KAJIMA CORPORATION

Kawasaki Heavy Industries, Ltd.

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Showcasing production of concrete utilizing CO_2 captured from the atmosphere
-- CO_2-stored concrete paving blocks to be displayed at Japan International Expo 2025

Kajima Corporation (President: Hiromasa Amano) and Kawasaki Heavy Industries, Ltd. (President: Yasuhiko Hashimoto) have successfully utilized CO_2 captured from the atmosphere by leveraging Kawasaki's advanced Direct Air Capture (DAC) technology to produce CO_2-SUICOM, an innovative CO_2-Sequestered concrete developed by the researchers at Kajima and others.

Kawasaki has developed a customized DAC equipment, which can capture CO_2 from the atmosphere using a original solid sorbent. The CO_2 capture equipment is capable of collecting more than 5kg of CO_2 per day at a purity level exceeding 99%. In a significant advancement, this equipment has been integrated with a carbonation curing chamber※1, creating a system enabling the storage of CO_2 in CO_2-SUICOM concrete.

To demonstrate its practical application, the newly developed integrated system was set up at a precast concrete plant to produce CO_2-SUICOM concrete products. It was also confirmed that the required amount of CO_2 was sequestered in the concrete, with product quality meeting industrial standards.

Following the successful demonstration, the innovative system was utilized to produce paving blocks called CUCO-SUICOM Blocks※2, which have been installed at certain parts of the entrance of CUCO®-SUICOM Dome, (also known as the Sustaina-Dome), at the Japan International Expo 2025.

※1 Carbonation curing equipment for CO_2-Sequestered concrete designed to store atmospheric CO_2 in a stable environment.

※2 Pavement Blocks produced as part of the research and development under the New Energy and Industrial Technology Development Organisation's (NEDO) Green Innovation Fund project entitled "Development of Materials, Manufacturing Methods and Quality Control System on Innovative Carbon Negative Concrete".

DAC Equipment (Left) and Carbonation Curing Chamber (Right)

Entrance area of the Sustaina-dome where the pavers were installed

【Background】

CO_2-SUICOM, developed by researchers at Kajima Corporation, is a pioneering solution that can significantly reduce CO_2 emissions associated with concrete production, achieving carbon negativity. This realized by storing CO_2 in the targeted concrete products during the carbonation curing process conducted at the precast concrete plants. However, as the CO_2 gas used for carbonation curing is currently sourced from external suppliers, procurement poses a significant challenge for the broader implementation of CO_2-SUICOM. Kajima has therefore begun to focus on DAC technology as a solution that can efficiently extract the required amount of CO_2 from the atmosphere in a timely manner, regardless of location, and thus has entered into a collaboration with Kawasaki a company with decades of experience in this field.

【Outcomes】

The DAC system developed by Kawasaki is installed within a compact container, complete with auxiliary equipment. This advanced system is capable of automatically capturing over 5kg of CO_2 per day from the atmosphere. Its compact design allows for easy transportation and installation at any location, making it suitable for a diverse range of applications. The purity of the recovered CO_2 is very high, about 99%, and 400ppm of CO_2, which is very dilute, was successfully concentrated.

The demonstration of CO_2-SUICOM production utilizing the integrated system, which combines DAC equipment with the carbonation curing chamber, was successfully conducted in cooperation with NIHON KOGYO CO.,LTD. (President: Yoshimi Yamaguchi, Sanuki City, Kagawa Prefecture). Following the successful demonstration, the CUCO-SUICOM blocks specifically for the Japan International Expo 2025 were produced.

<Production Procedure>

① CO_2 is captured from the atmosphere by DAC equipment and concentrated to a high purity.
② CUCO-SUICOM pavement blocks are placed in the carbonation curing chamber.
③ Highly concentrated CO_2 from (①) is supplied into the carbonation curing chamber and carbonation curing is started.
④ Storage of CO_2 in concrete while curing for 2 days.

Placement of pavement blocks in the Carbonation Curing Chamber

<Comparative and Analytical Results>

The CUCO-SUICOM blocks produced using this innovative integrated system were found to store the same amount of CO_2 and have similar flexural strength to blocks made from CO_2-SUICOM.

The supplied CO_2 being stored inside concrete in the carbonation curing chamber
(The carbonation curing chamber, which inflated during the CO_2 supply, deflated over time, indicating that the CO_2 had been absorbed by the concrete.)

【Further Development】

The companies continue their successful collaboration and upgrade the integrated system, ensuring that the CO_2 captured by the DAC equipment aligns with the needs for CO_2-SUICOM production at precast concrete plants. This initiative aims to foster a sustainable, localized supply chain that minimizes reliance on external factors.

Further research and development will be conducted to make a substantial impact towards achieving a carbon-neutral society.

(References)

CO_2-SUICOM KAJIMA CONCRETE BASE
https://www.kajima.co.jp/english/tech/c_sus_con/technology01/index.html

Information on Various Carbon reduction technologies being developed by Kajima Corporation
https://www.kajima.co.jp/tech/c_movies/others.html

Regarding Kawasaki's Direct Air Capture Equipment
https://global.kawasaki.com/en/energy/equipment/co2sr/index.html

Kawasaki and Kajima Participate in Joint Research into Absorbing CO_2 from the Air and Trapping It in Concrete
https://global.kawasaki.com/en/corp/newsroom/news/detail/?f=20240726_5592