

GREY MATTER

A green cement with promises to keep

How LC3, a new material developed in India, can decarbonise the cement industry by using waste material and cutting energy use

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This is not a pipe dream to reduce the environmental impact of construction, but a concrete solution – literally. Since the late 1990s a cement alternative is being developed and experimented with in India. A substitute that is economical, requires less energy to produce, uses waste material, is more environment friendly, and equals in strength with the existing ordinary Portland cement (OPC) and Pozzolana Portland cement (PPC).

Christened LC3, it was ideated first by a Cuban professor, Fernando Martirena, and later researched by Prof Karen Scrivener in Switzerland, who, in turn, felt this was the right fit for developing nations. She approached Development Alternatives (DA), one of the oldest research and action organisations in the country, for further research and development of the material. One of DA's divisions, Technology and Action for Rural Advancement (TARA), took on the challenge. Over the years, TARA roped in IIT Delhi, IIT Madras and IIT Bombay at different stages to intensify research and experimented with the production of LC3.

"In the first pilot we produced LC3 at Bansal Cements, a mini cement plant in Kharagpur, West Bengal, with good



Cementing sustainability Concrete slabs made from LC3 COURTESY: PROF FERNANDO MARTIRENA, DIRECTOR, CENTER FOR RESEARCH & DEVELOPMENT OF STRUCTURES AND MATERIALS (CIDEM)

clay. Then we asked for waste, throwaway quality clay, which the dealers gave us free. We used this cement to build an office structure in Jhansi, which stands even today," recalls Dr Soumen Maity, the chief technology officer at TARA. A material scientist, he has been associated with LC3 since the beginning and leads in the dissemination of the technology

within India and outside, especially in Africa, Asia and the Pacific.

Economical and sustainable

So, what is this innovative material that can help reduce costs and environmental damage? LC3 or limestone calcined clay cement is a family of composite cements containing 50 per cent Portland clinker, 30 per cent cal-

cined clay, 15 per cent limestone and 5 per cent gypsum. After research it has been found to be economical and more sustainable, with higher restivity than other cements. In environmental terms its production emits 40 per cent less carbon dioxide compared to OPC and 11 per cent less compared to PPC. Besides, for its production, kaolinic clay or waste clay is used, which is a throwaway material in the ceramic and tile making industry.

But why haven't we heard of it in India? While LC3 has become a cement of choice in over a dozen countries in Africa, South America and West Asia, in India the Bureau of Indian Standards (BIS) clearance is awaited. "India has stringent standards, rules and tests, so it takes time. We are hopeful we will get the green signal soon, as we have now completed several pilots with Indian cement companies and the Cement Manufacturing Association is also supporting it," says Dr Maity.

JK Laxmi Cements Ltd, Ultra Tech Cements, and JK Cements are among the companies involved with TARA's pilots. There were also trials with MP Birla Cement, Shree Cements, and Saurashtra Cements. "We first scout for clay close to the existing plants of cement companies as that can make LC3 much more economical," explains Dr Maity.

The best thing about LC3 is that it uses clay at lower investment and production costs. It also uses raw materials and technologies that are already available at cement factories. The production process, too, is similar to that of OPC and PPC.

There are other advantages as well. Through the production of LC3, the cement industry can utilise low-grade mine rejects, which are widely available. "While it reduces GHG (greenhouse gas) emissions from the cement industry, it also helps in utilisation of waste materials, thereby promoting resource efficiency," points out Dr Maity, who has seen it become popular in Malawi, Rwanda, Uganda, Zimbabwe, Egypt, and Senegal. "Cost of cement is very high in Africa, double that in India; so LC3 makes sense." He explains that the cement is also ideal for countries with harsh weather conditions and wide variations in temperature.

India, too, seems to be considering using LC3 in the future, as cement companies explore the feasibility of producing it. Dr Maity has hope and an interesting thought to share. He feels that if cement companies in India adopt LC3, it could help with a whopping 30 per cent of the one-billion-tonne carbon reduction that India has promised this decade.