
BETTER BLOCKS
39 Ways To Save The Planet
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Making cement results in high levels of CO_2 output.

- The cement industry emits 7% of the global anthropogenic (man-made) greenhouse gas (GHG) emissions. It is the 3rd ranking producer of anthropogenic CO_2 in the world after transport and energy generation.
- Of the total CO_2 output, 30% derives from the use of energy and 70% results from decarbonation

- the thermal decomposition of calcium carbonate in the process of producing cement clinker.

$CaCO_3$ (limestone) + heat -> CaO (lime) + CO_2

- Production of one tonne of cement results in 780 kg of CO_2

Can we do it better?

Pathway Towards A Carbon-neutral Cement Industry Using CO_2 Mineralization

CO_2 mineralization converts CO_2 into a thermodynamically stable solid and by-products to substitute cement.

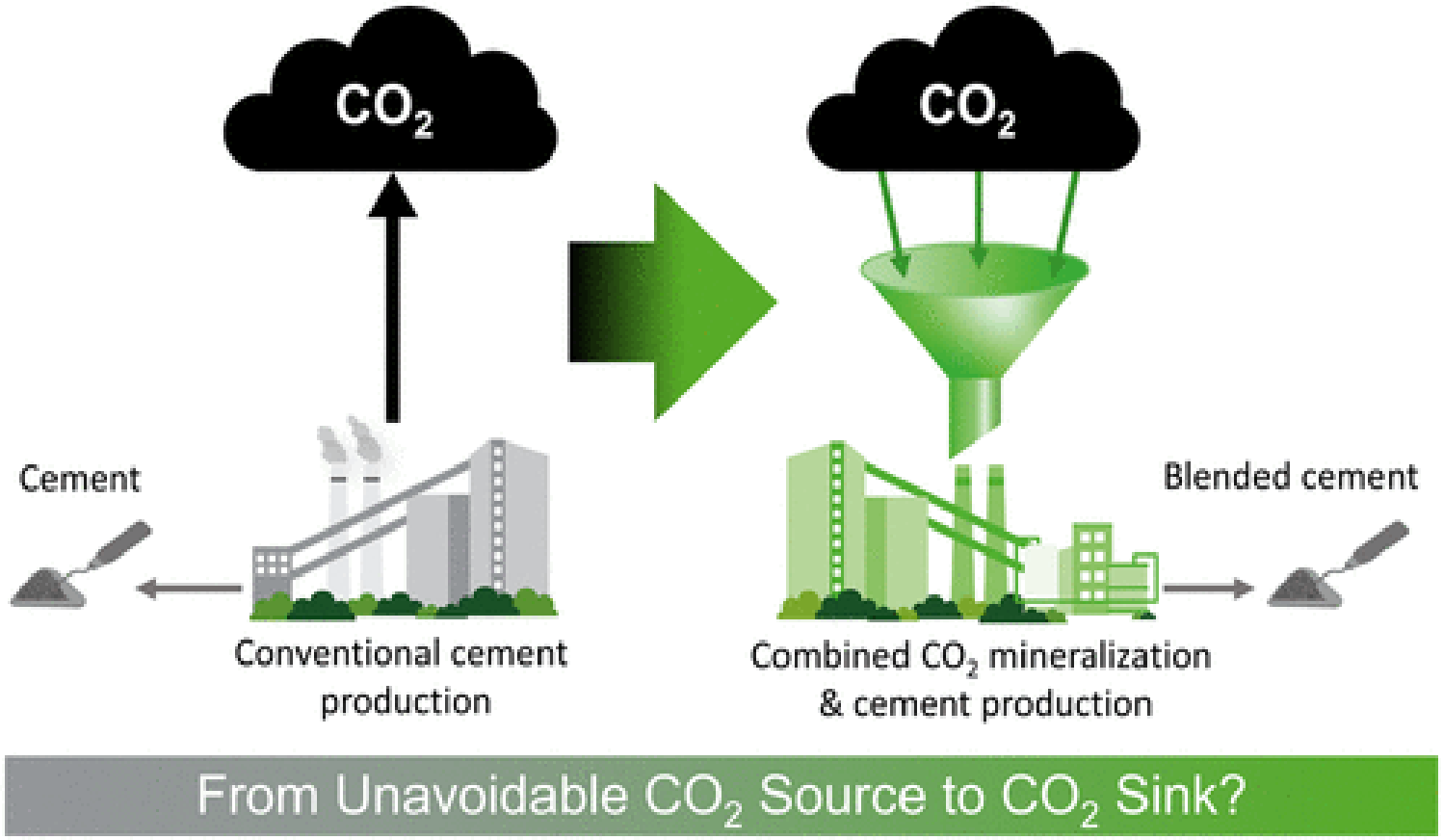
CO_2mineralization reduces the carbon footprint of the cement industry via:

(1) capturing and storing $CO_2$from the flue gas of the cement plant

(2) reducing clinker usage by substituting cement.

reducing the carbon footprint of the cement industry by 44% or even up to 85%.

With direct air capture, the blended cement could even become carbon-negative.



From Unavoidable CO_2 Source to CO_2 Sink? A Cement Industry Based on CO_2 Mineralization
https://doi.org/10.1021/acs.est.0c07599

Turning Waste Dust And Carbon Dioxide Into Building Materials.

- a technique that mimics natural processes: using carbon dioxide as a glue to form stone aggregates from waste dust left behind by heavy industry.

- The spin-off company, **Carbon 8 Systems**, has compressed the process into a shipping container and makes building materials in the UK and France with this clever carbon-munching technique.

Self-cementing Properties

System For The Developing World:
choosing waste to make a tailored range of building products relevant to the region in which they're made.

Biomass residues sourced in India, Africa and the UK were ashed and exposed to CO_2 gas.

(e.g., wood-derived, nut shells, fibres, and fruit peels)

Self-cementing Properties

- These CO_2-reactive ashes could mineralise CO_2 gas and be used to cement 'raw' biomass in solid carbonated monolithic composites.

- The approach is conceptually simple, scalable, and can be applicable to a wide range of biomass ashes in a closed 'emission-capture' process 'loop’.
- It helps diverting wastes from landfills.

How much carbon dioxide we can remove from the atmosphere by developing this new generation of bricks and mortar?

- Carbon Capture in Usage and not storage!
- Turning other waste into raw material
- Reduce extraction
- Circular economy
- We can capture 1.5% of current GHG emissions
- Up to 6% in 2050 by using concrete waste

Extra!

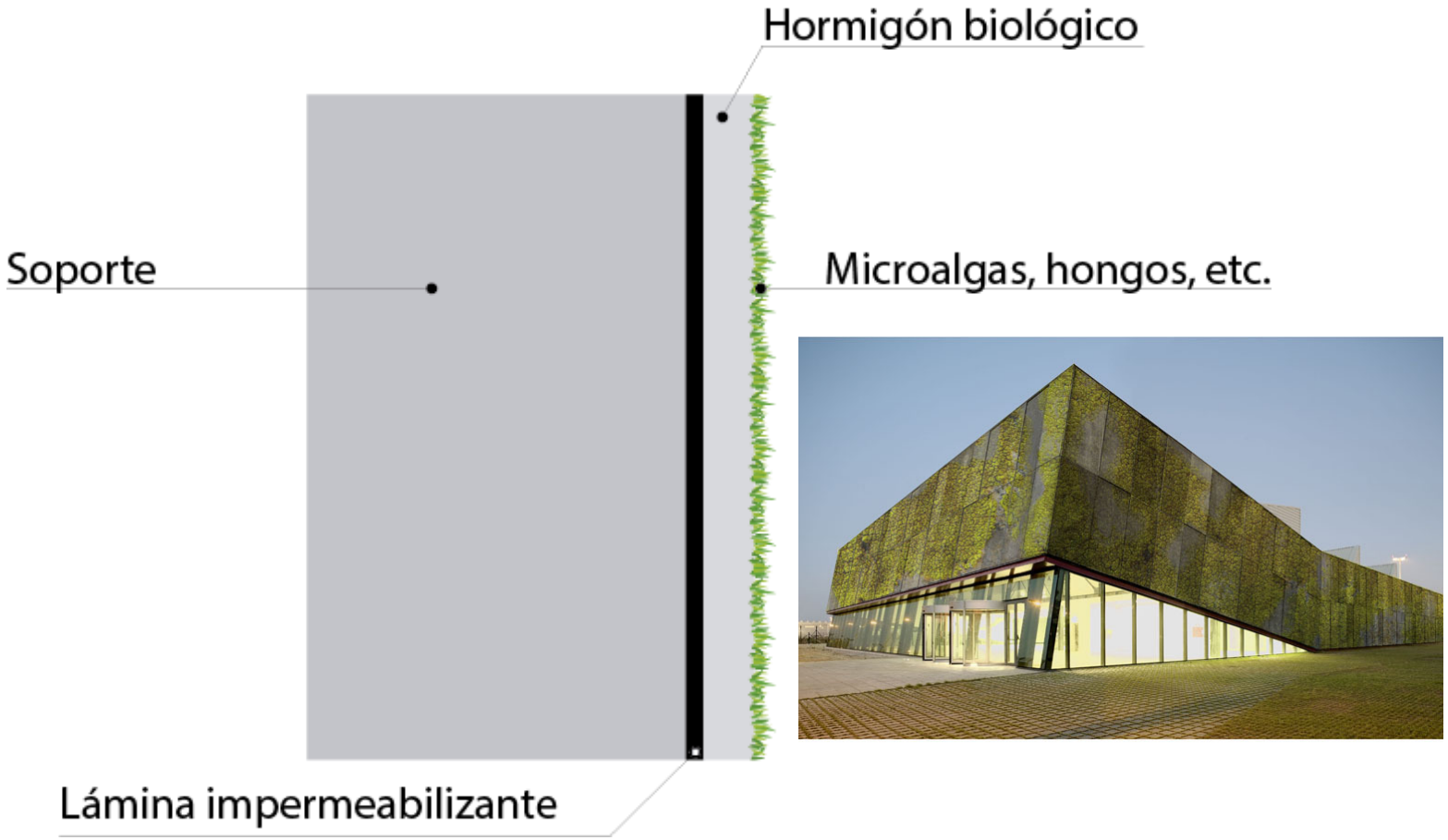
Self-Healing Concrete

- a self-healing concrete product
- Mixing bacillus bacteria spores mixed with calcium lactate capsules into the initial concrete mixture
- external elements (such as air and water) react with the bacteria to form limestone.
- more durable and environmentally friendly.
- less mining to obtain concrete
- fewer resources spent on building maintenance.
- reduces carbon emissions
- lower carbon footprints

By using less concrete to carry out maintenance and repairs, there will be fewer carbon emissions into the environment over time.

Biological Concrete

The plants capture CO2 from the air and release oxygen.
acts as insulation as a thermal mass:
absorbing heat and preventing it from entering the building in hot weather or escaping the building in cold weather.



Thank you for listening!

Resources

- 39 Ways To Save The Planet, BBC Radio 4
- From Unavoidable CO_2 Source to CO_2 Sink? A Cement Industry Based on CO_2 Mineralization https://doi.org/10.1021/acs.est.0c07599
- Study of self-healing properties in concrete with bacteria encapsulated in expanded clay https://doi.org/10.1016/j.stmat.2018.11.006
- Researchers develop a biological concrete for constructing 'living' facades with lichens, mosses, other microorganism Polytechnic University of Catalonia