

White Paper on rodent menace in Railways

Introduction

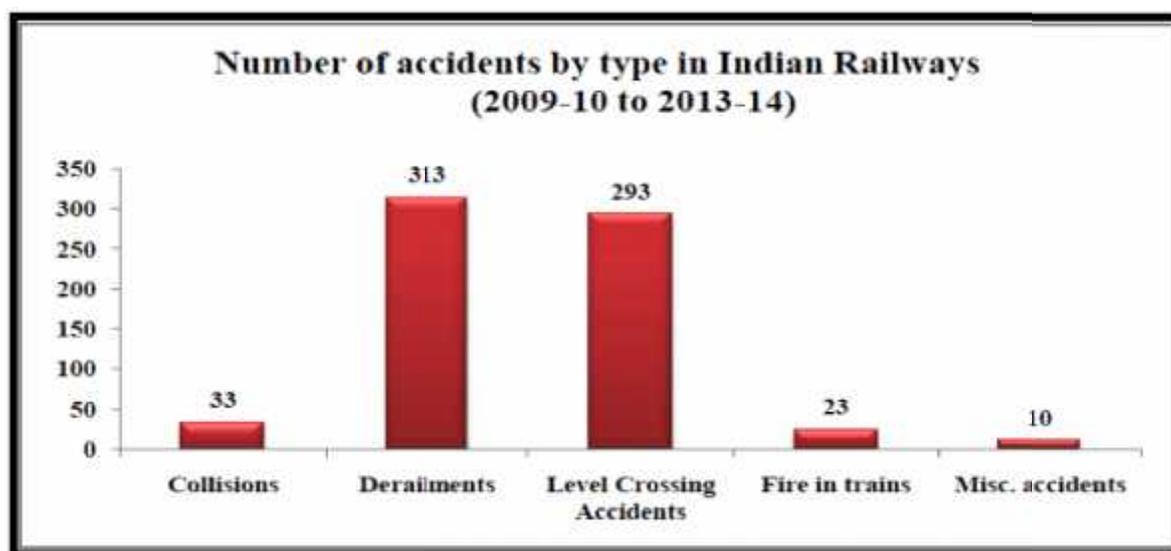
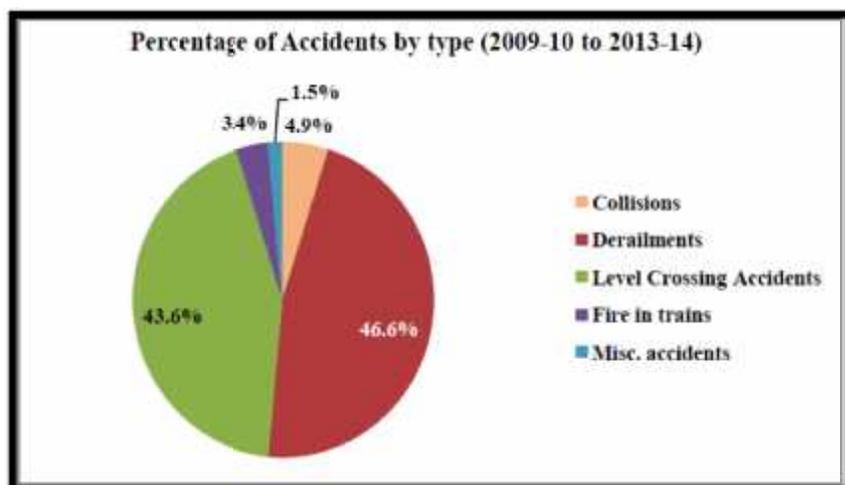
Railway transport occupies a significant role in the transport system of a country because the development of trade, industry and commerce of a country largely depends on the development of railways. Introduced as early as 1853, Indian Railways has grown into one of the largest Railway network in the world. Indian Railway provides the most important mode of public transport in India. This is the most commonly used and cost effective long distance transport system of the country. Indian Railways carries about 23 million passengers daily and 8.421 billion annually!

Indian Railways has served to integrate the fragmented markets and thereby, stimulating the emergence of a modern market economy. It connects industrial production centers with markets and with sources of raw materials and facilitates industrial development and link agricultural production centers with distant markets. It provides rapid, reliable and cost-effective bulk transportation to the energy sector, to move coal from the coal fields to power plants and petroleum products from refineries to consumption centers. It links places, enabling large-scale, rapid and low-cost movement of people across the length and breadth of the country. The Indian Railways has become a symbol of national integration and a strategic instrument for enhancing our defense preparedness. **Recently Indian Railways brought water relief to drought-hit Latur. The railways, along with the state government of Maharashtra joined hands to make arrangements for water supply, which included the laying down of a 3.5-km long pipeline within a record time of nine days.**

Indian railways have often encountered serious accidents in the past, the reasons behind them often being **lack of communication as the information transmission systems** mainly the wires and cables have often being damaged.

Signaling forms an important component of the safe functioning of railways. To perform its safety critical functions, a signaling system for a rail network needs to have timely information on the position of trains and the occupancy status of track sections. This is essential to perform its primary function of preventing collisions. For this signaling systems can be of great help in preventing accident at stations, level crossings and in block sections. Damage to these cables could cause electrical short circuits, incorrect signals, miscommunications leading to train collisions, derailment, fire in trains etc.

The railways listed 862,463 incidents of signal failure between 1 April 2000 and 31 March 2007; of these, 22 caused accidents. About 1.5% of accidents in India from 2000-2007 were caused by the signals malfunctioning, also known as “unsafe-side signal failure”. In case of train derailment, the review of train accidents of the last 5 years (2009-10 to 2013-14) indicates that a large number of accidents happen because of derailments.



Damage to Railway Property: The cost of damage to railway property and duration of interruption to through communication due to consequential train accidents during 2009-10 and 2010-11 were as under:

Year	Cost of damage		Interruption to through communication (Hours)
	Rolling stock inclusive of engines (in lakh)	Permanent way (in lakh)	
2009-10	4,126.48	1,244.99	1,105.01
2010-11	4,584.52	1,311.37	1,455.05

Note: the figures exclude Konkan and Metro Railways

Indian Railway accidents due to equipment failure are on rise from 2009-2014

Year	Equipment Failure
2009-2010	0%
2010-2011	1.5%
2011-2012	2.3%
2012-2013	5.8%
2013-2014	2.6%

A survey was conducted and literature gathered on the statistics of failure in the Indian Railways as well as all over the world. A prime reason for this is the wide spread proliferation of rodents and other insects, chewing on the OFCs (Optical fiber cables).

Railway coaches are favorable breeding ground for rodents and insects like cockroaches, bedbugs and lizards. Present system of rodent control in the coaching yards, station yards and AC coaches is not effective because of the magnitude of the problem. Rodents thus easily find a safe and favorable shelter in the railway coaches. This has resulted in rodents and insects entering passenger coaches which have lead to uninhabitable conditions due to rodent droppings etc. Also the insects in the pantry car make stored and ready to eat food unhygienic.

Glaring Evidences

In a relaxation showdown, trains are doubtlessly the most laidback style of travel, allowing us to sit back, relax, and enjoy the picturesque view. Luckily, some of the world's most beautiful destinations are also home to the most scenic train rides. But co-passengers like rodents make these ecstatic train rides transform into dreaded journeys.

Rodents are often the direct reason behind the **disruption of underground train services and metro rail services**. A dangerous collision between two passenger trains in France caused by rats in the year 2014 left more than 40 people injured. According to ISSUU-rail Connect Edition, 13 Feb 2014 issue, millions of pounds had to be spent on the repair and replacement of 20,000 miles of rail track, across the UK, solely due to rats gnawing and damaging cables, back in 2010. Rats were considered to be the culprits for the fire that sparked train delays across Melbourne in 2014. Also there was travel misery for thousands of rail passengers after rodents gnawed through cables, disabling signals, in the United Kingdom's on September 2015. The problem meant all trains north and south on the Midland Mainline from Leicester cancelled from 7am onwards, with the disruption lasting for 12 hours.

Considering the Indian Railways, day by day rodents menace is proving to be very difficult to handle. Rodents were found guilty for destroying 200 Km Bhopal Itarsi Fiber Optic Cable line which was laid alongside the track due to constant nibbling for manicuring there unremittingly growing pair of incisors. Rodents with jaw strength comparable to an adult white shark damaged

the entire Optical Fiber Cable Line, protected by the expensive and strongest engineering polymer PA-12 just within one month of installation!

Rodents are often blamed for derailment of trains as well. Rats were responsible for about three train derailments in a month in Jharkhand in 2015. No loss of life was reported as those trains were goods carriers. However if the train would have carried passengers instead of goods the magnitude of loss to life and property would have been huge.

Insects are not far behind in disrupting the functioning of the railways.

The lifeline of Mumbai, the suburban local trains carries lakhs of people every day. Red ants are also found accompanying these people every day on the local trains. Recently in November 2015, it was reported that red ants had gnawed through the primary brake cables. One can just imagine the catastrophic conditions that could arise due to such brake failure!

Other incidences of rats chewing the cables of the air-conditioning system of the first-class compartment of Patna-Pune Express , causing a passenger to suffer despite paying the exorbitant charges has also been reported in 2014.

Rodents are a nuisance for the passengers travelling in trains especially in A.C. coaches. The number of complaints of rats scurrying around pantry cars of long-distance trains is on the rise.

It was reported that the Central Railway in India spends more than Rs. 1.73 crore to get rid of cockroaches, rodents, bed bugs.

Rats have been said to have frequently attacked train passengers. In January 2014, passengers aboard Rajdhani Express had created ruckus and brought the train to a halt by pulling the chain, seeking medical attention after an elderly woman had her toe nibbled by scurrying rats.

Also due to the unhygienic conditions prevailing in the railway pantries, many meals served to the passengers are often found to be contaminated with rodents, rats in particular. One such incident happened in the year 2013 when Railways served 'rat biryani' to Gujarati pilgrims. A family from Valsad was served a revolting dish of 'rat biryani' from the pantry of the Sarvodaya Express.

- **Let us look at some other incidences as well where rodents menace has become difficult for the Railway officials to manage:**

- **Rats on a train: Couple claims Rs 10 lakh for being bitten on board**

By Saurav Roy, Hindustan Times, Ranchi, Jan 06th, 2016 10:10 IST

A Ranchi couple claimed Rs 10 lakh as compensation, stating that they were bitten by rodents in the AC first class compartment of a Kolkata-bound train.

- **Railway spends Rs 10 crore to get rid of rats at Delhi stations**

By India TV News Desk, 07th Dec 2015, India

Irritated over the menace of rats in large railways stations such as New Delhi, Delhi, Hazrat Nizamuddin and Sarai Rohila, authorities had chalked out a plan of Rs 10 crore, hiking its Rs 6 crore expenditure of previous year.

- **Karnataka Spends Rs 650 to Catch a Rat**

By Ashwini M Sripad, The New Indian Express, 28th November 2015, India

BENGALURU: The State government is spending close to Rs 650 a rat, to make Vidhana Soudha, Vikas Soudha and a few other government offices in the city rodent-free.

In the last five years since 2010, the government has handed over the task of catching rats to a private agency. They have been paid Rs 19.34 lakh so far to catch rodents, Chief Minister Siddaramiah stated in a written reply to JD(S) MLC Patel Shivaram's question in the Council. The CM said these agencies catch 50 rodents on an average every month. This means, the State government is spending Rs 644 to catch a rodent

- **Travel misery for thousands of rail passengers down to rodents**

By Tom Mack, September 15, 2015, Leicester, UK

There was travel misery for thousands of rail passengers after rodents gnawed through cables, disabling signals.

The problem meant all trains north and south on the Midland Mainline from Leicester cancelled from 7am onwards, with the disruption lasting until 7pm

- **Rats on board AC coaches of Kerala trains**

By Manoj Badgeri, TNN, Jul 6th, 2015, India

Trains to and from Kerala need a Pied Piper on board. With travellers often complaining of the rat menace on trains from the coastal state, a city-based cultural body of Malayalees plans to ask people to carry traps along to combat the rodent problem.

The rodents, they said, had damaged their luggage and food packets. Complaints to officials on board fell on deaf ears.

- **Bags destroyed by rats during journey, railways to pay Rs 15K**

By Times Of India, Aug 28th, 2014, India

NEW DELHI: Indian Railways has been held deficient by a consumer forum here which directed it to pay Rs 15,000 compensation to a retired serviceman, whose bags were damaged by rats in a train.

- **Rats give hard time to Rapti Sagar Express passengers**

By Times Of India, Sep 18th, 2012, India

BAHRAICH: Rats created nuisance on the Rapti Sagar Express 12511-up on Sunday. The train was going to Thiruvananthapuram from Gorakhpur. The rodents cut the wiring of the air conditioning in one of the coaches of the train and caused problem for a number of passengers, even injuring some of them and causing delay in the train's scheduled departure.

Such is the extent of damage that rodents are capable of causing.

The Reason

Going deep into the study of animal behaviour made us realize the bonding between the animals and the plastics. The bright colours and texture of polymer, the aromatic odour of polymeric products and the plasticizers used are all responsible for animals being attracted towards plastic goods. In addition, Rodentia, an order of mammals also known as rodents, is characterized by two continuously growing incisors in the upper and lower jaws which are kept short by gnawing. Thus to satisfy their own need, they hamper our living.

The Conventional Solutions

There is an urgent need for a sustainable solution to combat these unremitting rodent attacks resulting in inconvenience to the passengers as well as causing high economic losses.

The traditional methods used to protect wires and cables from pest damage like metal armoring, use of glass roving, and polyamide sheathing lower the flexibility of the cables and make them rigid. Polyamide 12 being an anti rodent is an absolute myth. Also the chemical repellants compounded in the sheathing are extremely toxic and have been proven to have harmful effects on human health. Pesticides are not basically designed for polymeric applications. They have very low thermal stability; thus the toxic fumes exuded during the extrusion processes for manufacturing the cables are extremely harmful for the workers working on the shop floor. Also these products volatilize easily. Thus the prevailing concentration of such toxic products in the cables would not provide protection against the rodents for a long span of time. Environmental degradation is a serious and adverse effect of using pesticides in the cable sheathing for protecting them from rodent damage. They tend to leach out easily from the polymer matrix which causes the soil and the ground water pollution and kill the non-target beneficial species essential for human survival. Also extensive use of toxic fumigants during the pest control of train coaches is proving to be a health hazard for the passengers. In case of traps, the definite problem of rat death emanating stench is the major drawback.

Thus we need a solution that is specially designed for polymeric applications and which does not harm the environment and the ecosystem while avoiding the damages caused by rodents to the railway cables.

The Solution

Employing novel techniques and focusing on environmental issues and safety norms are the need for the day and polymer-specific masterbatch for effective rodent aversion is now possible.

Rodrepel™, a patented non-toxic & non-hazardous product by C-Tech Corporation, has been successful in keeping the rodents away by keeping them away instead of killing them.

Rodrepel™ is available in the form of **universal masterbatches with a recommended addition level of 1-5%** depending on end application. Rodrepel™ alters the attractiveness by working on the following 5 principles:

Fear: The primary and the most pivotal defense against rodent attack. RODREPEL™ mimics the smell of predator urine thus exploiting the olfactory response of the rodents which would approach an application. Thus rodents in majority of the cases tend to stay away from the application thus preventing damage

Discomfort: RODREPEL™ causes severe distress to the mucosa of the animal in case of contact which could be accidental/ despite the fear mechanism.

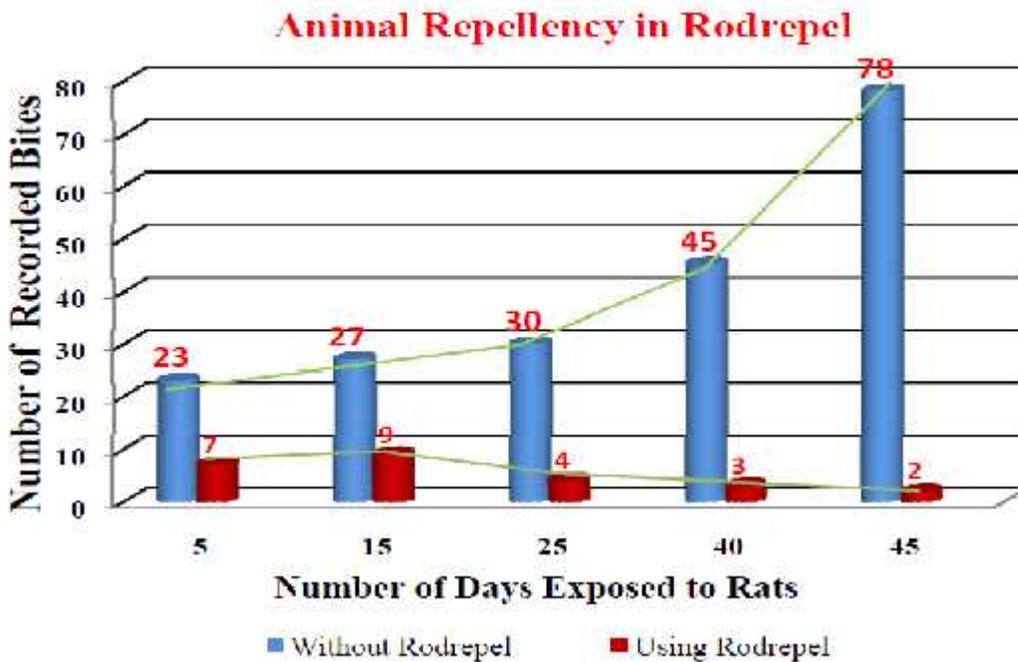
Aversion: RODREPEL™ triggers an unpleasant reaction within any rodent which might try to gnaw away at the application, ensuring that it won't bite again. Our labs have confirmed that in almost all such cases where the rodent might try to chew the substance incorporated with RODREPEL™, it won't bite again.

Training: After encountering the above mentioned emotions the animal instinctively perceives that RODREPEL™ is something it should stay away from and stores this information for future reference. This means that the next time it encounters RODREPEL™ it shall be more often than not automatically repelled.

Association & conditioning: The unpleasant experience with RODREPEL™ is imprinted within the animal's memory and passed on to its progeny. The next generation of evolved rodents would therefore be effectively repelled.

To come up with a non-toxic product, we first explored the conventional methods used by our ancestors for keeping the rodent away. We identified various types of predator urines which can evoke a fear response within the animal/rodent and we isolated the chemicals directly responsible for this. After extensive number of permutations and combinations followed by extensive trials we could combine them to give an effective concoction which was incorporated

in Rodrepel™ that has never failed to evoke the necessary fear response within the rodents and other such common target animals thus keeping them away from the application area. Despite this there is always a possibility that rodents try and come in contact with the applied area. In such a case incorporated within the Rodrepel™ chemistry are another set of chemicals which cause severe distress to the mucosa of the rodent and deter the animal from taking the next step forward and gnawing into the area. However the above two steps while extremely effective in keeping away majority of the rodents there are always some experimental rodents who would still sink their teeth into the application. Even in such a case the taste of the compound ends up creating such an unpleasant experience for the rodent that in almost all cases the rodent is automatically kept away from biting into the application again. However at each point, **we were careful not to include any poisonous products** for animals as in the wild; we could be dealing with endangered species or special animals & birds.



The graph proves the validity of above principles. The Rodrepel™ treated cables are less chewed as compared to the untreated cables

The Environment

Our approach is not to poison the animal or add hazardous chemicals. The term “aversion” means to drive back, ward off, or keep away. We have been working with several bio actives which are completely non toxic to humans as well as other animals. Since Rodrepel™ is designed to keep the rodents away effectively and not kill the rodents or any other animal; it doesn’t harm any target or non target species in any way. It is completely free of insecticides, heavy metals or products such as copper or lead naphthenates, lindane etc or chemicals found dangerous or harmful to humans or animals. It does not migrate or leach out from the polymer to contaminate ground water resources like the conventional rodenticides.