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Revolutionizing 3D printing with brine valorization

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A B S T R A C T

NEOM, a new development in Saudi Arabia, will rely on desalination to provide potable water to its inhabitants. However, desalination produces brine, which can harm the environment if not properly managed. Discharging brine directly into oceans or other bodies of water can damage marine life and ecosystems, while improper disposal on land can contaminate groundwater. To address these concerns and support NEOM's zero-liquid discharge (ZLD) requirements, this project proposes reusing brine in 3D printable concrete (3DPC). The innovative approach uses NEOM brine as a concrete accelerator, mixed with water to create a printing system involving two pumpable composites: one with Portland cement and the other with brine. The resulting product has compressive strength suitable for use as a construction material and can be employed to build structures and art installations. Additionally, this approach provides an environmentally sustainable solution for managing brine while producing a valuable structural material. 3DPC with reused brine has the potential to revolutionise the desalination and construction industries. It can reduce cement consumption, minimise waste, lower CO₂ emissions, and promote sustainability. Overall, this project offers an innovative solution for managing brine and contributing to a more sustainable future.

Keywords: Seawater; Brine recovery; Concrete 3D printing; Sustainable development goals; Circular economy

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