

Biobased concrete substitute can give coastal restoration a natural boost

An innovative alternative to concrete could enable important coastal restoration work to take place. The material Xiriton, made with local grass species and seawater, captures CO₂ instead of emitting it, as conventional concrete does. NIOZ researchers successfully tested the material for its suitability as a substrate for shell banks or salt marsh restoration, for example. They published their work in the journal *Frontiers in Marine Science*.

Using different variants of Xiriton NIOZ researchers set to work at the research institute in Yerseke. Xiriton is easy to make with chopped dried grass, volcanic [pozzolan](#), slaked lime, shells, sand and seawater. But is it also suitable for restoring tidal areas such as salt marshes and shellfish reefs where necessary?



Covered with life

The idea is that temporary structures in tidal areas provide a place where mussels and oysters can settle in areas where they have disappeared or declined significantly. The researchers placed blocks of Xiriton on the mudflat in Yerseke, where they were exposed to the tides twice a day. 'After a year, every block was around 70 per cent covered with life such as oysters, mussels and algae,' says PhD candidate Victoria Mason. 'This indicates that Xiriton blocks are not only cheap, sustainable and practical to manufacture on a large scale, but also suitable for use in enhancing settlement and potentially restoring biodiversity. By adjusting the lifetime of the material, it can also break down naturally into harmless substances once a reef can

sustain itself, instead of remaining permanently in the ecosystem.'

Cordgrass or bamboo

The researchers used cordgrass (*Spartina anglica*), which is widely available locally, and Elephant grass (*Miscanthus giganteus*), to make Xiriton. Other types of grass, such as reed or bamboo, could also be used, as long as they are harvested sustainably. Depending on the drying time of the material and the amount of binder in the mix, it becomes stronger. Mason: 'After five weeks of drying, it was at its hardest.' The research showed that the acidity of the material is favourable. Mason: 'With a pH value of 8 to 9, it is much more neutral than standard concrete, which is more alkaline. Concrete has a pH of around 13, which can be unfavourable for organisms that need to settle on it.'



Coffie cup shaped objects

The researchers found that after 63 days of heavy flow, Xiriton is as strong as concrete alternatives such as those made with Roman cement. In the so-called Fast Flow Fume (photo), for example, they unleashed a strong current on pieces of Xiriton that had been made using coffee cups as moulds, in an enhanced erosion experiment to test the adjustability of the material lifetime. That was the task of Jente van Leeuwe, then a master's student in Earth & Environment at WUR, now a PhD student at NIOZ. 'We used those coffee cups to place the material in the flow instead of having the flow go over the structure, like with tiles.'

Flexible, temporary and cheap

Mason: 'For the purpose of intertidal restoration, we need materials that are not environmentally harmful in the short or long term. They must be flexible in terms of what shapes we can build, and temporary, so they don't require expensive removal or leave harmful products in the environment. As well as that, they need to be inexpensive enough to be upscaled to larger projects and different areas.'



Follow-up study

The researchers want to conduct a follow-up study to determine whether Xiriton is also suitable for large, wave-breaking structures. Dependent on the composition, the lifetime of these semi-permanent structures could be altered – to be long enough to serve as temporary scaffolding for natural reef formation.

Almost everything you can do with bricks

The developer of Xiriton is Swiss [Frank Bucher](#), who lives in Stiens, Friesland. Back [in 2009, he won an award](#) for the concept, which he says can be used to build anything you can build with bricks. 'All buildings up to three stories high, for example. But you don't have to bake it and you don't need clean drinking water. You can make it with ditch or sea water.' To his regret, the material has not yet been used in the construction industry. 'The combination with wood enables new construction concepts, including for hydraulic engineering. Wood reinforces Xiriton, and Xiriton protects the wood.' In the world of coastal restoration, people are open to it, Bucher notices. Xiriton is also [the subject of research](#) at Van Hall Larenstein University of Applied Sciences.

Mason is nearing the end of her PhD research. 'I have enjoyed working with Xiriton as a more practical, applied side to my research. We were able to explore concepts of ecosystem restoration with a view to offering a realistic, non-harmful and globally upscalable option to placing materials into ecosystems, where intervention is required.'

Not a luxury, but a necessity

Senior researcher Jim van Belzen, also involved in the publication, places the research in a broader perspective. 'The built world now weighs more than all the biomass on Earth. If we really want to reduce our footprint, we need to radically rethink the way we build. New biobased concepts – where nature, circularity and regeneration are central – are not a luxury, but a necessity. The technology is still in its infancy, but biodiversity will not wait.'

According to Van Belzen, Xiriton offers prospects for nature-inclusive applications in coastal protection and ecosystem restoration. The material combines the strength and malleability of concrete with a much smaller ecological footprint and could potentially be used for breakwaters, seawalls or artificial reefs that enhance natural processes. 'The future of water safety? It could well be greener than stone and concrete.'

Read the article: [Frontiers | Using local materials for scalable marine restoration: Xiriton as a nature-enriching, low impact building material](#)