MALAYSIA: Your source for quality natural rubber products

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NATURAL RUBBER GOD'S GIFT TO MANKIND



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NATURAL RUBBER

Natural rubber (NR) comes from latex, a milky sap found in the South American rubber tree, *Hevea brasiliensis.*

After the latex has been harvested, it is first preserved with ammonia and concentrated by a process called centrifugation. To make natural rubber latex (NRL) products, the latex must be chemically treated through a complex process called vulcanisation, a process which was patented in the United States by Charles Goodyear in 1844. The process of vulcanisation converts natural rubber polymers into a more durable elastic material. Vulcanisation is also applicable to dry rubber to make dry rubber products. Both NR latex and dry rubber are important materials used to manufacture a multitude of rubber products that are essential in modern life, making NR one of the world's primary industrial commodities even after more than a century of use.

The Green Advantage: Eco-Friendly NR

Biodegradation for natural rubber as per ISO 14855 standard describes biodegradation as the process where polymer is converted into a new biomass, carbon dioxide and water molecules.

NR and rubber products are biodegradable through a combination of chemical and biological attacks. A number of micro-organisms are known to be able to rapidly degrade NRL products such as gloves within 45 days. Very few synthetic polymers can be degraded microbially.

Furthermore, many of the alternatives to NRL can produce toxic emissions when incinerated. In contrast to NRL, the raw materials for synthetic gloves are mainly derived from oil chemistry and are not a renewable resource. In the production process for the raw materials, it has been estimated that it requires only 16 GJ/ton in the case of NRL, but energy consumption ranges from 108 to 174 GJ/ton for the synthetic materials.

The biggest attribute of NR in terms of environmental friendliness is the relatively small amount of energy that is needed to produce it compared with synthetic rubbers as seen in the table below:



Source: Rubber Developments, Vol 47, 1994, Natural rubber as a green commodity – Part ii by Kevin P. Jones, Malaysian Rubber Producers' Research Association (MRPRA)

Helps Reduce Global Warming

Rubber plantations can be considered as a significant contributor towards reducing global warming through carbon sequestration by the rubber trees.

Carbon sequestration is a process that removes carbon dioxide from the atmosphere. Simply put, sequester means to lock transiently. As far as rubber plantation is concerned, carbon is sequestered in plant parts, products, litter, debris and soil. Total carbon sequestered in rubber plantations range between 225 tonnes/ha/30 years and 574 tonnes/ ha/30 years. Natural rubber trees annually remove about 400 million kg of carbon dioxide from the atmosphere and replace it with oxygen which helps to combat the greenhouse effect and global warming.



Renewable Resource

Besides producing latex, rubber trees also provide a sustainable source of timber. In recent years rubberwood furniture has gained wide acceptance by domestic and foreign consumers following its acceptance as an alternative timber to the natural forest species. The rubber tree breeding programme has now been re-emphasised to produce rubber clones with high latex yield as well as fast growing girth for high rubberwood yield. Rubberwood is an evenly light coloured hardwood and is mainly used for furniture making. With good acceptance worldwide, Malaysia's export of rubberwood has increased steadily over the years, reaching over RM300 million (US\$75 million) in 2017.



The success of the rubber tree breeding programme can be seen from the multifold increase in yield from about 500 kg/ha/year for unselected seedlings to about 3,000 kg/ha/year in the modern clones for rubber latex. However, the potential rubber yield of Hevea trees could be as high as 10,000 kg/ha/year. [Rubber Trees – Green and Sustainable, Malaysian Rubber Board]

Natural Rubber : A Valuable Resource

NR as a resource material holds a crucial role in many different industries and aspects of modern manufacturing of goods. Some say NR is irreplaceable. This is the reason why the US government continues to include NR on its list of strategic materials that are critical for national security. Natural rubber is widely used in engineering applications because of its unique combination of properties. It provides high strength, outstanding fatigue resistance, high resilience, low damping and low sensitivity to strain effects in dynamic applications. Compounds of NR can also be designed to give high-damping property for seismic bearing applications. Engineering design with NR is detailed in the NR Technical Bulletin by Malaysian Rubber Producers' Research Association (MRPRA). Besides NR, there are other types of modified NR that are used for their unique properties.

Epoxidised natural rubber (ENR) blend compounds have been demonstrated to reduce rolling resistance up to 25% and close to a 20% lower wear rate, compared with a control compound. ENR is mainly used for precured treads and tyres.

Deproteinised natural rubber (DPNR) is a purified form of NR from which most of the ash and protein components have been removed. It is used in hydro-mounts, seals, joint-rings and undersea applications, as well as medical and food applications.

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HIGH DAMPING RUBBER BEARINGS

Natural Rubber Products

NR has an extensive range of applications. You can find NR in products ranging from common items such as tyres, gloves, rubber mats and sports balls to specialised products such as rubber diaphragms that pump blood in artificial hearts and high damping rubber seismic bearings.

The unique properties of NR make it ideal for use in the automotive tyre industry. Almost 70% of global consumption is by the world's tyre manufacturing industry. NR is essential in tyre manufacturing, as they can be significantly deformed and still return to their original shape after release of the load. NR is also preferred due to its low heat buildup and high resilience properties. As such, the NR content of vehicle tyres increases with the tyre size. Almost 100% NR is used in the heavier truck and earthmover tyres as the high degree of flexing generates more heat which is more difficult to dissipate in large tyres. NR is a must for aircraft tyres which require nearly 100% NR for similar reasons.

NR is used in everyday life more than people realise, from consumer rubber products to rubber products for manufacturing and industrial applications. Industries where NR is indispensable include:







Rubber Medical Gloves

Besides tyres, NR is most extensively used in the manufacturing of medical gloves made from NR latex.

Since the 19th century, healthcare workers have been wearing gloves during surgical procedures to protect their hands as well as to protect patients from the potential risks of infection.

Medical gloves are considered as one of the most critical components of barrier protection for those who are exposed to infectious pathogens and hazardous materials. Personal protective equipment including gloves are indispensable for healthcare workers, particularly to control hospital acquired infections. The Centers for Disease Control and Prevention (CDC), Occupational Safety and Health Administration (OSHA), and National Institute for Occupational Safety and Health (NIOSH) all stress the importance of appropriate glove selection.

Medical gloves are effective in preventing contamination of healthcare workers' hands and helping reduce transmission of pathogens when they are used appropriately combined with proper hand hygiene.

In 2018, more than 250 billion pieces of rubber gloves were consumed globally with most of them for medical purposes.

Strengths and Unique Properties of Natural Rubber

The major component of NR is a polymer chemically known as polyisoprene which is the most important raw material used in the production of rubber products. NR has a multitude of superior performance characteristics which are not found in synthetic polyisoprene, a petroleum-derived rubber. NR exhibits many unique mechanical properties such as:



Advantages of Natural Rubber

NR gloves remain an integral part of health care, even with the invention of synthetic rubbers and the commercialisation of synthetic rubber gloves as they possess qualities which are superior to synthetic rubber gloves such as:

HIGH TACTILE SENSITIVITY

Except for synthetic polyisoprene gloves, which are much more expensive than NR gloves, gloves made of alternative materials generally do not fully match the dexterity or greater sensitivity to touch available with latex surgical gloves which is why the majority of surgical gloves are still made from NR and are the preferred choice of surgeons. Hospital studies have also endorsed the use of low-protein, powder-free gloves. [American Journal of Infection Control 42 (2014) 48-54]

TEAR RESISTANCE AND ELASTICITY

Punctured NR gloves have been demonstrated to possess superior barrier integrity than nitrile and vinyl gloves due to the resealing properties of NR which reduce or prevent the passage of bacteria and viruses. [American Journal of Infection Control. 12 (2016) 1645-1649]

NR gloves show high tear strength of 20 N/mm to 24 N/mm, about five times higher than that of vinyl and nitrile gloves. NR gloves also exhibit a low modulus at 300% of 1.4 MPa to 2.3 MPa compared to the higher modulus values of 2.8 MPa to 4.6 MPa for nitrile and 7.4 MPa to 11.5 MPa for vinyl gloves. *[Hasma, H. and Fauzi, M.S, 2003. Barrier Integrity of Punctured Gloves: NR Superior to Vinyl ad Nitrile. J. Rubber Research, 6(4), 231-240.]*

A lower modulus value indicates that NR glove has softer properties than those of synthetic gloves.

SUPERIOR FIT AND COMFORT

Due to NR latex's inherent stretchable quality, NR gloves are able to provide a more snug fit compared to gloves from other materials. This in turn makes NR gloves more comfortable especially when worn for longer durations which is why they are the preferred choice of material for surgical gloves.

Advancements in NR Gloves by Malaysian Glove Manufacturers

Major improvements in the manufacturing of medical gloves have been made in the last two decades.

Malaysia is at the forefront when it comes to the manufacturing of NR medical gloves. Made-in-Malaysia NR gloves are produced with the latest innovations and improvements in automation including automated glove stripping and doubledipping glove production.

One of the manufacturing advances has been the introduction of low-powder or powder-free gloves. Studies have shown that powder-free gloves reduce latex protein allergy. Hospital studies also endorse the use of low-protein, powder-free gloves.

Another breakthrough improvement in the manufacturing of NR gloves has been the significant reduction in the amount of latex protein. The residual extractable protein content of gloves can now be reduced from as high as 1,000-2,000 µg/g of gloves to a low of less than 50 µg/g using improved manufacturing technologies which include the use of low-protein latex concentrates, proper leaching protocols, such as online pre-leaching and post-leaching, and offline washing. Manufacturers are also able to reduce the level of latex protein in NR gloves through chemical or enzymatic deproteinisation, chlorination and polymer-coating.

Some of the latest glove innovations, both synthetic and NR gloves, offered by the manufacturers in Malaysia are:

Non-Leaching Antimicrobial Examination Gloves Low-Dermatitis Potential Gloves Approved by the United States Food & Drug Administration (FDA) **Examination Gloves** with Stethoscope Pocket

Today's technological advances and improved manufacturing processes have made NR, with its eco-friendly nature and dynamic properties, an indispensable material for medical gloves and thousands of other products.

MEDICAL GLOVES

Malaysian rubber products are exported to 195 COUNTRIES





