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**INTELLECTUAL PROPERTY** ◀  
 Copyright - LY2019004343  
 Trade Secret - (TS/IO/2019/046)

# Puncture Proof Self-healing Tyre

**Introduction and Problem Statement**

- Statistics from the National Highway Traffic Safety Administration, US estimate that tire blowouts cause over 78,000 accidents every year. This results in approximately 10,000 injuries and 400 deaths.
- In Malaysia approximately 20% of road accident root cause is due to tyre blowout
- Tire blowouts can occur in a variety of situations. The debris such as broken glass and nails can compromise the integrity of a tire, increasing the chance that it will blow out while on the road.
- Rubber is the main material for tyre manufacturing. Indeed to the properties of rubber which can sustain large deflections with little or no permanent deformation, rubbers still fail through fracture, puncture and fatigue.

**Novelty and Inventiveness**

Puncture Proof Self-healing Tyre engineered in this invention has the capability to repair itself and to recover functionality when it is damaged without the need for detection or repair by manual intervention of any kind.

The material was developed based on natural rubber and vulcanized using self-developed self-healing curative agent.

This makes possible to immediately transfer the technology to industry rendering high added value products.

**Applicability - Usefulness in solving problem**

Self-healing rubber forms a sealing layer, which is placed inside the tyre in the area corresponding to the tread pattern.

In case of penetration by external objects such as nails, there is no need for immediate roadside tyre changes, the material deals immediately with the hole and, in most cases, its fast and effective action means that the driver won't even realize that the tyre has been punctured

The material immediately repair itself, recover the tyre functionality and blocks every possible air leakage in the event of a puncture that passes through the tyre, with or without an external object still present.

Self-healing rubber can be used to manufacture new tyre or adhered into inner layer in existing tyre and does not need special rims or Tyre Pressure Monitoring System; it can be used on any kind of vehicle and tyre sizes.

Puncture Proof Self-healing Tyre provides the following benefits and features:

- Resist sharp objects while driving on different road conditions.
- Save cost of spare tyre and reduce fuel consumption.
- Save your valuable time and increase your personal safety.
- High network service on general wheel mounting instrument.
- Environmentally friendly-natural rubber.

**Product/Technology Readiness**

Product had been validated in lab scale and field test. TRL 5

- Self-healing rubber as inner layer for automobile tyre- USM-Malaysian Rubber Board (MRB)
- Self-healing seal layer in existing tyre- USM

**Level of Impact**

ECONOMIC	SOCIAL	ENVIRONMENT
Extended lifetimes Reduction of maintenance costs	Increased reliability Enhanced safety Fewer accidents Preventing catastrophic failures	Energy savings Cuts in pollutants-less rubber waste

**Intellectual Property Status**

- Copyright granted by MyIPO LY2019004343
- Trade Secret (TS/IO/2019/046)

**Knowledge Management**

**Publication**

1. Nuur Laila Najwa Thajudin, Nur Syamsinar Sardi, Mohd Hafiz Zainol, Raa Khimi Shuib. " Room Temperature Self-healable Natural Rubber " Journal of Rubber Research (2019)
2. Raa Khimi Shuib, Nur Syamsinar Sardi, and Nuur Laila Najwa Thajudin. " Effect of Carbon Black on Self-healing Efficiency of Natural Rubber " Materials Today (2019)
3. Thajudin, Nuur Laila Najwa, Mohd Hafiz Zainol, and Raa Khimi Shuib. "Intrinsic room temperature self-healing natural rubber based on metal thiolate ionic network." Polymer Testing 93 (2021): 106975.

**Research Funds**

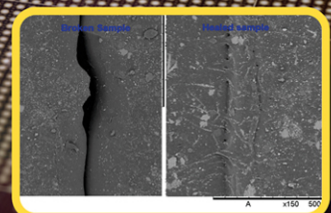
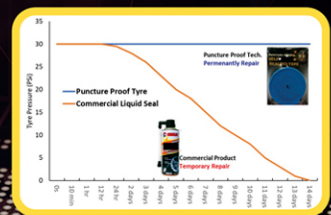
Raa Khimi Bin Shuib, Room Temperature Self-Healing Natural Rubber for Sensing of Damage and Lifespan Prediction, RM50,000.00, 01/01/2020-31/03/2023

**Talent Development**

- MSc- Nuur Laila Najwa Binti Thajudin , 2020, Preparation and Properties of Intrinsic Self-Healing Natural Rubber.
- PhD- Noor Faezah Binti Mohd Sani , 2020 SELF- HEALING NATURAL RUBBER FOR SENSING OF DAMAGE AND LIFESPAN PREDICTION.
- PhD- Mohd Hafiz Bin Zainol, 2018, DEVELOPMENT OF AUTONOMOUS SELF HEALING ELASTOMERIC MATERIALS.

**Commercialization & Tech Transfer Potential**

- World demand for tires is projected to rise 4.1 percent per year to 3.0 billion units in 2019. In value terms, sales of tires are forecast to advance 7.0 percent per annum to \$258 billion.
- Self-healing rubber costing is 20-28% lower compared with conventional rubber products. (Self-healing Rubber= RM 5.07/KG vs Conventional Products = RM 6.50-RM 7.10/KG)
- This material has huge potential to be applied to all automotive rubber parts such as hose, seals, gasket, interior panel and etc.
- Industrial collaborators- Malaysia Rubber Board (MRB), JEBCO, PETROGROUP and ACME



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