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Diversified Uses Of Natural Rubber

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Rubber products conventionally find application in various sectors such as transportation, communication, industry, agriculture, health and family planning, sports, and games etc. Natural rubber (NR), owing to its wide range of beneficial properties, is the basic industrial raw material which finds use in the manufacture of a broad spectrum of products.

Consumption of NR had been steadily increasing since the setting up of the first rubber goods manufacturing unit in India in 1921 and the rubber goods manufacturing industry been showing reasonably good performance. It is important to note here that the Indian rubber goods manufacturing industry is inward oriented in the sense that it predominantly caters to the domestic market.

Also it is worthwhile to point out the lion's share of the manufacturing units in the small scale sector which is mainly identified as having low investment, producing low quality products, of low output and with minimum management and marketing capabilities.

However, after 1997, the Indian rubber industry had been passing through difficult times. As a result of the general economic recession in India, the consumption of rubber products decreased substantially; but the NR production did not drop that heavily. When the ipts to export the surplus NR as well as to procure and store the rubber did not produce the desired results, there was surplus rubber available in the market resulting in the fall in price of NR. It is gratifying to note that the situation now shows signs of improvement.

However, the recently announced amendments in the Exim Policy of the union government can make definite impact on the situation if appropriate and timely actions are not taken to avoid the possible adverse effects. The policy which aims at substantially increasing the exports also has lifted the quantitative curb on import of many items which include rubber goods as well.

The Indian rubber goods manufacturers should rise to the occasion and take advantage by exporting more of the rubber products. The usual constraints such as comparatively low output, inferior technology, high cost of production, lack of awareness of prospective markets, etc of the units have to be sorted out by appropriate management and technology backup in a time-bound manner.

One way to overcome the crisis is to increase the consumption of NR in non-conventional applications or to promote 'new uses' for rubber. A new use of rubber may arise owing to various reasons viz the system for use of rubber itself may be new, or the system may have existed earlier, but the need for a particular function may be new.

Another 'new use' may be by replacing an existing material by a rubber product with definite techno-economic advantage. One typical example is the replacement of the conventional steel bearings in bridges by rubber bearings. If the above type of non-conventional or 'new uses' can be effectively promoted, it will definitely lead to more consumption of NR. Some of such explanations are discussed below.

RUBBERISATION OF ROADS

Incorporation of two to four per cent NR into bitumen improves the properties of the latter substantially and rubberised bitumen is found to be an excellent binder for metal and sand. Use of rubber modified bitumen in road construction is found to confer the following advantages compared to the use of ordinary bitumen for the purpose:

- Useful service life of rubberised roads increases at least by 100 per cent ad in many cases more
- Better resistance to fatting up under hot conditions
- More resistance to cracking under cold conditions
- More resistance to skidding and hence, more safe journey on rubberised roads
- Repair and maintenance cost of rubberised roads is considerably low. About 33 per cent saving in maintenance cost
- Extra cost of rubberisation of road comes to only 15 - 20 per cent
- Saving in fuel and lesser repair and maintenance cost for vehicles

Extensive rubberisation of roads combines savings with safety and will increase the consumption of NR in a non-conventional application. Rubberisation of roads has become a routine practice in developed countries like USA, UK, France, Australia and Malaysia. The government of India has now decided to go in for rubberisation of at least 10 per cent length of periodical renewal programmes (starting from 1999 - 2000) in every state and based on the results, to take appropriate steps for popularising the technology.

BRIDGE BEARINGS

The primary function of a bridge bearing, placed between the bridge deck and its fixed support, is to allow the movement of bridge deck on its supporting pier when changes in length occur due to thermal expansion and contraction. Bearings should also support the weight of the bridge and traffic movements. Prior to 1950, this was achieved by steel roller bearings or sliding plates and these needed constant maintenance to perform satisfactorily. Moreover, the mechanical bearings which roll or slide are expensive and difficult to install. Also, it has to be pointed out that corrosion and wear of the steel bearings adversely affect their performance.

Research and development work to overcome the drawbacks of the steel bridge bearings culminated in the development of synthetic rubber-based bridge bearings by the French in the 1950s. Steel laminated rubber bridge bearings are now in use world over. Only two types of rubber viz natural rubber and polychloroprene are recommended for manufacturing bridge bearings.

Considering the large requirement of rubber for the manufacture of rubber bridge bearings, inclusion of natural rubber in the specifications

as the basic raw material for the production of rubber bridge bearings needs immediate consideration and the matter has already been taken up by the Rubber Board with the Indian Roads Congress.

SEISMIC NR BEARINGS

Earthquakes are ground oscillations of a very large amplitude and low frequency. To overcome the damaging effects of earthquakes, the conventional approach is to design buildings and structures providing adequate strength and stiffness which would be sufficient to withstand a given level of earthquake generated force. Proper structural design and careful selection of structural members such as columns and beams may enable us to construct quake resistant structures.

However, it needs to be mentioned that the cost of construction of such structures would be rather high and the structures may not always be 100 per cent quake proof. This led to the need for following a better scientific and cost-effective approach for the design and construction of quake resistant structures. The basic approach for designing quake proof structures has changed from providing extra strength to structures to reducing earthquake generated forces acting upon them.

During an earthquake, the ground under each building tends to move. The building responds to this by undergoing a displacement. Owing to the complex nature of the earthquake induced ground motion, the building tends to vibrate back and forth. In the case of a conventional building, on account of the impact of earthquake, the building undergoes deformation resulting in the development of cracks and sometimes in the crumbling down causing deadly damage to the inhabitants and their belongings. In the case of a base isolated building, the forces acting on the building are considerably reduced and hence the building and its occupants are completely unaffected by earthquakes.

For base isolation, the commonly used material is a rubber bearing preferably made of natural rubber and laminated with steel plates. Since 1976 such bearings are being used quite successfully to protect many buildings and structures world over. However, in India this technology is yet to be practiced.

The Indian standards (IS): 1893-84, IV revision on the existing code of practice for seismic resistant design of buildings requires changes and has to include more rational procedures for the safety of buildings and structures using seismic NR bearings. Joint R&D work between structural engineers and rubber technologists for designing and developing indigenous technology for quake resistant buildings has to be carried out on a time bound basis. The Rubber Board has taken the required initiative in the matter.

NR LATEX IN BUILDING CONSTRUCTION

Latex modified cement concrete (LMCC) has many advantages like simple process technology, better workability of fresh concrete, improved tensile and flexural strengths, superior impermeability of concrete to water, chemicals and gases, enhanced impact resistance and very good adhesion to many substrates. LMCC finds use in the repair and rehabilitation of concrete structures.

CANAL LINING

Irrigation is the application of water to soil with a view to supplying moisture essentially required for plant growth, especially during stress periods. Irrigation helps to boost productivity, usually by two to five times or sometimes more. Though it is a costly proposition, it provides an insurance against short duration drought.

Of the different methods used for irrigation, the one using irrigation canals is of paramount importance in our country. Reports indicate that of the net area under irrigation by sources, irrigation canals account for about 33 per cent. Making the most efficient use of irrigation by minimising losses in conveyance by lining is a very important aspect to be considered.

With a view to develop more cost-effective canal lining techniques, especially using indigenously available materials, an applied R&D work was undertaken by the Rubber Board and the Kerala Engineering Research Institute (KERI), Peechi, using natural rubber latex as a material for lining canals.

Laboratory trials and preliminary model studies showed promising results indicating that NR latex can be used as a cost-effective and efficient canal lining material. However, further large scale trials are undertaken again to evaluate the usefulness for NR latex as an irrigation canal lining material. If the final results of the study are promising, it will also open a new outlet for the consumption of NR.

Non-conventional applications of rubber normally get promoted by 'producer push' or 'consumer pull'. It is gratifying to note that the Rubber Board is taking the lead role and providing the required impetus to the Indian rubber industry.

The Department of T&TC imparts training on various aspects related to rubber cultivation, rubber processing and rubber product manufacture with a view to making available trained manpower for the overall development of the rubber plantation and rubber industry. The technical consultancy division (TCD) imparts advisory services and consultancy work for setting up of rubber industries. It acts as a link between the know-how, innovations and entrepreneurs who have already made an investment or intend to do so. The services of TCD are extended on a consultancy basis at nominal charges. ◆

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