CONCRETE WITHOUT QUARRIES

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Introduction

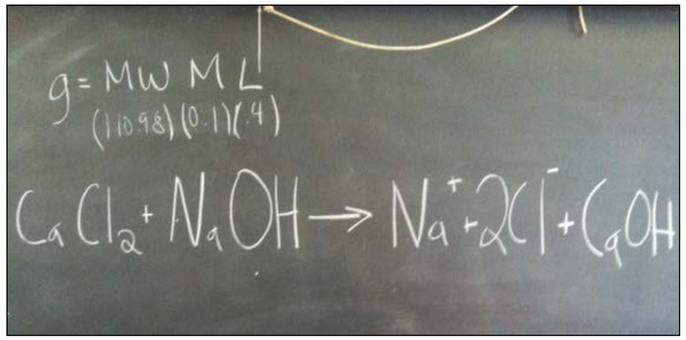
Biomimicry is an innovation method that seeks solutions to humankind's various sustainability challenges by applying principles underlying nature's time-tested strategies (Benyus 1997). Modern day manufacturing, for example, presents myriad challenges to environmental sustainability.

Material mined from the earth, processed using fossil fuels and hazardous chemicals, and resulting in pollutants discharged into the environment characterize our species' dominant manufacturing paradigm.

Concrete provides an illustrative case: cement used in concrete is manufactured by extracting calcium carbonate from open-pit mines, cooking the material at 2642 degrees Fahrenheit (1400 degrees Celsius), and discharging approximately 6% of humanity's annual greenhouse gas emissions into the atmosphere.

By emulating a physiological process used by corals to create calcium carbonate out of seawater and carbon dioxide, demonstrates first-hand a cutting-edge biomimetic technology with the promise of transforming conventional concrete manufacturing into a more sustainable industry. Moreover, students learn that there is a universe of biological models

The Process

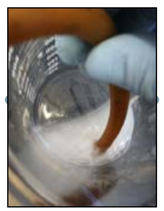


1 | The Formula

Calcium chloride combined with Sodium hydroxide to make Sodium chloride and Calcium hydroxide into Calcium Carbonate

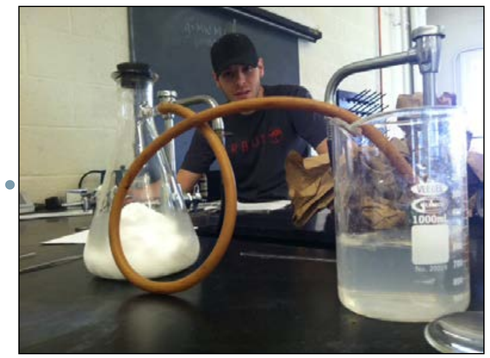
2 | Sea Water Mixture

Use seawater or create a seawater analog mix, either from a seawater mix from a solution of 0.1 M CaCl2 (i.e. 1.47 g in 100 ml). this solution is like the seawater that corals use and contains calcium atoms that will become part of the calcium carbonate (CaCO3) compound they are creating.



3 | Add drops of Sodium Hydroxide to Sea Water

A 1M solution of NaOH (i.e. 3.99 g in 100 ml). Household lye can serves a source of NaOH. Corals get calcium to bind with carbon and oxygen by controlling the solution in which the atoms are placed, increasing the concentration of some atoms and reducing the concentration of others.



4 | Insert tube into the container of seawater solution

White, cloudy precipitate should form immediately, falling slowly to the bottom of the container. To produce enough precipitate, run the reaction for at least 3-5 minutes. During this time, you can review with students the chemical reaction happening, emphasizing that, like corals, they are making something solid and valuable come out of simply a waste gas (CO2) and an abundant liquid (seawater).

5 | Filter Calcium Carbonate

Similar to corals,they are making something solid and valuable come out of simply a waste gas (CO2) and an abundant liquid (seawater). This can then be used as cement to make concrete without mining quarries