Turning Old Rubber into New

Green Rubber's DeLink technology heralds a revolution in the rubber industry.

Ever since Charles Goodyear discovered the process of rubber vulcanisation in the 19th century, the world has not been the same. It has had an impact on different industries, and vulcanised rubber has been used in the manufacture of floor mats, rubber washers, shoe soles, scuba equipment and, of course, tyres to name but a few of its uses. A world without rubber is inconceivable as its uses make it one of the most versatile and durable materials around. However, for over 150 years, vulcanised rubber could not be properly recycled. For example, once a tyre is worn out, it has very little use unless it is crumbed. These crumbs are only suitable for low-technolgy applications and products. This though is changing soon with the advent of Green Rubber Sdn Bhd's DeLink technology, which promises to revolutionise the rubber industry. Technology Business Review met with Dr. Jay Nambiar, Head of R&D at Green Rubber, Dr. Rafi Daud, Senior VP of Operations and Marketing and Mr. Philip Matthews, Senior VP of Technical Support, to find out more about this technology.

A pressing environmental concern

Green Rubber is a subsidiary of the Petra Group of Companies, which is headed by Malaysian business innovator Datuk Vinod Sekhar. It was Datuk Vinod's father, Tan Sri B.C. Sekhar - also fondly known as Mr. Natural Rubber - who pioneered the DeLink technology that Green Rubber is using today to turn old rubber into new. What DeLink does is to reverse the vulcanisation process of vulcanised rubber, thus transforming them back to their original raw state and make them usable again for high-end applications.

The importance of such a technology cannot be ignored. In the USA alone, approximately 2 million tyres in dump sites are awaiting disposal. In USA and Europe, it is estimated that 580 million tyres are being disposed of annually, a figure that is absolutely staggering. There are several ways of using waste tyres these days, which include burning for energy (TDF). At 52%, it is the biggest use of waste tyres. Presently in the US, only about 15% are sent to the landfills. The rest are used in low end applications.

Furthermore, rubber products manufacturers also have their own waste problems. Almost all factories have waste in the form of flashes, trimmings, semi-scorched and scorched compounds, rejects etc. that need to be disposed of. On average, a rubber product factory generates around 5% to 15% waste rubber in a day. Using the DeLink Technology, however, these factories can achieve zero wastage by recycling waste while at the same time improving rapidly-rising margins.

In the near future the rapid rise of China and India will also face similar problems. Not only are these two countries the two fastest growing economies, they are also the two most populated ones. The annual consumption rate of rubber in China and India has been calculated to be at 8%. By 2020, it is anticipated that there will be a worldwide deficit in the world's rubber supply.

Reversing the vulcanisation process

In order to understand how Green Rubber can help deal with this growing crisis, it is important to understand how the vulcanisation process works and DeLink works. Curatives, chemicals, fillers and rubber are subjected to heat and pressure, and through vulcanising agents such as sulphur, the molecules of the rubber are cross-linked together. This gives rubber its elasticity and its strength. Reversing this process and bringing the vulcanised rubber back to its original compound entails the "de-linking" of the sulphur bonds. Hence, the name DeLink.

DeLink, which was originally researched and invented by Tan Sri B.C. Sekhar in the 1990s, works as its name implies. It is a proprietary chemical mixture that reacts with vulcanised rubber and uncouples the sulphur cross-links in the material thus reverting it back to its original state. The resulting compound, which is also known as Green Rubber, can therefore be re-vulcanised and used on its own or blended with virgin rubber. As the accompanying table will show, Green Rubber can retain up to 80% of some of the original properties of the original rubber compound whilst in some properties such as heat build-up, compression set, resilience, there are improvement in its attributes.

As DeLink has been around since the 1990s, the question of "why is it only being marketed now?" comes into play. There are several reasons for this as explained to Technology Business Review. When Tan Sri B.C. Sekhar first developed DeLink, the price of natural rubber was rather low and therefore there wasn't as much a demand for a technology like DeLink. Furthermore, the Asian Financial Crisis hit around that time as well and that hindered the commercialization of the technology.

Also, the amount of DeLink required in the de-vulcanisation process was rather high at that time and needed a ratio of 6 parts DeLink to 100 part scrap or 6 kgs of DeLink to 100kgs

The exterior view of the Green Rubber plant in Sungei Buloh.

of scrap. Today, the technology has been improved so that only 2kgs of DeLink is needed for every 100kgs of vulcanised rubber (scrap). As the demand for rubber and the amount of waste rubber is increasing, the market is ripe for DeLink because it promises substantial savings coupled with the fact that by simply using DeLink one is reducing rubber waste which is currently one of the very pressing environmental issues our world is facing.

A two-prong action plan

Green Rubber has a two-prong business plan where DeLink and Green Rubber (the compound) are manufactured and marketed to rubber product manufacturers, so they can either use DeLink to create Green Rubber from their own vulcanised rubber waste or purchase Green Rubber directly from the company.

Therefore, a DeLink factory in Sungei Buloh, Malaysia will act as a service centre to the world (initially). This factory will produce and sell DeLink. In addition to that, a Green Rubber factory is being set up in New Mexico in the USA and Malaysia. The company is currently negotiating with several Malaysian state governments, in particular the Perak state government, to establish a Green Rubber factory in their territories.

The establishment of a Green Rubber factory in New Mexico is, without a doubt, one of the most important developments in the company's business plan given the amount of waste rubber in North America annually. More recently legislations have outlawed tyre dumping at landfills in New Mexico thus creating an opportune moment for Green Rubber to step in. This ban on tyre dumping means that disposed tyres in New Mexico will have to undergo crumbing and find its own market or transformed back to de-vulcanised rubber using DeLink.

The factory will act as an integrated plant where tyres are crumbed and devulcanised with DeLink thus

Technicians monitoring the computers at the Green Rubber plant.

resulting in Green Rubber. The Green Rubber compound would then be marketed and sold to rubber products manufacturers. It is estimated that the factory will take around eight months to a year to set up and it would be the flagship plant in North America with an estimated input of around two million tyres in its first year of operation.

The benefits of DeLink and Green Rubber

DeLink and Green Rubber provide several benefits to manufacturers, some of which have already been discussed above. They help promote zero-waste, by enabling factory waste to be recycled and put back into the original compound. Green Rubber offers a higher quality compound which enables it to be added to virgin compounds in higher proportions without adversely affecting the quality of the final compound.

The cheapest rubber compound can cost up to US$1,000 per tonne. In comparison, Green Rubber costs around US$700 to US$800 per tonne. When we take into consideration that Green rubber has higher quality and can now be added in higher proportions to virgin compounds to meet the specifications of the final product, then we have to agree that Green Rubber provides substantial cost savings to rubber product manufacturers.

The qualities of Green Rubber exceed virgin rubber

Retention	Property
Heat reversion resistance	Improved
Resilience	Improved
Hardness/Modulus	Improved
Heat Build Up	Improved
Abrasion Resistance	Marginal Change

Furthermore, it is possible for manufacturers to produce Green Rubber by themselves. And this is part of the aforementioned business plan. All a factory needs to have is a refiner or high performance shear mill, which will shear and expose the fresh surface of the rubber crumbs. Thus the crumbs and DeLink reacts through a mechano-chemical reaction to produce the devulcanised compound known as Green Rubber. In a 12 hour workday, a factory can produce up to 1000 kgs of Green Rubber per day.

Apart from the business aspects of DeLink and Green Rubber, there are also its environmental aspects. DeLink is the only known commercially-viable recycling technology for vulcanised rubber in that it enables vulcanised rubber scraps to be devulcanised such that it can be reused back to make a wide variety of rubber products. The process of creating DeLink and of creating Green Rubber from DeLink is also environmentally friendly and has no toxic by-product.

It is also important to note that Green Rubber can be used on its own or blended with virgin compounds for manufacturing purposes. This is because different products require different qualities based on the specifications of rubber products. This in turn creates a “gift that keeps on giving”, in that it is possible to keep on recycling rubber. What’s more, any amount of Green Rubber used helps save costs.

On a complementary level, there is also the impact it would have on the

Properties of Green Rubber compared to virgin rubber

Compound Retention	Original	Green Rubber	%
Tyre Tread Compound	28.0	17.2	61.4
Gloves	22.8	16.2	71.2
Linatex Scrap	27.5	23.5	85.5

environment. Currently, discarded rubber products, especially scrap tyres, are a major environmental and health concern. Scrap tyres are non-biodegradable and occupy large spaces. Furthermore, it provides a breeding habitat for disease-carrying mosquitoes, rodents and other pests and can be ignited accidentally or deliberately causing potentially catastrophic fires. And as Datuk Vinod explained, what we have in the world, especially places like Europe and North America, are huge tyre mountains that are sitting in landfills waiting for disposal. At times, these tyres catch fire and these fires are not easy to put out. So we have the additional threat of air pollution caused by burning tyres.

Also, synthetic rubbers, which constitute about 60% of all rubber consumed are produced from petroleum which is a non-renewable resource. It is believed that on average, over six billion litres of petroleum is used in the rubber industry in the United States alone. When we factor in Europe and Asia, it is another staggering moment. So we now see how DeLink can help ease this problem.

Convincing the people

One of the challenges that the company has identified is to educate potential customers on the benefits of using either DeLink or Green Rubber. The reason as explained by Datuk Vinod is that the rubber industry, being an old industry of over a hundred years, is understandably quite resistant to change.

This is why the company is setting up Green Rubber producing factories. The objective of these factories in Malaysia and New Mexico is to show that not only is there a product available - DeLink - which can be used to recycle vulcanised rubber, but it has a real, commercial value to its end product, which is Green Rubber.

Thus we go back to the two-prong business strategy of the company. Green Rubber (Petra Group) is currently selling DeLink to its customers in the rubber products manufacturing industry and they (the customers) are using DeLink to produce the compound Green Rubber. The other strategy is to manufacture Green Rubber and sell it to the rubber product(s) manufacturers.

At the end of the day, the company realises that it is not enough to tell people that the waste rubber problem is an environmental time bomb. It knows that in order to educate the industry to take up Green Rubber, it must demonstrate that not only does it exist and work but it is in their economic and environmental interests to do so. What Datuk Vinod envisages is that, through education and branding, people - from the manufacturers to the consumers - will want Green Rubber because of its quality, because of its costs and because it will be doing a good turn for the environment.

The biggest challenge, he has identified, is that of time. The company has given itself a deadline of two years to roll out the complete project. And in rolling out Green Rubber, it also needs to consider different marketing strategies for different markets. It needs to ensure that the personnel are in place strategically and that it is ready to deliver.

Targeted industries

As already known, the rubber products manufacturing industry is the main target of Green Rubber. To start Green rubber will be targeting industries where it can be used without too long an evaluation period and less stringent specifications. This will include the retread industry, motorcycle tyres, bicycle tyres, forklift tyres and other non OEM tyres. Other sectors will including the automotive industry in non-tyre applications, the industrial sector with conveyors, dock bumpers, railway tie-pads, and the General Rubber Product sector comprising molded products, sheeting materials, mats , etc.

The reason for this, we were told, is because the car tyres industry is one where the products require stringent testing. This does not mean that Green Rubber is not of a good enough quality, as tests have already shown that 15 to 20% of Green Rubber can be used safely in in tyre manufacturing. However, the industry has already tested tyres made from virgin rubber compound ad nauseam and they know that those tyres work. So a new compound like Green Rubber would necessitate a long round of tests.

This does not mean though that the car tyres market is completely closed off to Green Rubber at the present. The company counts tyre re-threaders among its prime customers and once due diligence studies are completed by the tyre manufacturers, Green Rubber is poised to enter the market with a bang. Tyre companies are coming under increasing societal and legal pressure to do something about the tyre dumping problem. In many legislations, the onus on disposing of the tyres lie in manufacturers and so DeLink would be a godsend to them.

Ultimately, what Datuk Vinod Sekhar envisages is for Green Rubber to be a brand name for rubber products akin to how Intel was for computers. To illustrate this point, he brought up the example of how computers have the logo "Intel Inside", which attracts people to buy them. This would be the same for Green Rubber as well. In the future, the company will license out DeLink and products made from Green Rubber will have a "Green Rubber Inside" label. This will ensure that consumers can make an informed choice- when buying a product with rubber in it.

Licensing the brand is also part of the company's strategy against piracy. The other strategy that they have in place to fight potential fake Green Rubber compounds and fake DeLink is, what Datuk Vinod calls, a very aggressive legal policy. He explained that should anyone manufacture pirated Green Rubber or DeLink, the company will not only take action against the manufacturer but also against companies that use the products. This not only discourages people from attempting to counterfeit DeLink but also discourages people from using counterfeit DeLink.

Leaving the competition behind

The most exciting thing about Green Rubber is that it has come up with a product that is unique and without equal in the world. DeLink is the only known commercially viable recycling technology for rubber, although there are several alternatives to dealing with waste rubber. However, as far as DeLink is concerned, it is the only true recycling technology around that is cost-effective, environmentally friendly and economically profitable.

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1. *Datuk Vinod expounding on the values of Green Rubber.*
2. *The Technology Business Review team interviewing Datuk Vinod and Dr. Rafi in Datuk Vinod's spacious office with its minimalistic yet elegant settings.*

One alternative is crumbing, which reduces waste rubber into finely granulated rubber crumbs. These crumbs are then used as fillers for asphalt, sports surfaces, car mats and other rubber products. Their biggest drawback is that the crumbs are of low quality and therefore application is limited.

Similarly limited in application is Reclaim rubber, which has limited elasticity and therefore cannot be used in performance applications. This

relegates its use to processing aids and diluents. Also, Reclaim rubber is not the most environmentally friendly material to produce.

Another non-environmentally friendly method of disposing of waste rubber is by burning. It has been calculated that tyres give out more energy than coal and in certain places, tyres have been used to power cement kilns and generate electricity. The problem though is that burning tyres emit a lot of air pollution and is therefore an environmental concern.

Of course, instead of burning the tyres for fuel, one can extract the oil and carbon black through pyrolysis. However, the process and equipment are expensive and there is no guarantee of consistency as the quality of the by-product varies.

So, from the above, we can safely conclude that DeLink offers the best and most comprehensive rubber recycling programme around.

Solutions for humanity

And this should not come as a surprise since the Petra Group, which owns the lion's share of Green Rubber, is at the forefront of creating technology that will help the world and at the same time is profitable. Apart from DeLink, some of the Group's other projects are DeProtein, which deals with allergens in latex and SCALAR, which is used in HIV treatment.

DeLink is probably the most exciting development to have come up in the rubber industry for decades. However, we should not look at it from the point of view of rubber alone. This is a technology that, in all likelihood, will help the world ease one of the biggest threats to the world. The tagline of the Petra Group says it all about the company's directions - "Solutions For Humanity" and with DeLink, it is living up to that mission.

Datuk Vinod Sekhar is a man of many achievements and here he is standing next to some of his awards.