Steel & Fibre from Scrap Tyre Processing

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1. **Summary**

There are three basic components of a tyre: rubber materials, steel and fibre. Steel and fibre represent between 15 percent and 25 percent of the waste tyre being processed. While markets for the rubber portions of the waste tyre are varied, markets for the steel and fibre are more limited.

2. **Steel from Tyres**

The steel in tyres is high quality. The bead wire is a thick twisted strand that can be removed from the tyre by mechanical “debeading” or separated during the shredding or powder production process along with the other steel. The belt wire is in very thin strands and more difficult to remove entirely merely because of its size. In ambient (room temperature) mechanical processing, the separated steel wire is usually contaminated with 1% to 20% rubber material: this contamination limits the recycling markets for the steel. In cryogenic (at temperatures below -80° C (-112° F)) processing, the steel is cleaner and therefore has a higher value.

The separated steel, if compacted, has a higher value to the scrap steel processor. A proven market for the separated steel is with niche steel manufacturers using small, sophisticated electric arc furnaces, such as those in Sheffield and Rotherham, Yorkshire, Sheerness, Kent and Cardiff, South Wales.

3. **Fibre from Tyres**

The fibre is a mixture of nylon, rayon and polyester. It usually has a small amount of contamination from rubber materials, and also can contain minute shards of steel.

Finding markets or uses for the fibre is problematic. We are aware of only one company, NRI Industries, Inc of Toronto, Canada, who use all of the fibre obtained from processing their whole post-consumer waste tyres.

In 2003 the USA’s California Integrated Waste Management Board, which controls all of the municipal solid wastes in California, commissioned an expensive study to determine the markets for waste tyre-derived steel and waste tyre-derived fibre. Repeatedly, the consultants’ report stated how difficult it was to find acceptable uses and markets for the fibre.
## Potential Uses of Tyre-Derived Fibre

<table>
<thead>
<tr>
<th>Use/Market</th>
<th>Comment</th>
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<tbody>
<tr>
<td>Fibre Tyre-Derived Fuel</td>
<td>Used in cement kilns.</td>
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<tr>
<td>Reinforcing Additive for Rubber, Plastic &amp; Composite Materials</td>
<td>This is NRI Industries’ use. However, others using rubber, plastic and composites in moulded goods that need reinforcement point out that waste tyre-derived aggregate “soaks up” polymer binders usually added to the mixed materials adding substantially to the final cost to manufacture products. Alternatively, the fibre might melt into the mixture, contaminating it with its own chemical composition: polyester, being a thermoplastic resin is less compatible in mixtures employing thermosetting binders. Instead, other reinforcing agents/materials are introduced, such as vermiculite or other minerals. The other problem is that waste tyre-derived fibre is a mixture of types, making the chemistry of the final product mixture more difficult to control.</td>
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<tr>
<td>Concrete Reinforcing Additive</td>
<td>Problematic, mainly due to the size of fibre particles (too small) and the mixed nature of the waste tyre-derived byproduct. Most of this market wants fibres of 18-19mm+ while most tyre-derived fibre is in the range of 12 mm or less due to the processing technology used for shredding and granulating rubber. Additionally, the tyre fibre may have adhesion coatings that make the use unacceptable and the polyester-based portion of the fibre may not be acceptable because it has an alkaline reaction problem with the concrete mix. Experiment are continuing, however.</td>
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<tr>
<td>Soil Amendment/ Mulch/ Erosion Control</td>
<td>The California report could not find any such use, but it points out that in the USA, government funded research demonstrated that cotton gin wastes are a positive benefit as a soil amendment. The problem, however: tyre-derived fibres are man-made, not natural.</td>
</tr>
<tr>
<td>Packaging or Blanketing Material</td>
<td>Residual steel particles make this problematic, as does the rubber contamination.</td>
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<tr>
<td>Sound Deadening, Filtering Medium, Stuffing, Fillers &amp; Insulation</td>
<td>Some of these markets may be promising, but none has emerged as commercially viable yet.</td>
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<tr>
<td>Carpet Underlay</td>
<td>Trials for this potential market have failed: fibre strands are too short, and rubber and steel contamination are unacceptable.</td>
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1 Information is from Assessment of Markets for Fiber and Steel Produced From Recycling Waste Tires August 2003, published by the California Integrated Waste Management Board.
Asphalt Additive

Using cellulose or minerals, fibres have been added to asphalt for emulsion surface sealing applications. Reportedly, France has used a chopped polyester fibre system to form a layer to prevent cracking at a 1% level.

4. **For additional information:-**

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