

The Soil Cement with added Biochar "SUSMICS-S"



Enhancing Quality and Achieving Decarbonization with Biochar

SUSMICS-S : **S**ustainable + **SMI** ("Charcoal" in Japanese) + **C**arbon **S**torage - **S**oil cement

Summary

By adding biochar to soil cement, bleeding water is reduced, and quality is improved. It also stores biomass-derived carbon in the ground, contributing to carbon neutrality in ground improvement.

Slurry-type cement-treated soils, such as soil cement, are produced by mixing construction generated soil or in situ soil with water and cement-based stabilizers. These materials face two primary challenges:

- Quality assurance issue: The high water-cement ratio leads to bleeding during the curing of slurry-type cement-treated soils.
- Environmental impact issue: The cement-based stabilizers emit a significant amount of CO₂ during production and transportation.

SUSMICS-S, a newly developed geomaterial, addresses these challenges by simultaneously improving quality and achieving decarbonization.

Benefits of Using Biochar

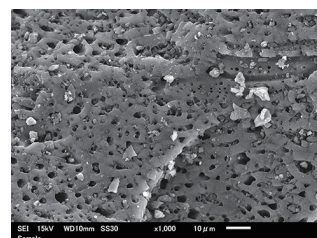
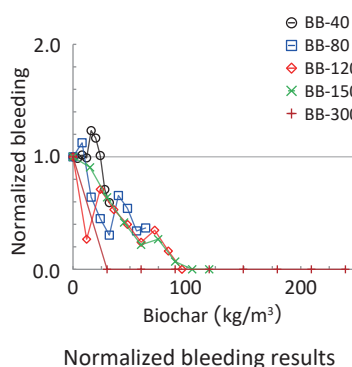
Enhanced Water Absorption Improves Quality Over Time

The biochar used in SUSMICS-S is characterized by its porous particle structure. Turning it into a powdered state ensures excellent water absorption, and this effect becomes increasingly pronounced over time. During curing, it can suppress bleeding by absorbing excess water within the soil cement.

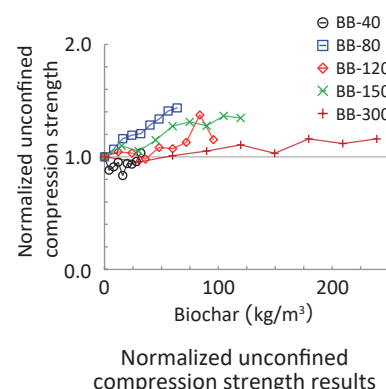
Ground Carbon Storage Aids Carbon Neutrality

The biochar used in SUSMICS-S fixed carbon (air-dried state) is approximately 90%. Using biochar as an admixture stores carbon equivalent to the CO₂ emissions from producing and transporting cement-based stabilizers in the ground, contributing to carbon neutrality.

Laboratory tests were carried out with varying biochar contents to evaluate the physical properties immediately after mixing and the mechanical properties after curing for 28 days. The soil cement base material was a sandy soil consisting of silica sand and clay in a ratio of 4:1. Blast-furnace cement Type B (symbol: BB) complying with the Japanese Industrial Standards was used as the stabilizer. Five levels of stabilizer addition (40 to 300 kg/m³) were compared. The bleeding tended to decrease with the amount of biochar added, improving soil cement segregation resistance. Overall the positive effect of adding biochar was confirmed, except when the amount of stabilizer was 40 kg/m³.



Microstructure image of biochar by SEM



Achieving Carbon Negativity On-Site

SUSMICS-S was used in backfilling part of the periphery of a newly constructed building in Japan. The amount of biochar added was set at 40 kg/m³.

No Impact on Manufacturing and Workability

This material can be produced by simply mixing powdered biochar into conventional soil cement using standard manufacturing equipment. Its fluidity is maintained during casting, allowing for conventional construction methods.

8.15 Tons of CO₂-Equivalent Carbon Stored in the Ground

As a result of adding biochar, the amount of carbon stored in the ground was 8.15 tons in CO₂ equivalent. This is equivalent to 181% of the CO₂ emissions from the stabilizer, therefore achieving carbon negativity compared to conventional soil cement construction.

