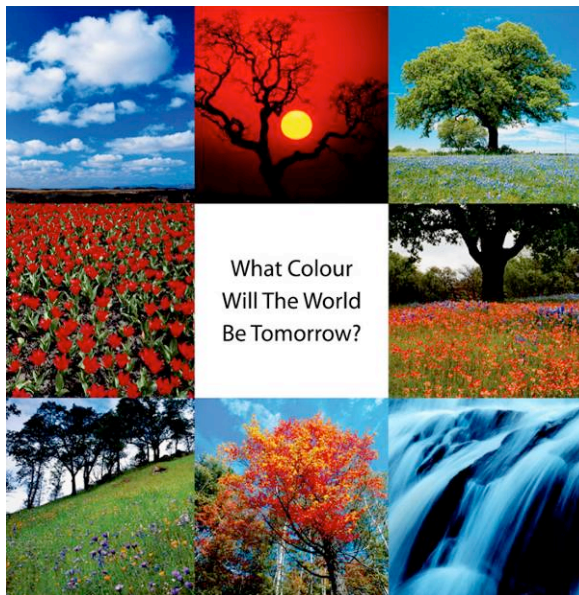


Green Rubber Group Company Profile



Our corporate brand Green Rubber™ was coined to describe the simple and clean process used to convert rubber scrap back into compound with its original properties preserved, making rubber a truly renewable resource.

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Message from the Founder

We at the Green Rubber Group see the development of Green Rubber™ as both an opportunity and a calling to introduce an innovative technology that provides a solution for humanity. After a decade of R&D, DeLink is now fulfilling its promise in making a major impact on the global rubber industry. Scrap tires are one of the largest global environmental problems. With DeLink, managing tire waste is now a commercially viable and environmentally friendly process.

2009 saw the support of Timberland®, co-branding Green Rubber™ in their Earthkeeper™ and Mountain Athletics® range, today over 2m pairs of Timberland shoes a year use the GR trademark. It also saw the uptake of Green Rubber™ in the retread market, with Green Rubber™ truck retreads on the road since 2008. Today we are ready to expand our production and service for an aggressive global roll out. As one of the most innovative technologies in the world today, that is proudly Malaysian, 2014 will see the global recognition of this innovation and solution, and the launch of DeLink3.0, the most innovative and exciting evolution of the GR tech yet. Solving one of the world's most hazardous waste problem and creating a new green and cost effective commodity. Doing well and doing good.



Datuk Vinod Sekhar
Founder, Green
Rubber



Meet Green Rubber...

Green Rubber™ brings to you a historic scientific breakthrough that intends to solve one of the world's most critical environmental challenges, that of waste rubber. Which stands today at 1.4 billion tyres discarded per year.

It all began in the late 1800's, when three inventions made modern automotive industry possible; the internal combustion engine, the pneumatic tire, and the vulcanization process. Otto, Daimler and Benz developed a practical gas-fuel combustion engine, Charles Dunlop made the first pneumatic tires, and Charles Goodyear invented vulcanization, a process which gave birth to the modern rubber products industry - **these developments provided rubber with its biggest market, but also its biggest environmental challenge.**

Vulcanization creates permanent bonds between rubber molecules making it durable, strong and elastic – the essential attributes needed to commercialize rubber into a wide range of products. But vulcanization, also created products that are difficult to dispose of, since the bonding process has up to now been considered irreversible.

In the late 60s scrap tires became a major environmental menace as they began accumulating in dumps, legal and otherwise, all over the industrialized world. Early solutions for disposal included stock piling and landfilling, then using tires for fuel, civil engineering and more recently grinding and retreading. Each of these solutions created environmental and public health problems of their own. Unstable landfill, failed tire reef projects, tire dumps on fire which took years to extinguish and rapid spread of mosquito borne diseases like the West Nile Fever led to growing public pressure on governments to come up with alternative methods of disposal.

Indeed, figuring out a “green” way to dispose of scrap tires has been one of the most vexing challenges of the rubber industry and scientists around the world worked on different routes to achieve the holy grail of the rubber industry – a way to truly recycle waste rubber. These resulted in a new wave of methods, thermo-mechanical, ultra-sonic and microwave de-vulcanization and pyrolysis, each facing their own challenges in their progress into a commercial proposition.

*“All things considered under current and likely near-term future conditions, devulcanisation faces an uphill struggle to be competitive with virgin rubber.”-
2004; CalRecoveryInc, CA, USA*



In 1995, a group of scientists led by the late Tan Sri Dr. B.C. Sekhar, fondly known as the ‘Father of Natural Rubber’, and his counterpart in Russia, Dr. Vitali Kormer, an expert in synthetic rubber invented DeLink a mechanochemical process to de-vulcanize scrap rubber. This was patented and developed into commercial scale processes at commercially competitive prices delivering industrial relevant solutions in Green Rubber™.

Why Now?

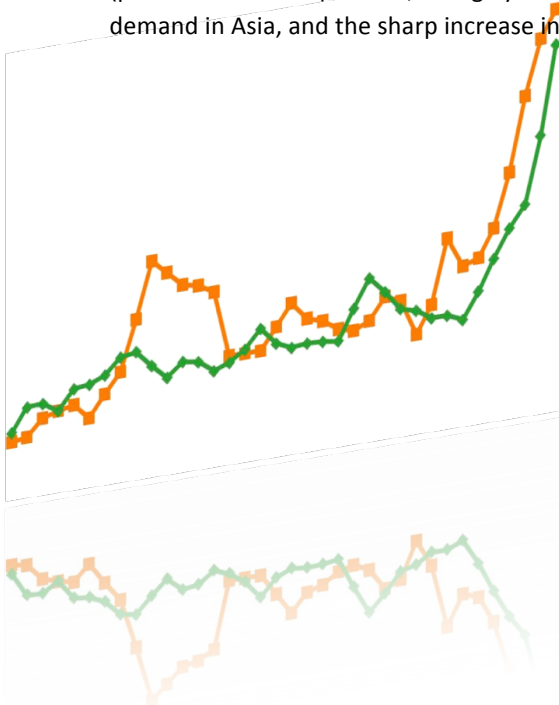
Environmental Pressures:

"Globally, in 2006 1.35 billion tires are sold, although a portion of these will be reused and have a second life, or even a third life, ultimately the quantities of tires that are sold must ultimately fall into the category of 'end of life'", Rubber Consultants, TAARC 2008

In the 1990's, growing public acceptance that climate change and global warming are real threats led to regulatory pressures worldwide to manage environmental conditions that present "imminent and substantial endangerment to health or the environment". **This led to specific regulatory measures to reduce scrap tire stock-piles, limit tire combustion emissions, and support recycling programs.**

Increasing Costs of Rubber

Increasing raw material costs for both natural and synthetic (petroleum derived) rubber, is largely due to greater demand in Asia, and the sharp increase in price of crude oil.



Projected Shortage of Polymers

Estimates show that worldwide demand for rubber will exceed supply by 2017 as growth in demand rises rapidly and supply is limited by availability of farmland for rubber plantations, and potential shortage of oil as feedstock for synthetic rubber.

EUROPEAN UNION: prohibits tires & rubber particles from being dumped in landfills & imposed limits on emissions from TDF

- European Landfill Directive (1999)
- The End of Life Vehicle Directive (2002)
- The Waste Incineration Directive (2000)
- Swedish Parliament bans use of crumb rubber in Synthetic Turf Infill (2006)
- REACH Chemical Policy (2006)

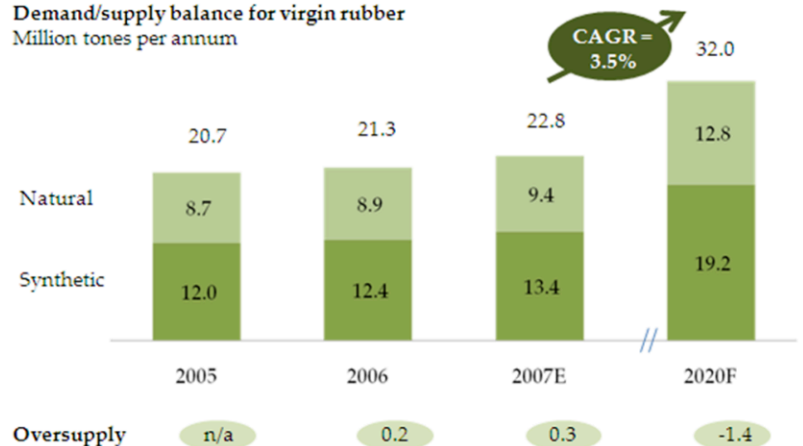
UNITED NATIONS

- Environmental Regulations for **Reclaim** (Baranwal & Klingensmith 1998 & UNEP 2000) – described the generation of nitrosamines (carcinogen) under elevated temperatures of reclaim process
- **Kyoto Protocol**, reduction of greenhouse gases causing climate change, carbon trading scheme

NORTH AMERICA

- U.S. Court of Appeals, Columbia –TDF violates the **Clean Air Act (2007)**
- **Nova Scotia** local government Canada – halted plans to use scrap tires in cement kilns
- **Bipartisan support** in form of tax break for fleet owners using tires with recycled product & subsidies and grant schemes for scrap tire collection & recycling program
- **Conservation & Recovery Act** provides enforcement tools to improve environmental conditions

Demand/supply balance for virgin rubber
Million tones per annum



Source: International Rubber Study Group

DeLink Technology

Despite extensive research, vulcanization has historically been a non-reversible process with the result that it has not been possible to re-use vulcanized rubber in the production of new rubber products.

De-vulcanization is the reverse of the vulcanization process. The sulfur bonds are opened up and the chemical characteristics of the de-vulcanized material now resemble virgin rubber compound.

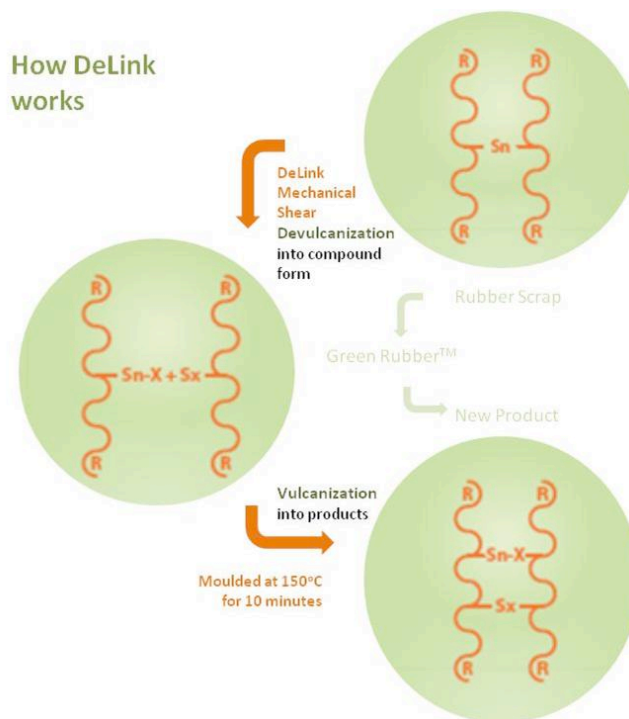
The DeLink reactant is a patented chemical mixture comprised of chemicals used commonly in the rubber industry. The process is mechano-chemical in nature, in that it requires mechanical shear to expose fresh crumb surfaces to the DeLink reactant, in order to effectively uncouple the sulfur cross links in the polymer chain.

The resulting material closely retains the properties of the original virgin rubber compound. This is further processed to yield a **technically standardized and cost- effective compound, Green Rubber™**.

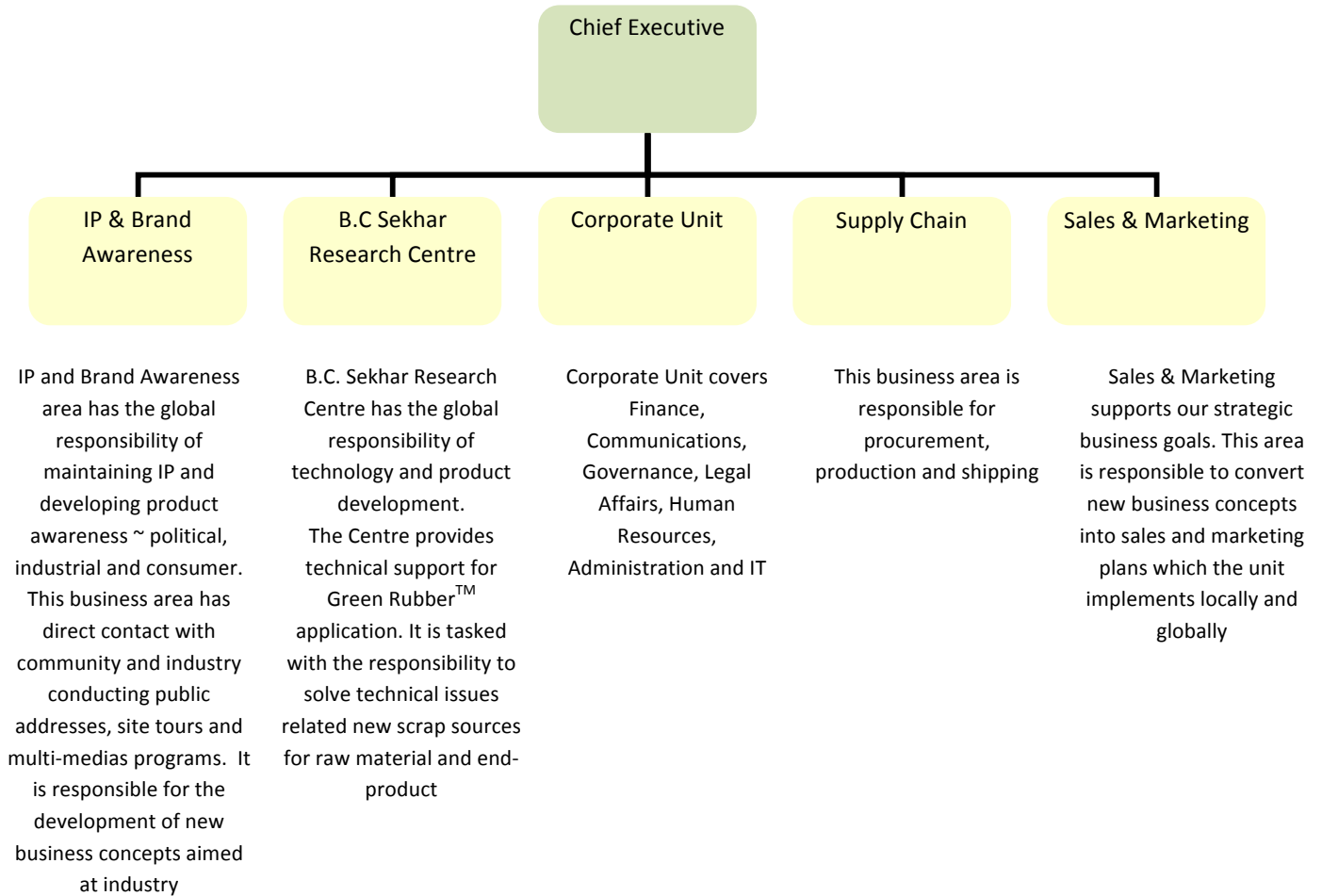
Green Rubber™ may be re-vulcanized on its own or blended with virgin rubber compounds for use in a wide variety of commercial rubber based products.

DeLink works effectively with both sulfur vulcanized natural and synthetic rubbers.

Whilst Charles Goodyear revolutionized the rubber industry in 1839 by inventing vulcanization, Green Rubber Global finishes the job by making de-vulcanization possible – thus making rubber truly recyclable.



The Company



Green Rubber Group of Companies:

- Green Rubber Global Limited
- Elastomer Technologies Limited
- Green Rubber ASEAN Pte. Ltd.
- Green Rubber US

Innovation

Since its pilot production, DeLink has made significant improvements.

- DeLink Master-Batch, the original formulation
- DeLink A, efficient with optimum scorch profile
- DeLink B, efficient with improved scorch
- Coming soon in 2014 - DeLink C

These on-going innovations take place at our R&D centre – where we continuously work with research organizations and manufacturers worldwide to improve the application and performance of Green Rubber™, and to develop a wider range of Green Rubber™ products.



Scrap glove, tire chips, treads, EPDM, 40 mesh truck

Our biggest challenge is understanding waste streams and converting these to relevant industrial compounds. These involve:

Technical: lab analysis and optimization of the devulcanized material into an acceptable Green Rubber compound

Mechanical: re-engineering lab processes into commercial scale

Logistical: sourcing, sorting and preparation of scrap



Converting lab scale processes into production scale



Lab analysis at our Research Centre

Scrap tires are our largest waste stream, but tires are not generic. Steel belted radial tires for example contain natural rubber, synthetic rubber, carbon black, polyester and nylon fiber, steel cords for belts, and about 40 additional chemicals. Truck tires contain more natural rubber whereas aircraft tires are fully natural. These are separately processed into different GR-tire products, for use in the commercial production of retreads, soling material and mats, whereas GR from post-factory aircraft tire scrap are used for sports balls and golf grips.

A second waste stream is post industrial scrap gloves which we source locally and process into GR-latex. This high rubber content material has the advantage of being compounded and allows coloring of the compound to produce a greater variety of consumer friendly products. With the successful launch of GR-latex, we've gained access to more post industrial scrap material. Scrap catheters and balloons, nitrile gloves and buffing of tennis balls are some of the GR products in the pipe line.

Main Products

Definition:

Green Rubber™: devulcanized rubber compound made using the patented DeLink process.

Description:

DeLink Process: a breakthrough technology that enables sulfur vulcanized rubber to be devulcanized into a compound which retains a significant percentage of its original physical and dynamic properties.

The resulting material, Green Rubber™ can be devulcanized on its own or blended with virgin rubber compounds to produce a wide variety of rubber products. The devulcanizing process is a simple, cost effective, and environmentally friendly process.

Typical Green Rubber™ Properties

Physical Properties:	Test Method	GR-tire	GR-latex
Hardness, Shore A	ASTM D2240	60	
Tensile strength, MPa	ASTM D412	>8	>12
Elongation at break, %	ASTM D412	>250	>800
Mooney viscosity, ML(1+4) @	ASTM D1646	~120	
Color		black	off-white
Curing Conditions:		10 minutes @ 150°C	



Green Rubber™-Tire

Green Rubber™ is an eco-friendly and cost-effective compound. This can be compounded to required specifications based on the end-product.



Green Rubber™-Latex

Making a Difference with Scrap Tire, Butyl, EPDM



Retreads

“Compound and cure characteristics of blends containing up to 30% of Green Rubber™ (using PVI) have been shown to be acceptable for tire building”

Jan 2008

Rubber Consultants TAARC, UK

Summer 2009, **Timberland®** launched a new version of its environmentally-friendly Earthkeeper™ range of boots using 50% of recycled rubber in the outer sole.



Golf grips



Railway pads



Floor tiles



Pilling material



Butyl tube



Anti-vibration mount



EPDM weather strips



Car mats



Motorcycle tires



Brake pads



Plugs



Furniture end

John Healy, General Manager, Invention Factory at Timberland® said, *“we have started a lot of testing to see how much content we can get into these soles.”* He added, *“we are a conservative company we need to be confident that anything that goes out to market is perfect, so we start at 50 percent, but we are confident we can go a bit further.”* 2008



Making a Difference with Scrap Glove and Factory Scrap

DeLink Technology

Promotes zero waste factory

Environmentally friendly, clean and safe

Performance quality retained



Mountain Athletics

“Enjoying the outdoors to the fullest, and leaving it the way you found it. That’s the idea behind the 2009 launch of Timberland® Mountain Athletics® footwear—high-performance outdoor shoes made with the environment in mind.”

Timberland® 2008 Annual Report



Potential of helping to restore eco-balance

by conserving raw materials,

and protecting biodiversity

by reducing the need to clear land for plantations



Swim fins



Snow boots



Basketball



Coasters



Tennis balls



Shower mats

Awards & Recognition

1999		<p><i>“The DeLink/Green Rubber technology is the only commercialized approach to the recycling of rubber that addresses the key requirements for true recycling of chemically breaking the cross links in the vulcanized rubber used product or scrap to provide a processable material capable of re-use in the same application at some level”. Dr. Andrew Tinker, Director of Research, Tun Abdul Razak Research Centre, UK</i></p>
July 2007		<p>WRAP (Waste & Resources Action Program), a UK government agency set up to provide environmental advisory service, issued a report concluding that DeLink provides the best solution to de-vulcanize waste rubber</p>
Jan 2008		<p><i>“DeLink B and Green Rubber™ B represent a further advance in providing satisfactory scorch safety for compounds comprising blends of virgin compound and Green Rubber™ or devulcanized compound produced independently with DeLink”. Dr. Stuart Cook, Tun Abdul Razak Research Centre, UK</i></p>
July 2008		<p>The CEO of the Company was awarded the Grant Thornton Award for Corporate Leadership for the groundbreaking work in Corporate Social Responsibility</p>
Dec 2008		<p>Green Rubber™ and her CEO were awarded the prestigious Global Green Award for Product Design, by Global Green USA, a part of Green Cross International, a leading environmental non-profit organization. First non-US company to be honored</p>
Fall 2008		<p>Timberland® launched the fall collection for Earthkeeper shoes; <i>“Green Rubber is positioned to have a major impact on the global rubber industry; managing tire waste can now become both commercially viable and environmentally friendly process.”</i> Jeff Swartz, CEO Timberland®</p>
Jan 2009		<p>The Asia Pacific Brands Foundation awarded:</p> <ul style="list-style-type: none"> • Green Rubber the Societe Brands Award • Green Rubber’s CEO the Humanitarian Award
Spring 2009		<p>Timberland® launched their spring collection for Mountain Athletics shoes and co-branding campaign. In 2013, 2m pairs of Timberland shoes used the GreenRubber trademark.</p>
Dec 2009		<p>SME Achievers Award 2009 by SMI Association of Malaysia in recognition to small and medium-sized industries (SMIs) and enterprises (SMEs) that have achieved excellence and outstanding success in their businesses</p>
Jan 2010		<p>Global Indian Origin 2010, the CEO is one of five overseas Indian to receive an award for <i>“their lifetime achievements towards the global community made in a specific domain”</i></p>

Contact

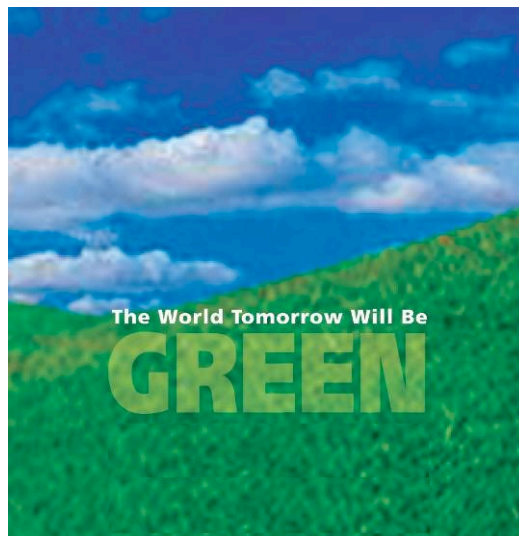
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Global sales or product enquiry : Steve Nieto at sn@greenrubbergroup.com

Or visit website www.greenrubbergroup.com

Protecting the Colors of the World for Our Children



What goes around comes around. What the World recklessly disposes off today will come back and haunt it in the future, especially in the bleak reality of rapidly diminishing natural resources. Pioneering recycling technology has been our ultimate goal. In this regard our patented DeLink process holds the key to effective rubber recycling and has played a pivotal role in reducing the amount of hazardous rubber-based waste world wide. This is just an example of how we can apply innovative scientific methods for a cleaner self sustaining and greener future.

