2024, CPCB came out with a revised Standard Operating Procedure (SOP) for pyrolysis units mandating that only ABAP and continuous pyrolysis plants will be allowed and the existing batch plants should upgrade to ABAP. The SOP also includes siting criteria, permissible plant capacity and requirements for environmentally sound operation.

Briefly, the 2024 SOP:
- Introduces and mandates the adoption of advanced batch automated processes (ABAP) or continuous pyrolysis systems, **banning the conventional batch operations.**
- Imposes ban on import of waste tyres for any pyrolysis units.
- Allows new ABAP-type tyre pyrolysis units only in industrial areas/land.
- Allows new or expansion of pyrolysis units using advanced batch automated processes (ABAP) to a maximum batch capacity of **60 tonnes per day (TPD)** within a single premises. For capacity exceeding 60 TPD, only **continuous process** units are permitted.

Apart from the stated compliance requirements, the 2024 SOP also claims to introduce several technical provisions for advanced batch automated pyrolysis plants, aimed at making them more environmentally sound. A comparison with the earlier 2015 SOP, however, reveals no major transformation—beyond the addition of a few automation-related specifications like the use of Programmable

Logic Controllers (PLC). Notably, the use of PLC was already mandated in the 2015 SOP. The revised SOP merely expands on this by specifying the types of PLCs required like CO sensor, bypass line for pyro gas and auto-cut of gas supply to reactor in case of increase in temperature and pressure. In essence, the revised 2024 SOP **does not introduce any fundamentally new technical measures for the ABAPs**—it either merely reiterates or elaborates upon already established requirements. As such, the term 'advanced' when used for ABAP completely contradicts the very limited extent of technological change actually implemented in practice.

Extended Producer Responsibility (EPR), 2022

In parallel with the procedure of updating SOP, the Ministry of Environment, Forest and Climate Change (MoEF&CC) also notified the Hazardous and Other Wastes (Management and Transboundary Movement) Amendment Rules, in 2022, and introduced the Extended Producer Responsibility (EPR) for waste tyres. Alongside this, an EPR portal was also created for the management of tyre waste.

The EPR framework is applicable to the following three categories of stakeholders:

- Producers (manufacturers/importers of new tyres),
- Recyclers (entities processing waste tyres into defined end-products), and
- Retreaders (entities extending tyre life through retreading).

All stakeholders falling under these categories are mandated to register on CPCB's EPR portal, and must register separately for each role they undertake—that is, they must register twice if they are both a producer and a recycler. The framework sets phased recycling targets for producers, beginning with 35 per cent of their production in 2022, rising to 100 per cent by 2025. Specifically for the imported waste tyres, the importer carries 100 per cent EPR responsibility for the quantity imported. Importantly however, the **import of waste tyres solely for pyrolysis has been explicitly prohibited in the EPR framework**.

The EPR system moreover clearly specifies the recycling processes eligible for EPR certification. These include:

- Crumb rubber production,
- Crumb Rubber Modified Bitumen (CRMB),
- Reclaim rubber,
- Recovered carbon black, and
- Pyrolysis oil production

Under the current EPR rules, recyclers generate EPR certificates based on the quantity of waste tyres being processed by them and the producers are required to just purchase these certificates from registered recyclers in order to meet the obligations. Further, both producers and recyclers are required to submit quarterly and annual returns on the CPCB EPR portal. Recyclers, additionally, are required to submit monthly data detailing the quantity of waste tyres collected, end products produced, and number of EPR certificates sold. As of June 2025, the portal shows 517 registered recyclers, reflecting a broad pool of recyclers involved in EPR credit generation.

While an EPR framework, in general, is meant to make producers responsible for the lifecycle of their products, in practice, the EPR for tyres frees **the producers from any real responsibility**. Producers are allowed to get away from their EPR obligations simply by purchasing credits from the recyclers, without playing any active role. It allows the tyre producers to remain largely disconnected from the critical processes of **collecting and responsibly managing the ELTs as well as environmentally sound recycling of the tyres that** they introduce into the market. The onus of ensuring these outcomes lies with the recyclers, which represents a critical gap in the way the tyre EPR is framed and undermines the core intent of a producer responsibility programme.

Further, the lack of transparency in the EPR portal is found to be another concern. The information on the type of recycling process undertaken by registered recyclers—whether its crumb rubber, reclaim rubber, or pyrolysis—is not publicly available (see *Figure 4: Public view of details of recyclers in the EPR portal*). This information is restricted and only accessible to producers and recyclers. Also, there is currently no way for the general public to verify from the EPR portal whether these assigned targets have actually been met.

This non-disclosure of information represents a step backward in transparency as it limits the possibility of public vigilance on highlighting any malpractices. Moreover, currently the portal only lists EPR targets mandated to producers, but it provides no indication of whether these targets are being fulfilled.

1.3 Dissecting the debate

A quick search for 'waste tyres and India' yields a series of urgent media headlines calling for a complete ban on waste tyre imports (see *Figure 5: Recent media discourse on India's waste tyre recycling scenario*). What then is the underlying issue? Why has the import of waste tyres into India attracted such scrutiny? This raises an important set of questions: To what extent will banning imports actually

Figure 4: Public view of details of recyclers in the EPR portal

EPR Portal for Management of Waste Tyre

Total Issued Certificate | Back

Show 10 entries | Search:

Producer Name	Address	State	Registration Grant Date	Date of Receiving
2 DEGREES CLICON PRIVATE LIMITED	Sy No: 266/A, Mallepally (V), Kondapur (M), Sangareddy (D), TS- 502295	Telangana	05-Jun-2024	14-May-2024
3R RECYCLER PVT LTD	G-175 & G-176,MG ROAD,MUSSOORIE GULAWATHI ROAD INDUSTRIAL AREA	Uttar Pradesh	21-Sep-2023	06-Sep-2023
6H Industries	Plot Number 122D KIADB Industrial Area	Karnataka	01-Jul-2024	09-Jun-2024
A K RUBBER	Plot No.6, Survey No. 527/3/P1, Gulshan Industrial Estate, Fansa, Sarigam, Valsad, Gujarat, 396155	Gujarat	29-Jan-2024	16-Jan-2024
A ONE RUBBER INDUSTRIES	PLOT NO 165 HSIIDC RAI	Haryana	29-Jan-2024	17-Jan-2024
A.P. RUBBER INDUSTRIES	E-29, INDUSTRIAL AREA, RAM DHAM COLONY ROAD,BAHDRABAD, Haridwar, Uttarakhand, 249402	Uttarakhand	06-May-2024	02-Apr-2024
AADITHYA PYRO OILS TECH PRIVATE LIMITED	4-71, Near Maisamma Temple, Farooqnagar Bypass, Industrial Area Kothur, Rangareddy,Telangana 509228	Telangana	30-Jan-2025	21-Jan-2025

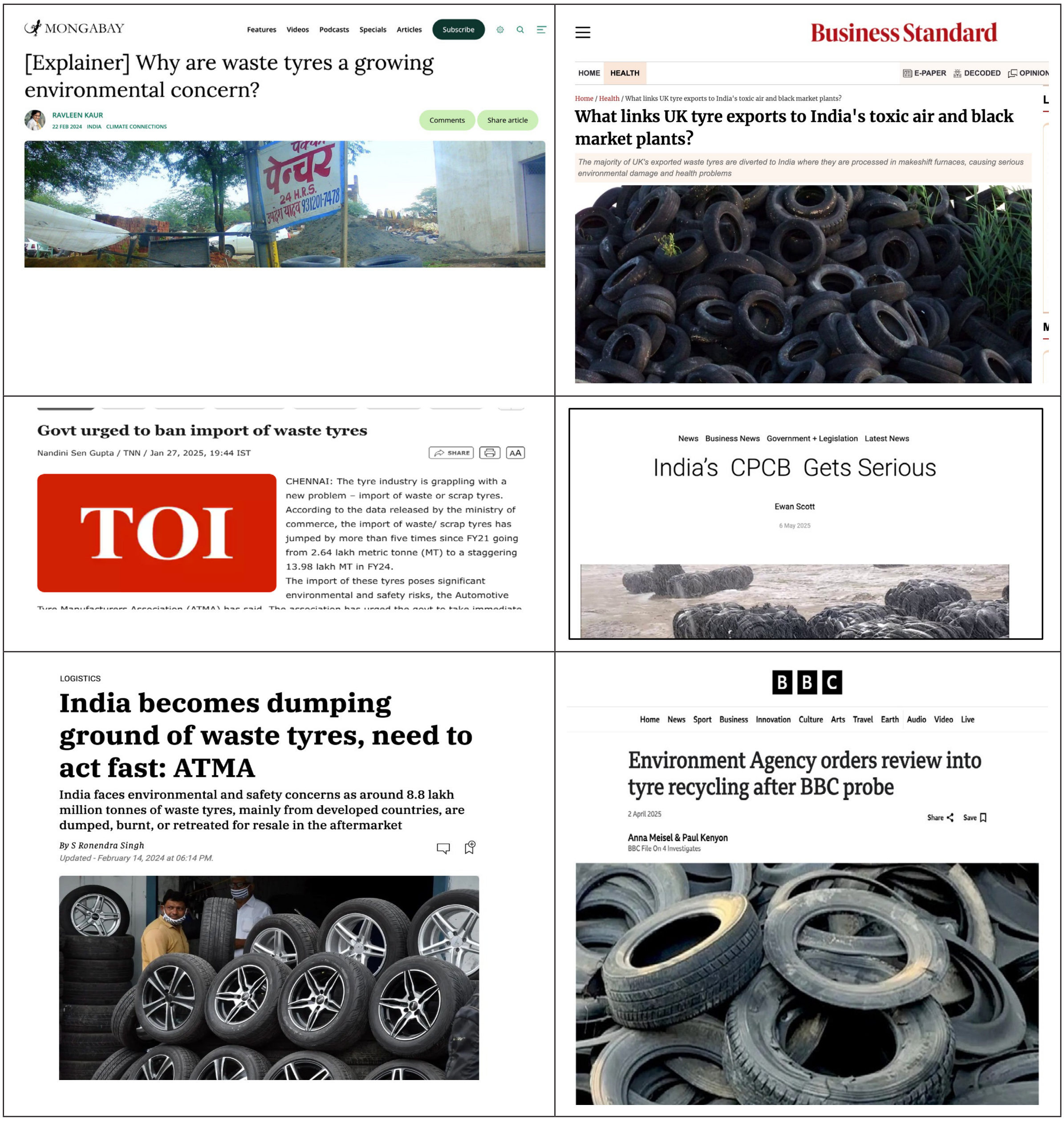
address India's domestic waste tyre management challenges? Are such measures being proposed purely from an environmental standpoint, or are they reflective of broader concerns about global waste movement?

As highlighted earlier, India imports substantial volumes of tyre scrap. These imports surged from 0.3 million tonnes in 2021 to **1.4 million tonnes** in 2024, a nearly fivefold increase in just three years. At the same time, India's domestic recycling capacity, as reported by the Material Recycling Association of India (MRAI), is approximately 6.84 million tonnes per annum. Notably, around 75 per cent of this capacity is concentrated in the pyrolysis sector.

Advancements in the Indian law, as discussed in previous sections, have banned import of waste tyres for the purpose of pyrolysis. Thus, legally, there is no import in the country for pyrolysis. The law, however, allows the import of waste tyres for crumb rubber and reclaim rubber production.

The pressing matter getting highlighted is that India is becoming a dumping ground for imported waste tyres particularly from the UK as India imports 50 per cent of the waste tyres from the UK. The core issue lies in the stark economic disparity driving the flow of waste tyres from the UK to India. In the UK, waste tyre

Figure 5: Recent media discourse on India's waste tyre recycling scenario



Source: Compiled by Centre for Science and Environment

traders are required to pay approximately US $40 per tonne of ELTs to domestic recyclers for the processing. In contrast, by exporting these ELTs to India, they can sell the same waste at around US $50 per tonne—**flipping a disposal cost into a profit!** This US $90 per tonne swing creates a powerful financial incentive, making India an attractive destination for waste-tyre exports.

This arrangement is clearly profitable for the UK waste tyre trader; however, it has adversely affected the business of tyre recyclers in the UK. As a result, UK-based recyclers are calling for a ban on the import of whole tyres in bales to India, and allowing only pre-shredded tyre imports. Their rationale is straightforward: since the traditional pyrolysis units in India rely on whole tyres (intact bales) for their operation, allowing import for shred only tyres will cut down the raw material supply making it difficult for unauthorized pyrolysis to operate.

The question that arises is: Since import of waste tyres for pyrolysis is banned in India, how are the illegal pyrolysis plants getting their raw material supply? First, it seems to consume a portion of domestic ELTs. According to the data shared by MRAI, out of a total 1.6 million tonnes of annual ELT generation, **only around 60–70 per cent** is currently being recycled by the formal sector. The remaining 30–40 per cent might be getting diverted to the unorganized units. This information was verified by various formal recyclers during CSE's interaction with them.

Most recyclers emphasized that securing consistent and clean raw material is one of the greatest challenges faced by them. They stated that ELT traders prefer selling the waste tyres to illegal batch pyrolysis operators since they offer slightly higher prices and quicker transactions—enabled by their lower capital costs, minimal environmental compliance expenses, and informal business practices. This has reduced the accessibility of domestic ELTs to formal recyclers, thus forcing them to seek imported tyres.

Another surprising aspect is that apparently many of the crumb rubber manufacturers are speculated to divert the waste tyres imported under their name to the illegal pyrolysis plants. According to the existing law, the import of waste tyres is banned for pyrolysis. And according to statistics shared by MRAI, crumb rubber producers are the highest importer of the waste tyres using 85 per cent of the total imported ELTs per year (see *Table 1: Recycling capacity of and import contribution to waste-tyre processing pathways*). Once the ELTs are imported, the crumb manufacturers, instead of processing the tyres at their own plant, allegedly divert the bales to unauthorized pyrolysis units, providing them with a steady supply of raw material. This malpractice is possible since the current Harmonized System of Nomenclature (HSN) code for whole waste tyres is the same as that for shredded/crumb rubber as the making of shredded/crumb rubber is simply a physical process.[8]

Table 1: Recycling capacity of and import contribution to waste tyre processing pathways in India

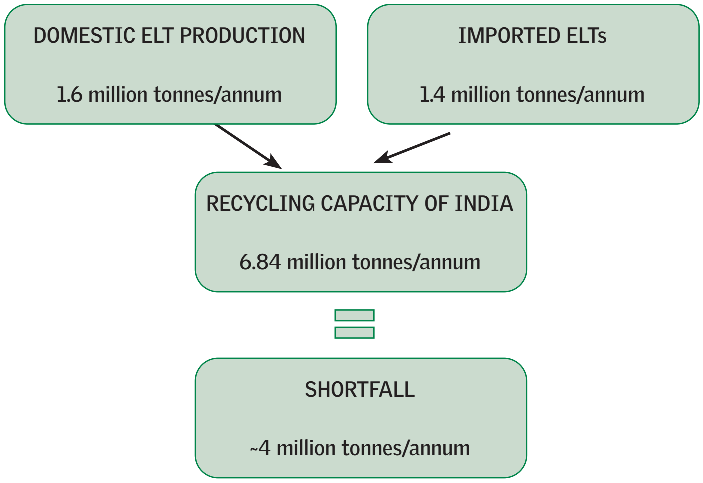
Recycling practice	Recycling capacity (million tonnes/annum)	Contribution to import (million tonnes/ annum)	Contribution to import/annum (%)	Total import (million tonnes/ annum)
Pyrolysis	5.13	0	0	1.2
Crumb rubber	1.03	1.02	85	
Reclaim rubber	0.68	0.18	15	
Total	6.84	1.2	100	

Source: Material Recycling Association of India

This concern over misuse of imports is not only highlighted by the UK recyclers, but is also strongly voiced by the Automotive Tyre Manufacturers Association (ATMA). While the UK recyclers ask for an import ban of only whole tyres but are fine with the import of shredded waste tyres to India, ATMA has gone a step further by calling for a blanket ban on the import of waste tyres, irrespective of the declared end-use. One of ATMA's major concerns is that imported whole tyres are being illegally refitted and reused on vehicles in India, posing serious road safety risks. However, the percentage of such tyres being refitted was not shared by them, which fails to solidify this claim. Also, ATMA argues that the continued import of ELTs contradicts the intent of India's Extended Producer Responsibility (EPR) policy. The policy, they claim, was designed to hold domestic producers accountable for the recycling of ELTs they place in the market. Imported ELTs, they believe, diverts valuable processing capacity away from the management of domestically generated ELTs. As already detailed, the current EPR for tyre waste doesn't actually hold domestic producers accountable, but instead lets them get away from their responsibility by simply purchasing credits from the recyclers. This claim of ATMA's, thus, also fails to hold solid ground.

Lastly, ATMA asserts that with India producing over 200 million tyres annually, the country is already self-sufficient in ELT generation, and therefore there is no need to import waste tyres. This self-sufficiency claim also seems contradictory when placed against actual data. As discussed earlier, India generates about **1.6 million tonnes of ELTs per year while the total installed recycling capacity stands at 6.84 million tonnes.** Even if the entire domestic ELT volume is fully processed and the 1.4 million tonnes of imported tyres is added, there would still remain a shortfall of nearly **4 million tonnes in capacity utilization** (see *Figure 6: Gap between the recycling capacity and the actual recycling in India*).

Figure 6: Gap between the recycling capacity and the actual recycling in India



Source: Data from MRAI, compiled by Centre for Science and Environment

This mismatch between capacity and input raises critical questions about the structure and sustainability of the sector and whether a blanket ban is the most effective solution or more stringent regulatory measures are needed to address this issue.

In particular, with so much regulatory and media focus on pyrolysis, it becomes necessary to examine the broader picture of what alternative pathways are currently in use. To understand the existing scenario, the Centre for Science and Environment (CSE) visited various tyre recycling practices in major hubs, as well as engaged with diverse stakeholders. The objective was to look beyond conventional pyrolysis and understand how other processes are being implemented. This report focuses exclusively on waste tyres and excludes inner rubber tubes, which differ significantly in composition, reuse potential and recycling routes.

2. End-of-life tyres (ELT) recycling—Current practices

A network of reuse and recycling pathways for tyre waste is evolving in India, each defined by their own set of processes, cost-efficiency, environmental impact and market demand. These pathways all utilize specific types of tyres, except for pyrolysis, which can use all types.

Tyres are broadly categorized into two types: **radial tyres and nylon tyres**. Radial tyres are reinforced along their whole circumference with steel belts, while nylon tyres use nylon cords instead. In some cases, radial tyres may also incorporate some nylon as a secondary reinforcing material, to further increase structural integrity. Today, radial tyres dominate the Indian market across both commercial and passenger vehicles, while nylon tyres are being phased out, especially in passenger cars. From a recycling standpoint, many practices prefer radial tyres because of their higher rubber content and ease in separation of steel from rubber in comparison to nylon tyres, which require additional complexity in separating fibre from fine rubber.

Within radial tyres, there are two subcategories: Passenger Car Radial (PCR) tyres and Truck and Bus Radial (TBR) tyres. PCR tyres, used in private vehicles, typically weigh around 8.6 kg, while TBR tyres—used in commercial vehicles—can weigh up to 56.2 kg thus providing nearly 6.5 times more rubber yield per tyre than PCR tyres.[9] TBR tyres also generally contain less nylon than PCR. The greater quantity of recoverable rubber, coupled with easier processing (no nylon separation), explains why recyclers selectively prefer TBRs—even though PCRs are more numerous in the market. While rubber is the most economically valuable component, the extracted steel is sold as scrap metal while the fibre fraction is either sent to cement kilns as alternative fuel resource or for low-grade applications which results in additional economic benefits.

As tyres reach the end of their life, they enter a critical network of collection and transfer. In India, this system is still evolving but currently remains heavily dependent on **unorganized chains.** ELTs typically pass through a web of intermediaries—from local tyre dealers and workshops to vehicle service centres—before reaching scrapyards. From these scrapyards, a few tyres still fit for use are directed toward retreading, while the majority are routed to various recycling units for material recovery.

Gradually, India's ELT management ecosystem has diversified into four principal recycling methods:

- **Mechanical shredding** to produce crumb rubber,
- **Chemical devulcanization** to generate reclaim rubber,
- **Blending with bitumen** to create Crumb Rubber Modified Bitumen (CRMB) for roads, and
- **Pyrolysis** to extract oil and carbon black.

Apart from these four principal methods, a small but growing number of upcycling initiatives also repurpose ELTs into products such as footwear, flooring and furniture. While these applications remain niche and limited in scale, they highlight the creative reuse potential of tyre materials beyond conventional recycling.

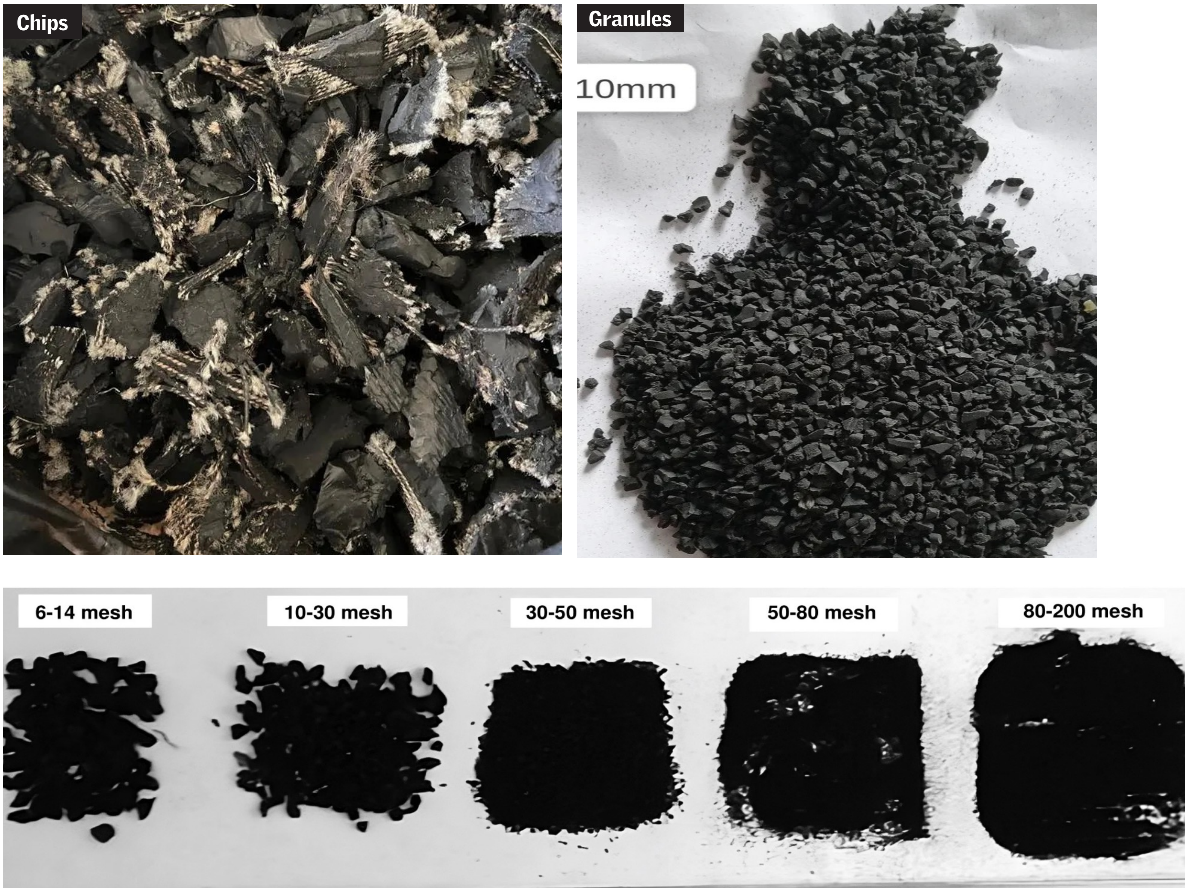
2.1 Crumb rubber production via mechanical shredding

Crumb rubber (CR) is the **second most common recycle pathway** for ELTs in India, after pyrolysis, with around 15 per cent of ELTs in the country being recycled in this way. Currently, there are approximately 100–120 crumb rubber manufacturers scattered throughout the country. This manufacturing process involves shredding of waste tyres into small chips/granules via a fully mechanical process. The term 'crumb rubber' (CR) is often used to describe a wide range of outputs that vary significantly in particle size and application (see *Figure 7: Crumb rubber of varying sizes*). Broadly, CR can refer to:

- **Tyre chips:** Coarse fragments, typically 25–28 mm in size, often sent to continuous pyrolysis plants as feedstock.
- **Tyre rubber granules:** Particles smaller than tyre chips (usually <25 mm but >4 mm), used in products like artificial turf, playground surfacing and some rubber goods.
- **Mesh-sized crumb:** Finer particles measured by a unit called the **mesh number**—the higher the mesh, the smaller the particle. Ranges are from 5 mesh (1–4 mm), 8 mesh (0.8–2 mm) and 30–40 mesh, until 180 mesh. CR of these sizes are used in the manufacture of crumb rubber modified bitumen (50–60 mesh), in the making reclaim rubber (30–40 mesh), gym and, athletic tracts (40–120 mesh) as well as the manufacture of new tyres (80–170 mesh).

In tyre manufacturing, crumb rubber can be used in two distinct ways. First, as simple crumb rubber, it serves as a filler material replacing China clay. This substitution enhances strength, as China clay has a high ash content, and higher ash

Figure 7: Crumb rubber of varying sizes: chips, granules and mesh



Source: Online web search

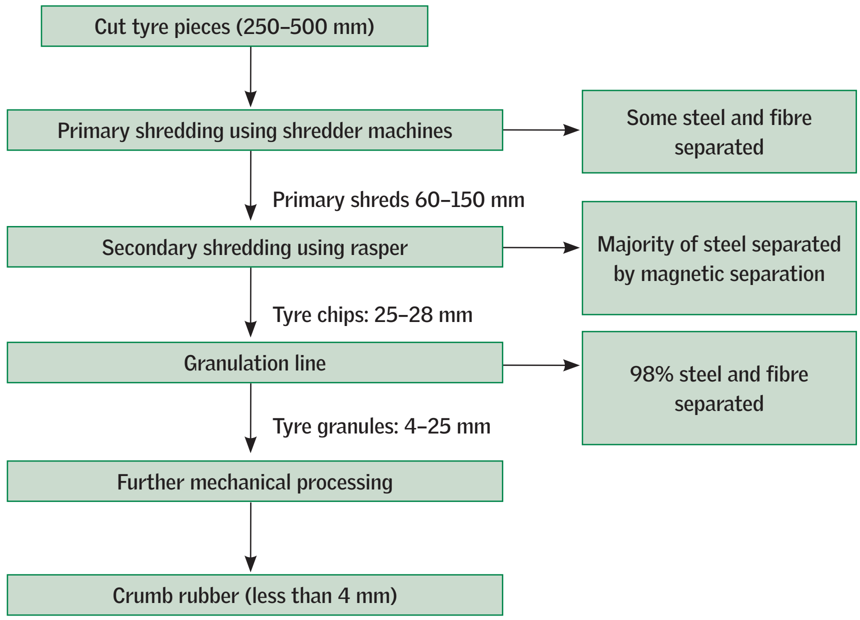
content typically weakens the compound. Second, when processed into micronized rubber powder (MRP)—170 mesh—crumb rubber can be used to replace up to 7 per cent of natural rubber in new tyres. This not only strengthens the circularity of the manufacturing process but also leads to cost savings and conserves natural resources.

Manufacturing process

CR is produced through a process that involves multiple stages of mechanical size reduction (see *Figure 8: Manufacturing process of crumb rubber*).

Stage 1: Primary shredding: The manufacturing process begins by feeding large shreds (~250–500 mm) containing rubber, steel, and depending on the type of tyre, fibre as well into the shredder to be reduced into primary shreds (~60–150 mm). Steel and fibre are partially separated from rubber and collected.

Figure 8: Manufacturing process of crumb rubber



Source: Centre for Science and Environment

Stage 2: Secondary shredding: These primary pieces are then processed by using a more refined machinery called a rasper, which produces secondary shreds (chips) of size 25–28 mm. The remaining steel components are separated through magnetic separators. These chips are mainly sold to continuous pyrolysis plants due to their input requirements.

Stage 3: Granulation: The chips from secondary shredding still contain some embedded steel and fibre. These are fed into a series of machinery called granulation lines, where further size reduction and material separation occur. Fibre and steel are progressively removed to produce granules of crumb rubber that are greater than 4 mm in size but less than 25 mm. If this granulation is continued, crumb rubber less than 4 mm in size can also be made, and these are usually measured in mesh.

Home Zone Rubber Solutions is a tyre recycling facility located in Lavaccha, Gujarat, which operates a fully automated tyre-waste-processing system to convert ELTs into crumb rubber. The facility produces approximately 21,000 tonnes of crumb rubber annually and produces the bulk of its product in the form of **tyre chips**, which remain the company's highest-demand product for the continuous pyrolysis plants. The facility exclusively processes PCR tyres, and notably, **relies primarily on imported ELTs**, deliberately opting out of the domestic collection ecosystem. This operational choice stems from the lack of an organized collection network, which, according to them, makes the domestic feedstock unreliable, unclean and inconsistent. The facility also sometimes produces finer crumb in the 8–10 mesh range; however, since this grade is primarily used in sports infrastructure—such as hockey fields and synthetic turfs—demand remains limited and irregular, making its production only seasonal.

2.2 Crumb rubber modified bitumen

Crumb rubber, apart from the applications discussed, also forms the key input in the production of crumb rubber modified bitumen (CRMB), a specialized binder used in road construction to improve pavement durability, elasticity and resistance to environmental stress. CRMB is created by blending bitumen, a heavy residue derived from the distillation of crude oil, with Modified Crumb Rubber (CRM). CRM itself is an intermediate product made by mixing **50–60 mesh-sized crumb rubber** with proprietary additives that enhance its binding and performance characteristics.

In India, only few recyclers manufacture CRM, with Tinna Rubber being one of the major players, and the general practice is to sell the CRM to the oil refineries where the final product CRMB is made by blending it with bitumen under tightly controlled temperature and timing specifications. When added to bitumen, CRM can replace up to **15 per cent of bitumen** in the final mix.[10] There is thus also a cost rationale for using CRMB since CRM is priced at approx. Rs 27–28 per kg while standard bitumen costs around Rs 45–48 per kg. Replacing a portion of bitumen with CRM can also **bring down the overall cost by an average of Rs 20 per kg.**

Beyond cost, CRMB also offers significant technical benefits. When combined with bitumen, CRM raises the softening point of the mix from around 30°C (standard bitumen) to nearly 60°C, allowing roads to better endure high temperatures, heavy loads and water exposure. This improved performance significantly reduces cracking, rutting and weather-related degradation—in many cases, doubling the lifespan of asphalt surfaces.[11] These enhancements highlight CRMB's potential as an alternative to conventional bitumen, especially in a country like India where the roads are exposed to significant thermal and mechanical stress.

To ensure quality, CRMB must meet a lot of performance standards, particularly for elasticity, softening point, and viscosity according to Bureau of Indian

Standards (BIS) specifications (IS: 17079:2019). However, currently the adoption of use of CRMB in India remains limited. The major reason that came out from discussions with various stakeholders is the concerns over CRMB's inconsistent field performance, particularly the mixture instability of CRM and bitumen during handling and application.

Moreover, the Ministry of Road Transport and Highways (MoRTH), through its 2024 circular, only **recommends, and not mandates** the use of CRMB in flexible pavement construction, leaving the final decision to project-specific discretion. As a result, CRMB remains an optional material, with its adoption not compelled across national or state highway projects.

Manufacturing process

Stage 1: The first step is simply the making of CR as discussed previously. This involves mechanical shredding of ELTs into CR of 2–4 mm in size, with steel and fibre removed in the process.

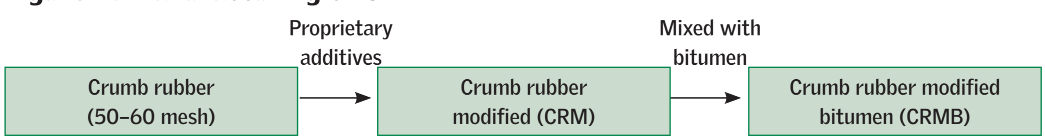
Stage 2: The 2–4 mm crumb is further processed using fine grinders and roller breakers to produce much smaller particles, typically around 50 mesh–60 mesh. These finer particles are essential to ensure uniform blending with bitumen and achieve the required performance characteristics in road applications.

Stage 3: This final processing stage is the addition of proprietary additives in controlled conditions, resulting in the production of Modified Crumb Rubber (CRM).

Stage 4: This CRM is then generally sent to refineries to manufacture CRMB or mixed in the facilities with the purchased bitumen (see *Figure 9: Manufacturing of CRMB*).

Tinna Rubber and Infrastructure Limited is one of India's largest CRM producers, with six operational units across India. The company processes both PCR and TBR tyres and produces 40,000 tonnes of CRM per annum. **Interestingly, 70**

Figure 9: Manufacturing of CRMB



Source: Centre for Science and Environment

per cent of Tinna's raw material is imported, while only 30 per cent is sourced domestically—a pattern attributed by them to the unavailability of consistent and clean ELTs in the Indian market. This reinforces a common refrain across the sector: recyclers prefer imports because the domestic collection system fails to offer reliability. In addition to CRM, Tinna produces several other grades of crumb rubber for other applications:

- **2–4 mm:** Produces around 8,000 tonnes/annum and sold for use in gym tiles, sports surfacing, and conveyor belts.
- **80–170 mesh-made exclusively from TBR** (Micronized Rubber Powder or **MRP**): Produces around 12,000 tonnes per annum and is used by tyre manufacturers to replace natural rubber without loss in quality. The percentage of natural rubber that can be replaced varies from different tyre industries, but generally around 5–7 per cent of natural rubber is replaced. This high-grade MRP, priced at **Rs 38–56/kg**, highlights the role of high-value crumb rubber in reducing the natural rubber (Rs 140–150/kg) costs for tyre manufacturers.

For the case of PCR tyre manufacturing (with rubber content of 6 kg), a 7 per cent substitution rate by MRP will result in 0.4 kg of natural rubber replaced and a total savings of 43 rupees per tyre. Similarly, in case of TBR tyre manufacturing (with rubber content of 42 kg), a 7 per cent substitution rate by MRP will result in 3 kg of natural rubber replaced and a total savings of Rs 300 per tyre. These are not minor gains—across high production volumes, **the cost savings become quite substantial**. More importantly, using MRP reduces the demand for virgin natural rubber. Thus, by integrating MRP into new tyre production, the industry can not only cut costs but also advance circular practices.

2.3. Reclaim rubber production via devulcanization

Crumb rubber also serves as the raw material for the production of reclaim rubber, so named because it involves bringing old, hardened rubber back to life and restoring its flexibility so it can be reused in manufacturing. In India, reclaim rubber is the third-largest process of recycling ELTs, contributing to 10 per cent of the ELTs recycled.

The need for such a process lies in the chemistry of tyre production. When new tyres are initially made, the rubber is 'vulcanized,' meaning it is treated with sulphur and heat to form strong cross-linked bonds between the rubber polymer chains.[12] These bonds make the rubber tough and durable, but also make it very difficult to reuse. Simply grinding up an old tyre into crumb rubber doesn't undo these bonds. Reclaim rubber, on the other hand, is made through a process called **devulcanization**, where these cross-linked sulphur bonds are selectively and carefully broken using heat, chemicals and mechanical force, without destroying the polymer backbone. Once these bonds are loosened, the rubber regains its plasticity and becomes soft, flexible, and moldable again. This reclaim rubber can then be blended into new rubber products like tyres, mats, conveyor belts, footwear and moulded goods.

Manufacturing process

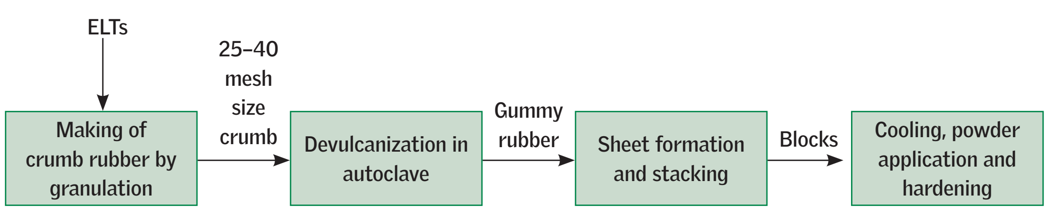
Stage 1: The production of reclaim rubber begins in a similar way to other recycling processes, with the initial generation of crumb rubber from ELTs. The rubber is crumbled into different mesh sizes from 25 mesh to 40 mesh, ideal for the next stage.

Stage 2: This is the devulcanization stage where the crumb rubber of 25–40 mesh is transferred into the 'autoclave', under high-pressure and temperature to break down the sulphur bonds in the rubber matrix. Proprietary chemical additives—varying by facility—are also added during this step. The autoclave cycle typically runs for six hours, operating at 22–25 kg/cm^2 of steam pressure and a temperature of approximately 180 degrees Fahrenheit.

Stage 3: Once the devulcanization process is complete, a gummy, softened mass of rubber—now devulcanized—is extracted from the autoclave. This material is then fed through a series of processing machines that roll and shape it into sheet-like forms. These sheets are subsequently stacked and mechanically pressed together to form uniform blocks. To prevent the blocks from sticking to one another, a fine layer of white talcum powder is applied between each (see *Figure 10: Manufacturing process of reclaim rubber*). The blocks are then left to cool and harden under ambient conditions, after which they are ready to be dispatched to downstream facilities for end-use applications (see *Figure 11: Blocks of reclaim rubber*).

Vitally, reclaim rubber reduces the need for expensive natural rubber by replacing it at a rate of 5–6 per cent, and also cuts virgin material manufacturing costs. Reclaim rubber, priced at around Rs 45/kg, offers a compelling cost

Figure 10: Manufacturing process of reclaim rubber



Source: Centre for Science and Environment

Figure 11: Blocks of reclaim rubber


advantage compared to natural rubber (Rs 140–150/kg). In the case of PCR tyre manufacturing (with rubber content of 6 kg), a 6 per cent substitution rate by reclaim rubber will result in around 0.4 kg of natural rubber replaced and a total savings of Rs 36 per tyre. Similarly, in case of TBR tyre manufacturing (with rubber content of 42 kg), a 7 per cent substitution rate by reclaim rubber will result in 2.5 kg of natural rubber replaced and a **total savings of Rs 253 per tyre.** Thus, when large-scale production is considered, the cost savings become significant, and by replacing virgin natural rubber with reclaim rubber, the tyre industry both reduces expenses and promotes circular-use practices.

Surprisingly, in spite of these benefits, reclaim rubber remains severely underutilized—making up only about 10 per cent of all ELT recycling in India. This is particularly striking given that it is one of the pathways **whose output loops fully back into tyre and rubber manufacturing, making it a truly circular process**. Unlike other recycling routes that shift tyre waste into unrelated sectors, reclaim rubber preserves material value within the industry. The question remains, despite being the most circular option, why is it also the least adopted? One possible reason for its limited adoption could be the lack of policy-driven incentives; there are currently neither mandates for its use, nor tax benefits that encourage facilities to adopt fully circular practices like reclaim rubber production.

Even amidst these limitations, some facilities have nonetheless built operations around reclaim rubber production—**Lead Reclaim and Rubber Products Limited,** based in Gujarat, is one such long-term player in India's tyre recycling sector. The facility produces reclaim rubber and, contrasted to most recyclers, **sources its tyres exclusively from the domestic market,** and uses only the TBR type. The acquired tyres are carefully inspected and categorized by type and composition before being accepted for processing. Lead Reclaim produces around **11,520 tonnes per annum** of reclaim rubber. Around 40 per cent of this goes into conveyor-belt making, around 20 per cent into manufacturing of new tyres, and the remaining 40 per cent goes into making other rubber products.

Similarly, another key player in Gujarat's tyre recycling sector, **Gangamani Enterprise Private Limited**, also produces reclaim rubber using domestically sourced TBR tyres with a production capacity of around 11,400 tonnes per annum. The facility channels a greater percentage of its product towards tyre manufacturing—**60 per cent as compared to Lead Reclaim's 20 per cent**—and the remainder is split between conveyor belts (30 per cent) and other rubber goods (10 per cent). On the operations side, the facility has implemented several energy efficiency measures as part of its ongoing efforts to improve sustainability. The facility, over the past few years, has reduced its power consumption from 700 kWh per tonne to 530 kWh per tonne. It is also evaluating a transition from wood-fired steam heating to electric autoclaves, with the aim of cutting carbon emissions and modernizing its production process.

Together, Lead Reclaim and Gangamani reflect the operational diversity and evolving practices within India's reclaim rubber industry.

2.4 Pyrolysis

As discussed in Chapter 1, batch pyrolysis currently remains the most widespread method of recycling ELTs in India, accounting for 75 per cent of the total ELT recycling done in the country. Pyrolysis is a thermochemical process that breaks down tyres using heat in the absence of oxygen, so that the rubber doesn't burn, but instead thermally decomposes. The result is a mix of various products:

- **Pyrolysis oil** (35–50 per cent): A low-grade fuel oil with a gross calorific value (GCV) of around 6,500 kcal/kg.
- **Solid carbon char** (25–40 per cent): A carbon-rich residue with a GCV of approximately 6,500 kcal/kg, often sold as a substitute for coal or used in manufacturing recovered carbon black.
- **Pyrolysis gas** (20–35 per cent): A combustible gas with a high GCV of 12,000+ kcal/kg, commonly used on-site as an energy source to fuel the pyrolysis reactor itself.
- **Scrap steel**: Recovered steel wires from the tyre structure, sold to steel scrap markets or used in secondary steel production.

Manufacturing process

Stage 1: The process begins similarly to other recycling methods: tyres are collected from various places and cleaned. Batch pyrolysis plants use whole tyres, so they do not need to cut the tyre into pieces.

Stage 2: Whole tyres are manually or mechanically fed into the reactor. Gaps between the whole tyres are filled with tyre chips to ensure maximum utilization of the reactor space.

Stage 3: The reactor is gradually heated to temperatures between **400–500°C** using burners or recovered pyro-gas. At this stage, the rubber polymer chains begin to thermally break down into smaller hydrocarbons, forming **pyrolysis gas**, and **char.**

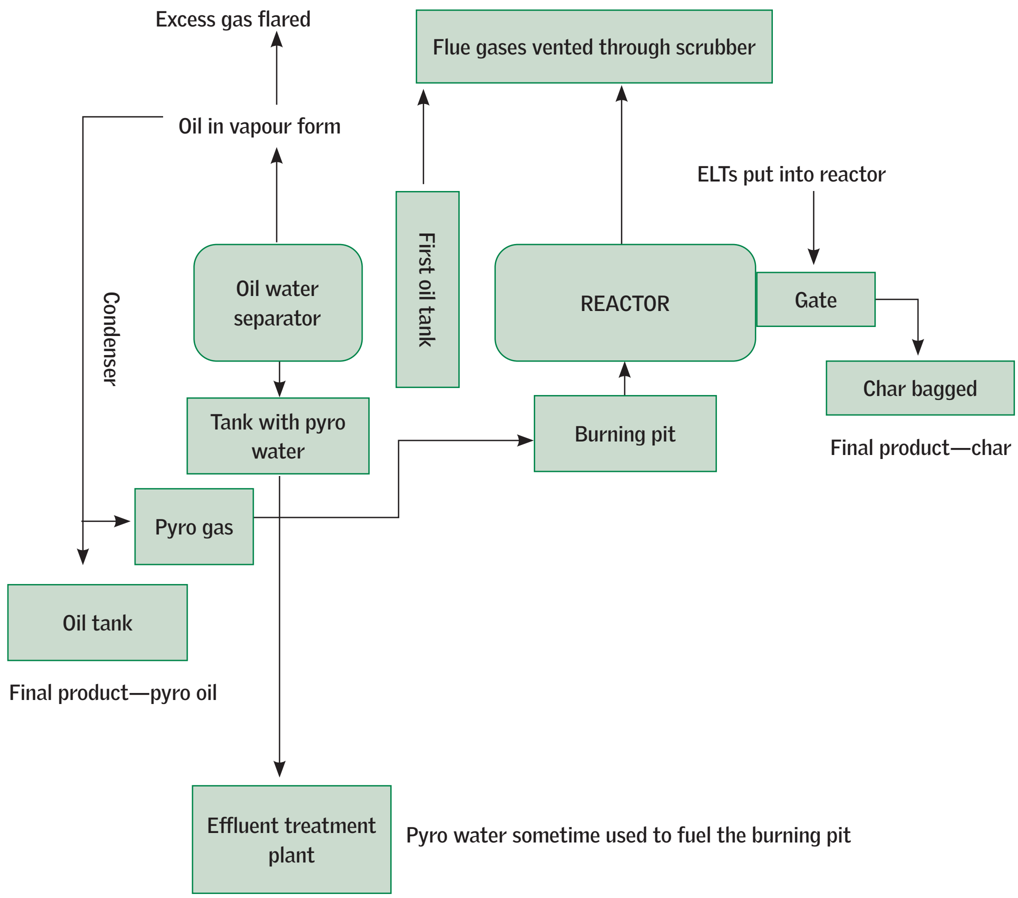
Stage 4: The vapours are passed through a series of **condensers** where they are cooled and collected as **Tyre Pyrolysis Oil** (**TPO**), a thick, diesel-like fuel that is sold to industries, kilns or blending units. In addition, **a smaller aqueous fraction known as pyro water** is also collected during condensation. This is typically reused for initial heating of the reactor but must otherwise be treated via an effluent treatment plant. The remaining non-condensable gases, referred to as **pyro gas**, are often recirculated and used as fuel for the reactor itself, enhancing energy efficiency.

Stage 5: Once the reaction is complete, the reactor is cooled for around 10–12 hours and purged again with nitrogen. Once the temperature drops to 50°C, the chute is opened to collect the powder residue called char—a black powder used as a filler in rubber or as fuel in low-grade applications—and it is then bagged (see *Figure 12: Pyrolysis process*).

India is now in the process of phasing out conventional batch pyrolysis units, which have long raised environmental concerns due to poor emissions control and lack of proper safeguards. As per recent CPCB directions, these older batch plants are no longer legally allowed to operate, and any that still do are running in violation of regulations. In response, the uptake of a newer category of pyrolysis plants known as **advanced batch automated process** (**ABAP**) has been mandated by CPCB. These plants still follow a batch-wise process, but with **claimed key upgrades** to reduce pollution and improve safety.

The 2024 SOP, which details this ABAP process, however, does not appear significantly different from the 2015 version in terms of technical upgrades—apart from very minute technical details added on the automation systems, such as the installation of PLC-based auto-activation for gas stoppage to the burner and during pressure or temperature fluctuation inside the reactors, use of automatic bypass systems to divert pyro gas in case of vent blockage, either to the separator

Figure 12: Pyrolysis process



Source: Centre for Science and Environment

tank or directly for flaring, as well as carbon monoxide (CO) gas sensors linked to sirens for an alarm system in the event of CO release.

CSE planned to visit to a few pyrolysis plants in Madhya Pradesh. Although most of the facilities denied entry, two advanced batch plants were visited briefly. The facilities visited claimed to have diligently adopted the full set of technical measures outlined in the 2024 SOP, including the various environmental safeguards associated with the ABAP processes. **However, visual observations contradicted the environmentally sound claims that the 2024 SOP makes for the new ABAP process.** Dense black smoke was visibly escaping from reactors, suggesting poor combustion efficiency and lack of emission control. Further, the removal of steel scrap/char was not always done through a mechanized system. Fugitive emissions were also evident, with many operational areas visibly covered with black particulate matter. The visits indicate that the new proposed advanced batch automated process for tyre pyrolysis does not seem to provide any improvements in terms of environmental performance of pyrolysis units, but since the sample size of the visits was limited, more survey is required to authenticate the effectiveness of the new proposed pyrolysis technology.

Continuous pyrolysis plants represent a more fundamental technological shift than batch-based systems, which operate in cycles and require periodic shutdowns for loading and unloading. They are fully automated, with conveyor-fed inputs, real-time gas recirculation and 24x7 operation. This not only improves energy efficiency but also ensures more consistent product quality and lower emissions per tonne of tyre processed. Unlike batch reactors, which require whole tyres as a feed, continuous reactors require crumbed or tyre chips of a certain size (25–28 mm). The adoption of this technology in India is limited, with around only six or seven facilities of this type. Further, the continuous reactor is expensive, costing around Rs 6 crore as compared to Rs 1 crore for a batch reactor.

One of the reasons why batch pyrolysis is thriving is its ability to process **all types of tyres** with minimal sorting or pre-treatment unlike other recycling technologies which often have specific feedstock requirements and limitations (see *Figure 13: Tyre compatibility across recycling technologies*).

Despite its proliferation, pyrolysis is not at all a circular activity—and this distinction matters. As the country moves toward more sustainable resource management, it becomes important to evaluate tyre recycling technologies not just by recovery volume, but by their contribution to a circular economy. In simple terms, this means asking whether the recovered materials are looped back into tyre production, or diverted permanently into other sectors. From this perspective, ELT recycling in India is heavily skewed toward non-circular streams like pyrolysis oil, char and steel, reaching around 2.2 million tonnes in 2024 (see *Table 2: ELT material recovery in India by application type*). On the contrary, only 0.2 million tonnes (8 per cent) of material were recovered through circular routes—primarily reclaim rubber—which feeds back into new tyres, belts and rubber goods. The data makes it clear that while circular recovery exists, **India's ELT recycling landscape is dominated by non-circular processes**, limiting the sector's ability to reduce dependence on virgin rubber or close the material loop within the tyre industry.

Figure 13: Tyre compatibility across recycling technologies

	CYCLE	TUBES	BIKES	CAR	TRUCK	JCB/ FORKLIFT	MINES TYRE
Batch type pyrolysis	✓	✓	✓	✓	✓	✓	✓
Continuous pyrolysis	✗	✗	✗	✓	✓	✓	✗
Crumb	✗	✗	✗	✓	✓	✓	✗
Reclaim rubber	✗	✓	✗	✓	✓	✓	✓
CRMB	✗	✗	✗	✓	✓	✓	✓

Table 2: ELT material recovery in India by application type

Application type	Material stream	Amount (tonnes/annum)
Circular	Reclaim rubber	180,000
	Recovered carbon black	2,000
	Crumb rubber	10,000
Total: 0.2 million tonnes		
Non-circular	Oil, char and steel	2,150,000
	Tyre cord nylon, die-cut products, some crumb	50,000
Total: 2.2 million tonnes		

3. KEY CHALLENGES AND RECOMMENDATIONS

India's ELT recycling sector has seen growing attention and public scrutiny in recent years, primarily around the proliferation and operation of pyrolysis plants—with some concerns on the effectiveness of the EPR system. India currently processes around 3 million tonnes of ELTs each year—comprising approximately 1.6 million tonnes of domestic tyres and another 1.4 million tonnes imported from global markets against the total annual recycling capacity of 6.84 million tonnes. These ELTs are currently processed through various recovery pathways like the manufacture of reclaim rubber, crumb rubber as well as pyrolysis—with pyrolysis being the most prominent, constituting 75 per cent of total ELT recycling in India.

To regulate these recycling practices, the government introduced an EPR framework for tyres in 2022 and a SOP in 2024 for a technology shift of the batch pyrolysis plants. The policy aims to enhance accountability and reduce environmental harm from unregulated recycling practices.

Yet, despite the introduction of these policies, critical regulatory gaps remain in the ELT recycling framework. These gaps not only hinder the establishment of a systematic recycling setup, but also limit the uptake of circular recycling pathways, and fail to prevent the operation of unauthorized pyrolysis units. As a result, the transition to truly circular and accountable recycling practices remains stalled.

3.1 Key challenges

1. Lack of producer reponsibility in EPR

Although India's framework for waste-tyre recycling is built on the principle of Extended **Producer** Responsibility, in practice the responsibility is non-existent. As noted previously, tyre producers have no obligation to ensure the collection of ELTs or ensure their environmentally sound disposal. Instead, according to the Extended Producer Responsibility (EPR) for Waste Tyre (2022) under the Hazardous and Other Wastes (Management and Transboundary Movement) Amendment Rules (2022), tyre manufacturers are merely required to purchase EPR credits from the registered recyclers and are considered compliant in fulfilling their EPR responsibility. This structure enables the producers to remain detached from where, how, or even whether their tyres are being recycled responsibly. The responsibility of locating, collecting and then processing ELTs is on the recyclers while the producers face no direct accountability for on-ground outcomes.

Importantly, this gap does not stem from a lack of precedent. India does have other EPR frameworks that assign clear, operational responsibility to producers. These EPRs not only mandate the producers to be directly responsible for their collection but also propose some models such as deposit refund systems, buy-back schemes, or other models to create dedicated collection streams for plastic waste. The absence of any such collection mandates or models in the tyre EPR regime represents a **critical policy gap that undermines the effectiveness, as well as the credibility of the EPR system.**

2. Unregulated ELT collection system

Without obligations on tyre manufacturers for collection of ELTs, the current collection system is largely done through unorganized scrap dealers. This leads to inconsistent supply of raw material with variable pricing depending on the market demand. The constraints in accessing regular and clean ELTs were also highlighted by many of the formal recyclers. It has also been claimed that in the absence of any standardized system for tyre collection, the scrap dealers and ELT traders apparently sell the tyre waste to unauthorized pyrolysis plants that offer higher prices and faster payments, as such units operate with lower overheads due to limited environmental compliance. This diverts the domestic ELTs from formal recyclers to informal ones, pushing the formal recyclers to opt for imported ELTs.

3. Regulatory gaps contributing to illegal pyrolysis

To regulate the operation of illegal pyrolysis plants, the government has taken two key steps. Firstly, it banned the import of ELTs specifically for pyrolysis. Secondly, CPCB developed a SOP in 2024, replacing existing batch pyrolysis units with a new ABAP process. This move **effectively bans older, polluting conventional batch-based systems** and allows only advanced batch as well as continuous pyrolysis plants with proper emission control and environmental safeguards. However, as discussed earlier, the revised SOP for the pyrolysis (where this change from conventional to ABAP is effected) reflects only incremental changes to the process over the 2015 SOP. While it introduces some additional detail—particularly around automation—it doesn't deliver a technical overhaul, offering next to no substantial new measures. This raises concerns that the revised ABAP may not represent a truly transformative shift in the actual practice of pyrolysis and is simply a continuation of the old practices under new terminology.

Moreover, while this policy and technological update may work in strengthening the formal pyrolysis sector, there remains a critical blind spot in regulating illegal pyrolysis that is ongoing in the country. According to estimates, only 60–70 per cent of ELT processing in India occurs through formal channels, implying that 30–40 per cent may be slipping through informal or illegal routes. Despite that, **no targeted policy has been introduced to directly cut off feedstock supply to unauthorized units or directly shut down these illegal pyrolysis plants**. Banning import of ELTs will reduce their supply but they thrive on the domestic market by paying higher prices for raw materials and diverting the raw materials from formal recyclers.

Another route that might be enabling illegal pyrolysis plants with the availability of raw material is the **loophole** in the nomenclature of imported goods since the **Harmonized System of Nomenclature** (**HSN**) **code** for shredded, crumbed and bales/cut tyres fall under the same code.

There is no reliable way to distinguish the product sold by crumb rubber manufacturers. As a result, a crumb rubber manufacturer could, possibly, import whole tyres and hand them off—without any mechanical processing—to unauthorized pyrolysis units. This allows a consistent supply of raw material for illegal pyrolysis plants while providing both financial incentives to reroute raw material and credit benefits to crumb manufacturers.

4. Lack of economic and policy support for circular recycling

Circular products that enable substitution of virgin rubber in new tyres generally require significant capital investment, expensive automation and skilled labour. However, as outlined earlier, there are currently **no economic mechanisms** in place to make these circular outputs more competitive. There are no tax rebates, subsidies or differentiated GST rates that provide financial relief to recyclers who choose these higher-effort pathways. At the same time, **there are no policy mandates or incentives from the government** that pushes the use of these recycled materials in different products.

In short, the existing policy framework treats all recycling outputs the same—regardless of whether they feed into a circular system or not. Without economic signals or policy direction that specifically promote circularity, recyclers are left to make these choices without support, which could be a reason why such processes remain limited in scale (currently only 10 per cent of the total ELT recycling in India) and impact.

5. Data transparency gaps in the EPR portal

While over 500 recyclers are registered under the CPCB's EPR system, the platform does not publicly disclose what type of recycling each facility carries out, whether they produce crumb rubber or reclaim rubber, or operate pyrolysis units. This information is available only to registered producers or recyclers. This limited access undermines transparency and makes it nearly impossible for civil societies to flag misrepresentation or non-compliance. Public visibility into **who is recycling what and where** is essential for public oversight and ensure that the system doesn't remain effectively self-regulated, without any external checks or accountability. Moreover, currently the portal only lists EPR targets mandated to producers, it provides **no indication of whether these targets are being fulfilled**. Lack of systemic transparency would erode the confidence in the EPR framework.

3.2 Recommendations

The current practices and regulations around tyre waste recycling seem to have a few limitations and gaps. As the framework around the recycling of waste tyres in India is evolving, it becomes critical to not only strengthen regulatory aspects but also to develop policies supporting recycling pathways that enable actual circularity in the tyre value chain. If the tyre sector is to move toward a model of responsible and sustainable material recovery, the system must evolve—through clearer accountability, tighter traceability and economic signals that reward high-value recycling.

In this context, CSE recommends the following policy measures to address current regulatory and market gaps, and to build a more credible, functional and circular ELT recycling ecosystem in India.

1. Impose producer accountability under the EPR

If the benefits of EPR really need to be reaped, the EPR framework for waste tyres needs to be amended to place explicit responsibility on tyre producers and new tyre importers for the collection of ELTs that they place in the market. Producers should not be allowed to meet their compliance obligations solely through the purchase of credits, without any role in the actual collection process. Assigning clear collection responsibility would ensure that producers are directly invested in building a functioning, traceable supply chain for ELTs. Various models can be adopted for ensuring collection of ELTs, for instance, deposit refund systems, buy-back schemes, or reverse logistics partnerships with dealers and service centres.

Additionally, extending financial incentives to small-scale waste collectors can strengthen their participation in a more reliable and formalized collection network. Such a network would provide formal recyclers with a consistent source of ELTs, reducing their dependence on imported waste tyres.

2. Strengthen regulatory frameworks to curb illegal pyrolysis

Even with import bans in place, illegal pyrolysis units can continue to thrive by sourcing ELTs from the domestic market. To disrupt this supply chain, the government needs to introduce targeted measures to restrict raw material access to unauthorized units.

One of these could be the introduction of **distinct HSN codes** for whole/baled tyres, shredded tyres, and crumb rubber. With distinct HSN codes, it would be easier for the regulatory authorities to compare the form of material entering a facility with what comes out—making it easier to detect diversion and ensure that only genuine processing is taking place. This small technical correction could close one of the alleged raw material source routes for unauthorized pyrolysis plants.

3. Incentivize circular pathways for ELT recycling

Circular tyre recycling methods like reclaim rubber and high mesh crumb require high investment, technical precision and consistent market demand. However, in the absence of policy incentives or sufficient market demand, these processes often remain financially unviable for recyclers. To address this, economic support measures such as **GST exemption on raw materials** could be considered for units producing circular outputs that replace virgin rubber in new tyres. In a similar vein, the **GST could also be reduced on circular products**—such as fine mesh crumb rubber and reclaim rubber—to further incentivize recyclers to invest in and scale up these circular practices.

Additionally, mandating the use of recycled tyre-based products in government procurement—for road, flooring or other public infrastructure—could serve as a direct economic incentive for circular recyclers, also fostering proliferation of these circular outputs.

4. Improve transparency and disclosure in the EPR framework

Given that public oversight plays a key role in ensuring compliance and serves as a guard against misuse, CPCB could consider modifying the public view of the EPR portal to reflect the **type of recycling activity** undertaken by each registered facility—whether it is crumb rubber production, reclaim rubber or pyrolysis. Additionally, the portal could also display progress against EPR targets assigned to producers, making it possible to track compliance and identify gaps. By making such data publicly accessible to civil societies, the system would open space for independent scrutiny, early detection of non-compliance, and stronger pressure on both producers and recyclers to adhere to their commitments—strengthening the effectiveness of the EPR overall.

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India currently recycles around 3 million tonnes of waste tyres, a higher volume than ever before, but what do these numbers really reflect? Behind the growing volume lies a more complicated reality: three-fourths of the end-of-life tyres (ELTs) are routed into pyrolysis, which—despite their popularity—raise persistent concerns around environmental pollution and safety risks.

This report goes beyond the numbers and unpacks how regulatory gaps might be permitting illegal pyrolysis to thrive, while a hollow transactional Extended Producer Responsibility (EPR) system weakens the very principle of producer responsibility.

Even as, at a glance, regulatory measures seem to be evolving, this report questions whether recent 'reforms' are genuine progress, or just fresh paint on an old problem. The report also zooms out to explore the global dynamics at play, including why India has become the favourable ground for the UK to export nearly 50 per cent of its ELTs. Grounded in field insights and policy analysis, this report offers a clearer understanding of India's ELT landscape and points to key areas where stronger oversight and course correction may be needed.

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