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Strengthening concrete with tyre fibers

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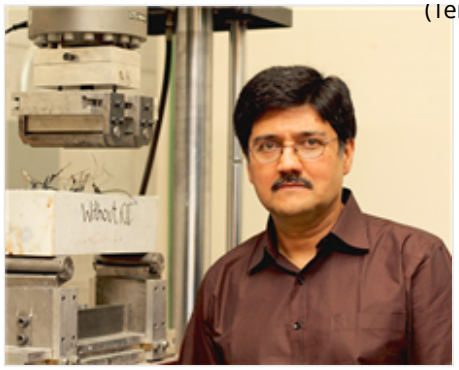
In an Interview Dr Nemkumar Banthia delves into the grave environmental menace of tackling disposed tyres ending up in landfill by diverting it as a sustainably efficient ingredient for the construction industry. His research is based on extracting fibers from tyres and utilizing them as reinforcement in concrete.



Dr Nemkumar Banthia, Professor, Distinguished University Scholar & Canada Research Chair in Infrastructure Rehabilitation at the Department of Civil Engineering in The University of British Columbia, Canada.

Dr Banthia is a Professor, Distinguished University Scholar & Canada Research Chair in Infrastructure Rehabilitation at the Department of Civil Engineering in The University of British Columbia, Canada. He is also the CEO and Scientific Director at Canada India Research Center of Excellence (IC-IMPACTS).

Insight into current research

The research relates to extracting fibers from the tyres, and utilizing them as reinforcement in concrete.

The fibers we are extracting are entyrely made of polyester. The process specifically extracts only the polyester fibers and leaves behind other fibers such as steel, rayon and nylon fibers.

There are many advantages of adding fibers to concrete. Concrete is a very brittle material that cracks easily. Due to the brittleness induced cracking, deleterious chemical are allowed to enter the body of concrete and thereby create undesired outcomes such as rebar corrosion and various other forms of internal damage. To combat brittleness and crack growth, we have been reinforcing concrete with fibers for more than 50 years. Fibers produce stress-transfer bridges and abate crack formation and growth. The difference is that so far industry has been using fibers from virgin source and in our current work, we have extracted the fibers from a waste stream, ie. automobile tyres instead of from virgin sources.

Advantages of using polymer fibre from tyres in concrete structures.

Fibers control crack growth and enhance durability that can in turn enhance the lifespan of concrete structures by as much as twenty years. Fibers can also enhance mechanical resistance of concrete including strength, toughness, energy absorption, fatigue endurance and impact resistance. As a bonus, we now know that polymeric fibers also enhance the fire resistance of concrete structure.

Recycling automobile tyres.

The current rates of recycling of automobile tyres are less than 35 percent, which means that more than 65 percent of the tyres are ending up in the landfills. This is unacceptable. Whatever we can do to protect our landfills and use waste products from one industry as a resource in some other industry will help us achieve long term sustainable growth. This concept is called "industrial-ecology" and in this case we are taking the waste from the automobile industry (tyres) and using it in the construction industry (concrete).

Fibre-reinforced concrete significantly helps reduce tyre industry’s carbon footprint. First we are sparing virgin fiber that would otherwise be used as reinforcement in concrete and instead replacing them with tyre fibers. Second, we are enhancing the performance, lifespan and durability of concrete structures thereby achieving additional sustainability and reduced municipal costs.

Advantage of the research compared to similar material usage.

This is completely new. Thus far, no one has extracted fibers from tyres as we have and used them as reinforcement in concrete the way we have. Tyre crumb has been previously used but is not very effective. We have demonstrated that our tyre extracted fibers perform as good as the virgin fibers the concrete industry is currently using in large quantities.

Commercializing the research

There is a significant interest in both the tyre sector and the construction sector to use the technology. Further, the research will be absolutely useful for adoption in emerging markets. This would be excellent for India as India's concrete consumption is growing rapidly and so is the volume of scrap tyres. All of the tyre fiber can be consumed by the concrete industry thereby improving the quality of concrete in India.

Enhancing the research.

We will continue to enhance the performance of concrete reinforced with tyre fiber. Also, we are attempting to extract fibers from other industrial sources such as the pulp and paper industry, agro-foods industry, garment industry, etc.

Challenges faced while conducting research.

Some of the challenges include lack of purity of fibers, high pH stability of fibers, low extraction yield, high energy consumption during extraction and low rates of recovery.

Ways in which Canada-India Research Center of Excellence (IC-IMPACTS) can support research collaborations between Canada and India.

IC-IMPACTS is a very successful model of two countries collaborating with university, industry and government sectors involved with the aim of finding sustainable solutions to problems facing both countries. Currently, IC-IMPACTS is tackling problems in Infrastructure, Water and Health. The next step is to explore Clean Energy.

See the Interview in Chemical Today magazine

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