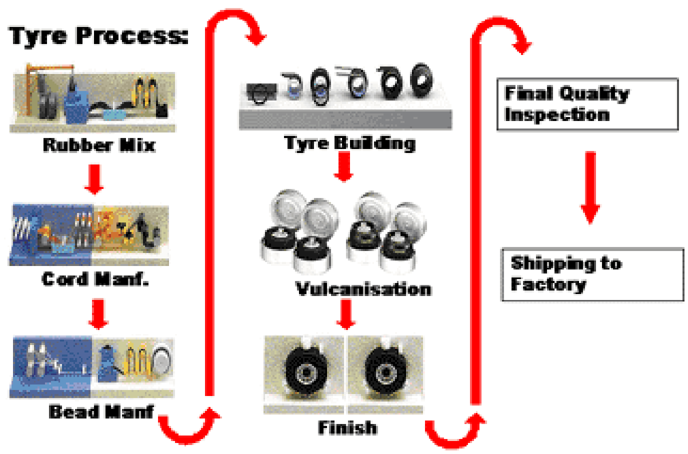
OPTIONS FOR THE USE AND DISPOSAL OF WASTE TYRES

Waste tyres are a tremendous problem throughout the world. Designed to be tough and hard-wearing, once they are no good as tyres they are difficult to cut up, hard to store or transport, and of little value to anyone. It is hardly surprising that in many countries it has been deduced that the best option is to simply burn them in cement kilns. At least in this way, the reasoning goes, some of the energy invested in the tyre is reclaimed.

Tyres are generally made up of the following components[1]:

Rubber (Natural and synthetic)	38%
Fillers (Carbon black, silica, carbon chalk)	30%
Reinforcing materials (steel, rayon, nylon)	16%
Plasticizers (oils and resins)	10%
Chemicals for vulcanisation (sulphur, zinc oxide, various chemicals)	4%
Chemicals as antioxidents to counter ozone effects and material fatigue	1%
Miscellaneous	1%

The basic manufacturing process is[2]:



The inclusion of steel, rayon and nylon, and the process of vulcanisation[3], make tyres particularly difficult to recycle. The vulcanisation process means that the rubber is not easily re-used, and the steel and fibre makes it more difficult to extract uncontaminated rubber. The equipment required to change tyres from tyres to rubber, steel and fibre are expensive, and the resulting product generally has a low value.

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1 http://www.etyres.co.uk/tyre-construction, 19 April 2007
2 http://www.etyres.co.uk/tyre-construction, 19 April 2007
3 Vulcanisation is the process of cooking "green" rubber compounds to create a hard plastic rubber that retains its form for tyre use. De-vulcanisation is the chemo-mechanical process which causes the tyre compound to break down, often through heat build-up due to under-inflation, and which can cause tyre failure. It is also a process used in recycling vulcanised rubber.

What is happening with tyres in South Africa at the moment

A quick phone-around to Pietermaritzburg tyre dealers indicated that there are two main ways of getting rid of waste tyres. About half the tyre dealers have an exclusive arrangement to sell their scrap tyres. When asked, the dealers claimed that they do not know what happens to these tyres subsequently. It is likely, however, that at least some of these tyres would be recut or regrooved, and illegally sold back into the market[4]. Regrooving is the process of cutting new grooves into a tyre, following the original tread pattern, in order to extend the life of the tyre. Regrooving is only allowed on commercial tyres where "Regrooveable" is clearly stated on the sidewall and this is generally only for large tyres. Regrooved tyres may not be fitted to a car, 4x4 or light commercial vehicle which is to be used on a public highway. Regrooving will often be seen in the world of motor sport, particularly rallying, where a tyre requires a particular pattern for the conditions experienced[5].

The second lot of dealers make their scrap tyres available to anyone who wishes to use them. This would primarily be plumbers, who use them for soak pits, and farmers. They claim never to have a problem getting rid of their tyres – they are available on a first-come first-served basis, and they never have any sort of tyre build-up.

The manager of Farm City in Pietermaritzburg told me that the manufacturers of feed troughs and animal beds have lately found it very difficult to acquire tyres. I was given similar information by Highfield Manufacturing.

Rubber Resources, who appear to be the only people regularly producing rubber crumb, say that they have a large backorder situation as they are unable to source sufficient tyres. They use, however, only steel belt truck tyres as they don't have the facilities to properly separate the fibre in passenger tyres from the rubber. The shortage of crumb was confirmed by a floor covering manufacturer in Pietermaritzburg and a landscaping company in Stellenbosch. Nevertheless, Ettienne Human from SATRP indicates that the crumb market is saturated in South Africa and that the application for rubber crumb is very limited[6].

Mr Human claims that 10% of tyres currently go to landfill, 4% are recycled and the remaining 86% are illegally regrooved, are dumped in the veld, are burned for the steel inside the tyre or are stockpiled.

How tyres can be recycled

Tyres can be recycled in the following basic ways:

1. Used whole in engineering and construction applications;
2. Baled whole, and used in bales in engineering and construction applications;
3. Used whole in agricultural applications;
4. Whole tyres can be converted into new products;
5. Tyres can be mechanically broken down (shredded, crumbed and/or granulated) and used as an input material to create new products or used in landscaping and road-making applications;

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[4] At the groundWork Waste Bill Meeting in March 2007, Ettienne Human suggested that 25% of accidents can be related to poor tyres.
[5] http://www.etyres.co.uk/glossary-tyre-terms?term=regrooving
[6] E-mail of 22/02/07

6. The carbon can be extracted to make carbon black or activated carbon;
7. Hydrocarbons can be extracted to create Limonene ($C_{10}H_{16}$), Diesel fuel ($C_{16}H_{24}$) and Jet Fuel or Kerosene;
8. The steel can enter steel recycling streams;
9. The fibre can be composted, used as filler or incorporated into cement as a reinforcing material;
10. Whole or shredded tyres can be burned for energy.

Whole tyres in engineering and construction applications

Waste tyres can be used for a range of civil engineering applications. Examples are the building of retaining walls, erosion control, shoring up embankments, and so on. They also have marine application and can be used in wharf buffers and floating docks. They can also be used for fencing, curbing and crash barriers.

Techniques have been developed to create wall building blocks. This is achieved by removing the sidewall of the tyre, creating a structural unit which can be filled with crushed rock, gravel or sand to create a block[7]. This is apparently cost-competitive with conventional methods, and as a low-technology solution could be suitable for non-urban areas.

Tyres can also be baled, and used in construction, sea-walls and jetties, and so on. Portable balers are available.

Agricultural applications of whole tyres

Tyres are used in a variety of ways by farmers. Potatoes can be conveniently grown in piled-up tyres, they are used extensively for erosion control and for terracing, and they are used for weight in the making of silage. It appears, however, that farmers are not always willing to move tyres from one area to another, and have a tendency to abandon them in the veld.

Whole tyres converted into new products

Whole tyres can be used to make hanging plant baskets, feed and water troughs, dog baskets, sandals and swings. There is, however, a limited market for any of these items.

Applications for shredded, crumbed and granulated tyres

There is a very wide variety of things that can be done with broken down tyres.

Shredded tyres can be used as filler in road, railway and construction scenarios. When shredded finely enough old tyres can also be used as a mulch, which is apparently very long lasting, and is supposed not to leach. Rubber mulches (in a variety of colours) have been awarded innovation awards, and are becoming widely used in gardens, parks, playgrounds and equestrian arenas. There are, however, indications that they are not as great as they are touted to be[8], [9].

A land-fill technique, known as a BioReactor and pioneered by Lafleche Environmental Inc[10], claims to be able to use three and a half million tyres a year. Shredded tyres are used in the drainage layer of the BioReactor instead of stones.

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[7] http://www.p2pays.org/ref/34/33662.pdf, March 2007
[8] http://www.ransfords.co.uk/equine_linda.htm, 20 April 2007
[9] http://www.rachel.org/bulletin/index.cfm?St=3, 02 May 2007
[10] http://www.laflecheenvironmental.com/bioreactor.htm , 03 April 2007

The uses for crumbed or granulated tyres are extensive. Theoretically, tyre granules can be used in many, if not most, circumstances where rubber is needed. Because of vulcanisation the quality of the rubber is somewhat degraded, which means that for applications like tyre manufacture only a percentage of the input material can be re-cycled tyres. For less stringent applications, however, rubber crumb can be used as a substitute. Some popular applications are: floor coverings[11], carpet underlay, sports floors, adhesive sealants, flexible foam, conveyor belts and vehicle and pit liners.

The economics of tyre crumbing

Tyre recycling is not a business in which to easily get rich. According to an American tyre recycler[12], the following must be complied with if you are going to create a workable business in recycled tyres:

1. *You must get paid an up-front disposal fee:* without a disposal fee, tyre recycling is simply not feasible. He says that it costs about US$0.5 (50 cents) to process one passenger tyre into -4mm crumb rubber, and 1 kg of rubber can be sold for $US0.10 (10 cents) per kilogram. You will get approximately 5kg of crumb rubber from a passenger tyre, which means that you would get about 50 cents for the output. It is recommended that a tyre recycling business does not start unless there is a guaranteed disposal fee of 50 cents per passenger tyre equivalent (i.e. your disposal fee equals your cost). Using the Big Mac Index for 2006[13], this would equate to approximately R2.25 per passenger tyre, or R0.30 per kilogram of waste tyre.

   Ettienne Human of SATRP says that it costs about R1600 to grind a tonne of tyres, which is R1.60 per kilogram. A South African tyre grinder should therefore receive a disposal fee of about R12.00 per passenger tyre, but SATRP's suggested disposal fee equates to only R1.05 per passenger tyre[14]. Rubber Resources[15] provides 20 mesh crumb at R2.60 per kilogram, and 45 mesh (much finer) at R3.30 per kilogram. This would equate to an income of R13.00 per passenger tyre[16].

2. *You need to be in an area where there is a steady disposal of at least two million tyres annually, within a radius of 200km:* a tyre recycler needs to process at least one million tyres per annum in order to get the economy of scale correct. All effective machinery is designed for large volumes, and smaller machines do not work for any length of time. Your capital costs are therefore based on the processing of one million tyres per annum. Tyres from more the 200km away are not cost-effective to transport. Because the cubic capacity of tyres is too large, and the value too low, long-distance road transport is not feasible.

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[11] For example, a product called Rubbafloor has been developed in Pietermaritzburg – http://www.floorworx.co.za

[12] http://www.tyrerecyclingsuccess.com – and the report "The secrets that successful tyre recyclers don't want you to know!"

[13] http://www.oanda.com/products/bigmac/bigmac.shtml, 19 April 2007

[14] The current suggestion for the disposal fee is 14 cents per kilogram: 7.5kg x 14c = R1.05

[15] Rubber Resources, Alberton, 011-864-1720 (spoke to Nolene, 19 April)

[16] Rubber Resources, however, cannot use passenger tyres because their equipment does not remove the nylon from the crumb. Their customers generally use polyurethane with the crumb, and the nylon tends to soak up too much of this. They therefore use only steel belt truck tyres for their crumb.

While the rule of thumb for working out how many waste tyres would be available per annum is consistently quoted as being one tyre per head of population[17], all estimates in South Africa centre around the 10 million tyres per annum mark. It is probable that the Gauteng region would offer two million tyres in about a 200km radius, but unlikely that anywhere else would do so.

3. *Make end products:* it is important to 'value add', and use up crumb rubber that might otherwise be hard to get rid of. It is suggested that two good 'value-add' products are low density carpet underlay and high density noise vibration insulation.

   The machines that are suggested cost US$350 000 and US$300 000 respectively. We cannot apply the Big Mac principle here, because we would be physically importing the machines. Without freight, duties and installation, we would be looking at R2.46 million[18] and R2.11 million respectively in capital costs.

   Rubber underlay retails at R28.00 per square meter in Pietermaritzburg. No-one knew how much a square meter weighs, so no cost/profit extrapolations can be done.

4. *Invest in the best recycling machines:* in fact, buy only Eldan.
   I contacted the Eldan representatives[19] in South Africa, who have provided us with a quotation for a typical plant. This information is included in the box titled "Setting up a tyre crumbing plant".

Crumbed or granulated tyres can also be used to amend soil in areas which are under grass and are heavily used. According to the sales blurb a product known as Rebound[20], when incorporated into the soil, will reduce compaction, stabilise the soil, facilitate water percolation and create a safer playing surface for athletes. It can be used in both existing and new facilities.

Scrap rubber can be very useful in road construction. It can be used as fill materials, in the asphalt, as a crack sealant and to create membranes that are used for repair[21]. Because it is lightweight, it can reduce costs when used on, for example, slopes but here there is concern, about road-side fires.

Rubber asphalt can increase the economic life of a road by at least a factor of two. Its use results in a reduction in occurrence of cracking, bleeding and ageing. It is also claimed that the surface is more skid resistant and is quieter than conventional asphalt. This is a proven technology which is particularly suitable for use in overlaying fatigued and cracked roads. About five percent of the mix can be replaced with rubber crumb. In practical terms this works out to about 3 tonnes of scrap rubber per one kilometre lane[22].

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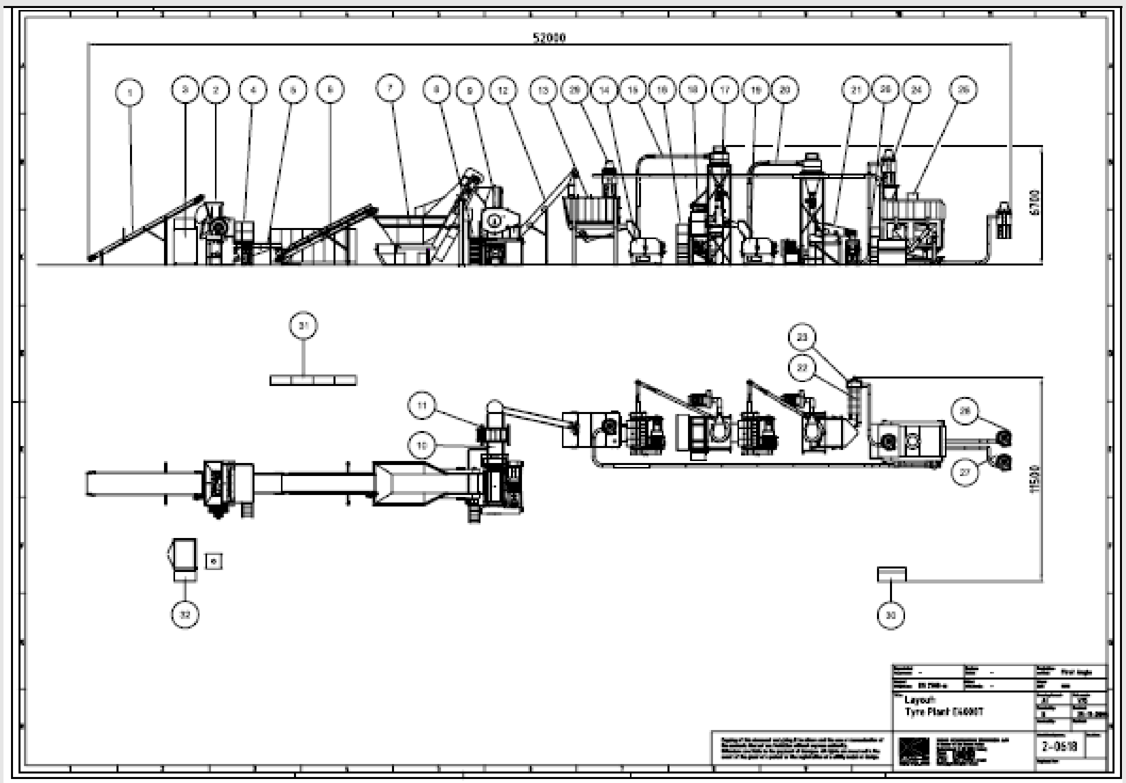
[17] http://www.p2pays.org/ref/34/33662.pdf, "The secrets that successful tyre recyclers don't want you to know!"
[18] Based on an exchange rate of R7.03 to the dollar, as published in the Mercury on 19 April 2007.
[19] MMH Recycling Systems, 011-297-6897, nic@mmhrecsys.co.za
[20] http://www.americanrubber.com/rbnd.htm, 03 April 2007
[21] http://www.environment.gov.au/settlements/publications/waste/tyres/national-approach/tyres10.html
[22] N Hougton, K Preski, N Rockliffe & D Tsolakis, 2006, *Economics of Tyre Recycling*, ARRB Transport Research Ltd

Unfortunately, the addition of rubber crumb does generally increase the cost. Reports vary is to what this increase might be. In some instances, where it is claimed that when the rubber enhanced product is used to re-surface where generally a new road would be required, the cost is estimated to be only 20% of the new road[23]. A number of reports indicate an increase of about 20%[24] in asphalt costs, while other estimates indicate that the cost can double or even treble[25]. Another concern is that when the road surface is recycled, the addition of rubber increases the emissions.

Setting up a tyre crumbing plant

The recommended crumbing plant would consist of the following:



1. Inlet conveyor
2. Super Chopper
3.
4. Service Platform
5. Vibrating Discharge Conveyor
6. Inlet Conveyor
7. Tumble Back Feeder
8. Service Platform
9. Heavy Rasper
10. Vibrating Discharge Conveyor
11. Overband Magnet
12. Screw Conveyor
13. Silo
14. Fine Granulator
15. Pneumatic Material Transport
16. Service Platform
17. Classifier
18. Overband Magnet
19. Fine Granulator
20. Pneumatic Material Transport
21. Classifier
22. Vibrating Discharge Conveyor
23. Drum Magnet
24. Pneumatic Material Transport
25. Aspirator
26. Service Platform
27. Pneumatic Material Transport
28. Pneumatic Material Transport
29. Pneumatic Material Transport
30. (to 32) Electrical Control for the entire plant

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[23] http://www.wrap.org.uk/downloads/Micro-asphalt_Summary_-_final.de5068cd.pdf , 19 April 2007
[24] http://londonremade.com/download_files/Mkts%20for%20tyres%20report.doc, 20 April 2007
[25] http://www.environment.gov.au/settlements/publications/waste/tyres/national-approach/tyres10.htm, 4 April 2007

An optional filter system can be installed, which results in a maximum of 10mg/m3 dust.

Such a plant can deal with both passenger car and truck tyres. De-beading[26] of tyres is not necessary before they are placed in the super chopper. About 3.3 tonnes of tyres can be dealt with per hour using this equipment, producing a 99.9% steel and textile free rubber crumb, although this is only guaranteed when the optional filter system is installed.

Briefly, the plant does the following:
The super chopper roughly cuts up the tyres. This is a very heavy-duty machine with large knives and a disc pusher to assist in feeding truck tyres. The chopped tyres then pass via conveyor to the tumble back feeder, which controls the rate of feed to the heavy rasper. The heavy rasper, which has 20 flying and 21 static knives and a screen, cuts the chopped tyres up further. From the rasper the material moves under a magnet, which removes the steel from the rubber granulate, and into a silo which balances the output from the heavy rasper with the input requirement of the fine-granulator.

The fine-granulator is equipped with 18 flying knives and 6 static knives, and further grinds the tyre particles down. The granules are then conveyed to the classifier, which removes about half of the textile from the granules. The granules are then passed, once again, under a magnet, which removes more of the steel. This granulation and lint removal process is repeated through another set of machines, and the granules are again passed under a magnet. Now the granules pass through an aspirator, which removes the last of the textile from the granulated rubber, and separates the rubber into three sizes, which then get bagged. Over-sized granules are sent back to the beginning of the fine-granulation process.

This equipment and this configuration is reportedly the soundest, if one wants to produce high quality, lint-free rubber granules, with low maintenance costs and relatively smooth running. The cost of the equipment, including installation and training, but excluding the optional filter system is €1 752 036[27] (R16 766 984[28]). The optional air filter costs €220 336 (R2 108 615). These prices include the cost of a technician who would supervise the installation, plant start-up and staff training for a period of four weeks.

In the current market rubber crumb is not easily sold, so it is advisable to produce value-add products as well. A machine to make carpet underlay costs in the region of $350 000 (R2 460 500[29]) while a high density rubber sheet making machine, which makes sheeting suitable for noise and vibration insulation or sports field underlay, costs about $300 000 (R2 109 000).

The ideal set-up to create rubber crumb would therefore cost in the region of R19 million for the basic equipment, R5 million for the additional equipment, plus the cost of the buildings, which require special foundation flooring for the equipment.

It should be noted that very few jobs are created through this process, as most of it is

[26] The bead is the area of the tyre that is in contact with the wheel rim. The bead carries a multi-layer steel band and a shape that helps hold the tyre on the rim. Although tyres can de-bead spontaneously at low pressures, de-beading them for recycling purposes generally requires additional machinery.
[27] Quote from Eldan Recycling A/S, received on 24 April 2007
[28] Converted at R9.57 as per conversion rate published in the Mercury on 25 April 2007
[29] Converted at R7.03 as per conversion rate published in the Mercury on 25 April 2007

automated (and has to be, as jobs like the chopping and granulating could not be done manually), and is controlled by few workers through a central panel.

Can we make a profit?

Because we don't know anything about the cost of producing carpet underlay and high density sheeting, let us assume that we are simply going to produce rubber crumb. Our initial capital outlay will be in the region of R21 million.

Let us assume that we have access to one million tyres per annum. This would equate to roughly 7500 tonnes of tyres (or one tenth of the total number available in South Africa). Our plant can handle 3.3 tons per hour, so 7500 tons a year can be dealt with in one eight-hour shift per day, six days a week.

Out of our 7500 tonnes of tyres we will produce about 5000 tonnes of crumb. Let us assume that we can sell all our crumb without too much trouble, even though at present a maximum of 2000 tonnes of crumb is produced[30] per annum, and this has apparently saturated the market. Let us assume that half of this is a fine mesh, for which we can get R3.30 per kilogram, and the other half is less fine, for which we will get R2.60 per kilogram. It costs about R1600 (excluding capital costs[31]) to process a tonne of tyres, which means that our total annual cost is R12 million. Our annual capital cost will be in the order of R10.7 million[32], although over the first five years we can claim an establishment levy of R0.38 per kilogram, which will reduce them by R2.85 million . Our income from the sale of the crumb will be R14.75 million[33] while our income from disposal fees will be R1.05 million[34]. The waste steel can be sold at 40c per tyre[35], which will bring in R400 000, and let us assume that we can somehow get rid of the fibre for another R100 000.

So far we have lost R4.6[36] million in our first year, and there are undoubtedly additional costs which have not been factored in. After five years our capital costs will have reduced, but by this point it is likely that we will have to invest in new equipment, or will be subject to high maintenance costs. It would appear, therefore, that under the current circumstances, making a profit will be very hard indeed.

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[30] Extrapolated from figures given by Dr Human in his e-mail of
[31] Telephone consultation with Des Griffith of SATRP, 25 April 2007
[32] This was somewhat simplistically calculated by taking our total cost of R21 million, depreciating it over five years, and adding annual finance costs at a rate of 11.5% per annum, repaying the capital over 5 years. (R21 million x .20% = R4 million) + (R21 million x 11.5% = 2.5 million) + (R21 million / 5 = R4.2 million) = R10.7 million rand
[33] (2500 x 1000 x 3.30) + (2500 x 1000 x 2.6) = 14 750 000
[34] R0.14 x 7500 x 1000 = 1.05 million
[35] Ettienne Human at the Waste Management Bill Meeting, Parktonian, 22 March 2007
[36] (14.75 million income from crumb + .5 million from steel and fibre + 2.85 million establishment subsidy) – (12 million cost to produce crumb + 10.7 million capital cost) = R4.6 million loss

Molectra[37]

Molectra Technologies is an Australian company which appears to have developed new technology to facilitate the recycling of all kinds of tyres. Through this process they claim to be able to extract high-grade rubber crumb, oil, carbon black and activated carbon, limonene[38], diesel fuel and jet fuel. Because of total separation they can also access the steel and plastic fibre. I have tried several times to contact them for an idea of equipment price, but they have not responded.

The Molectra Process[39]

As this process is quite different from other processes, it is worth exploring a little further.

The first part of the process is to mechanically remove the steel beadwires from the rim of the tyre. The tyres are then sliced into 4 to 12 pieces (depending on the size of the tyre). After this the tyre pieces are treated in the same oil that is extracted from the tyres in the last stage of the process. This makes the downstream separation of the tyre components easier. It also serves to clean the tyres. This done, the reinforcing steel wires and fibre cords that are embedded in the tyre pieces are mechanically separated from the rubber using a series of rollers. This means that the steel and fibre are left in long pieces which are easily separated. At this point the rubber, which has been partially granulated in the separation process, is further granulated into various mesh sizes.

For a tyre weighing 10 kilograms, Molectra can apparently recover 7.6 kilograms of crumb rubber. This crumb can either be sold on or can continue through the process and into the "MolectraVac" machine, a high-temperature vacuum microwave, where it is turned into carbon, oil and zinc oxide.

The "MolectraVac" utilises industrial microwave energy within a continuous-feed chamber, under a complete vacuum. First, the rubber is heated to neutralise the rubber and recover the remaining solution used in the chemical treatment process. Then the temperature is gradually increased to 1300° Celsius to extract the hydrocarbons that are essentially the building blocks of the rubber compound. The gases are recovered within the unit and undergo distillation to become various quality hydrocarbons. After the rubber is devolatised, what is left is 97.3 percent pure carbon.

Burning tyres for energy

One has to question whether incineration, even with energy as a by-product, can be equated to recycling[40]. It takes 120MJ (mega joules) to produce one kilogram of rubber. When we burn a tyre as fuel, we recover about 30MJ per kilogram – in other words 90MJ is lost forever. When we make a kilogram of rubber crumb from the tyre, however, this costs us about 2.2MJ which could be regarded as the loss, and the recovery would be about 118 MJ.

Whole tyres can be burned in cement kilns. Tyre Derived Fuel (TDF) which is chipped tyres, can be burned in cement kilns, power stations, smelters and paper mills, but generally cement kilns are most likely to do so.

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[37] http://www.molectra.com.au, 03 April 2007
[38] An organic solvent
[39] http://www.molectra.com.au/technology.aspx
[40] And groundWork certainly does not support the burning of tyres.

Burning whole tyres is a different proposition to burning chips and different technologies are required. More modern kilns have more trouble with whole tyres, and require to be fed with chips[41].

Whether burning tyres for energy can be regarded as recycling or not, doing so results in emissions which are harmful to peoples' health[42]. Dioxins and Furans are inadvertently created through combustion and industrial activities and are considered to be persistent, bio-accumulative toxic compounds. Some are carcinogenic and are suspected to be neurological, developmental and reproductive toxicants or endocrine disruptors. They may be produced when exhaust gases cool, and cooling these gases quickly through the critical temperature range of 450 to 200°C has been demonstrated to reduce dioxin and furan formation in cement kilns.

In 1995, at an EPA workshop, it was indicated that the cement industry was responsible for 17% of all dioxin emissions in the United States, and that those kilns burning hazardous waste were responsible for 99% of the cement industry's dioxin emissions, and in 1998, in their report "The inventory of Sources of Dioxin the United States", they say that kilns that burn hazardous waste have 80 times higher dioxin emissions in the stack gases than those which use only conventional fuels. In addition, USEPA also reports that dioxins are found in the Cement Kiln Dust (CKD) of both kilns which burn conventional fuel and those that burn hazardous waste, but that concentrations of dioxins in the CKD of those burning hazardous waste are almost 100 times greater than those not doing so.

Heavy metals are also a problem. In Northern America in 2003, cement kilns, which represent less than one percent of industries reporting, reported about nine percent of the total mercury released in air emissions in North America. This equates to approximately 5.75 tons of mercury and mercury compounds, about 5.23 tons of which were emitted to the air.

Controlling mercury emissions from cement kilns is particularly troublesome as the high temperature of the kilns makes it impossible to use the bag houses used in other industries. A bag house traps dust from the boiler and an activated carbon injection system is used to extract the mercury. The bags would melt in a cement kiln environment, and carbon injection is not effective where there is a lot of dust.

Conclusion

Tyre recycling is not a simple proposition. Transporting and storing tyres is expensive and dangerous, and because of the nature of tyres, in doing so a lot of space is used by a very low value item. The applications for whole tyres are limited and cannot hope to use up more than a fraction of the tyres available. The manufacture of new products from rubber crumb is the area most likely to grow, but the crumbing of waste tyres is expensive and cannot be done at a profit under the current circumstances. As things stand, it is almost inevitable that tyres will be burned in cement kilns, as the cement industry is making themselves ready, and are likely to be able to establish themselves as the primary users of waste tyres right from the start.

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[41] Which would explain why Rubber Resources, currently the only tyre crumbing facility in South Africa, is quite happy to go along with the SATRP/DEAT MOA, even though this MOA is likely to lead to a severe shortage of rubber crumb for other applications.

[42] Please refer to the groundWork report "Cement Kilns (Report as at November 2006)" for full references

There are some ways to change this scenario, not all of them easily implemented:

1. Increase the proposed levy to a point where recycling becomes an option;
2. Increase the percentage of the proposed levy that goes to genuine recyclers of tyres, and reduce the percentage of the proposed levy that goes to TDF users;
3. Increase demand for crumb rubber to a point where the market forces the price up;
4. Make the use of recycled rubber more attractive than the use of virgin rubber;

[This is where I need input from everyone – maybe we could brainstorm this at some point?]