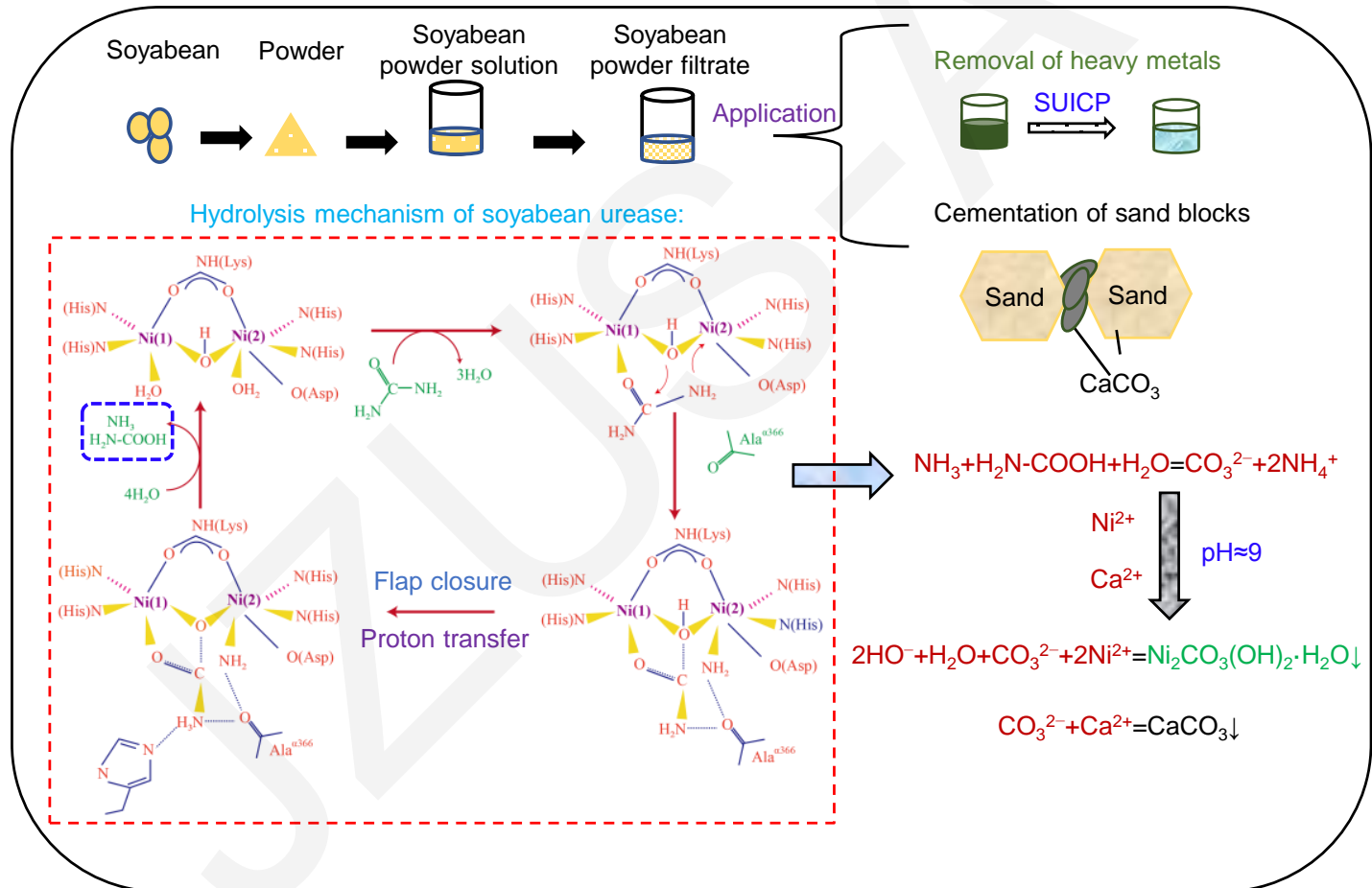


Biotreatment of incinerated bottom ash and biocementation of sand blocks using soybean urease

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Cite this as: Xiaoniu YU, Yidong XU, 2024. Biotreatment of incinerated bottom ash and biocementation of sand blocks using soybean urease. *Journal of Zhejiang University-SCIENCE A (Applied Physics & Engineering)*, 25(1):36-46. <https://doi.org/10.1631/jzus.A2300006>

Potential applications and formation mechanism of soybean-urease-based biocement



■ IBA biotreatment and Sand-block biocementation

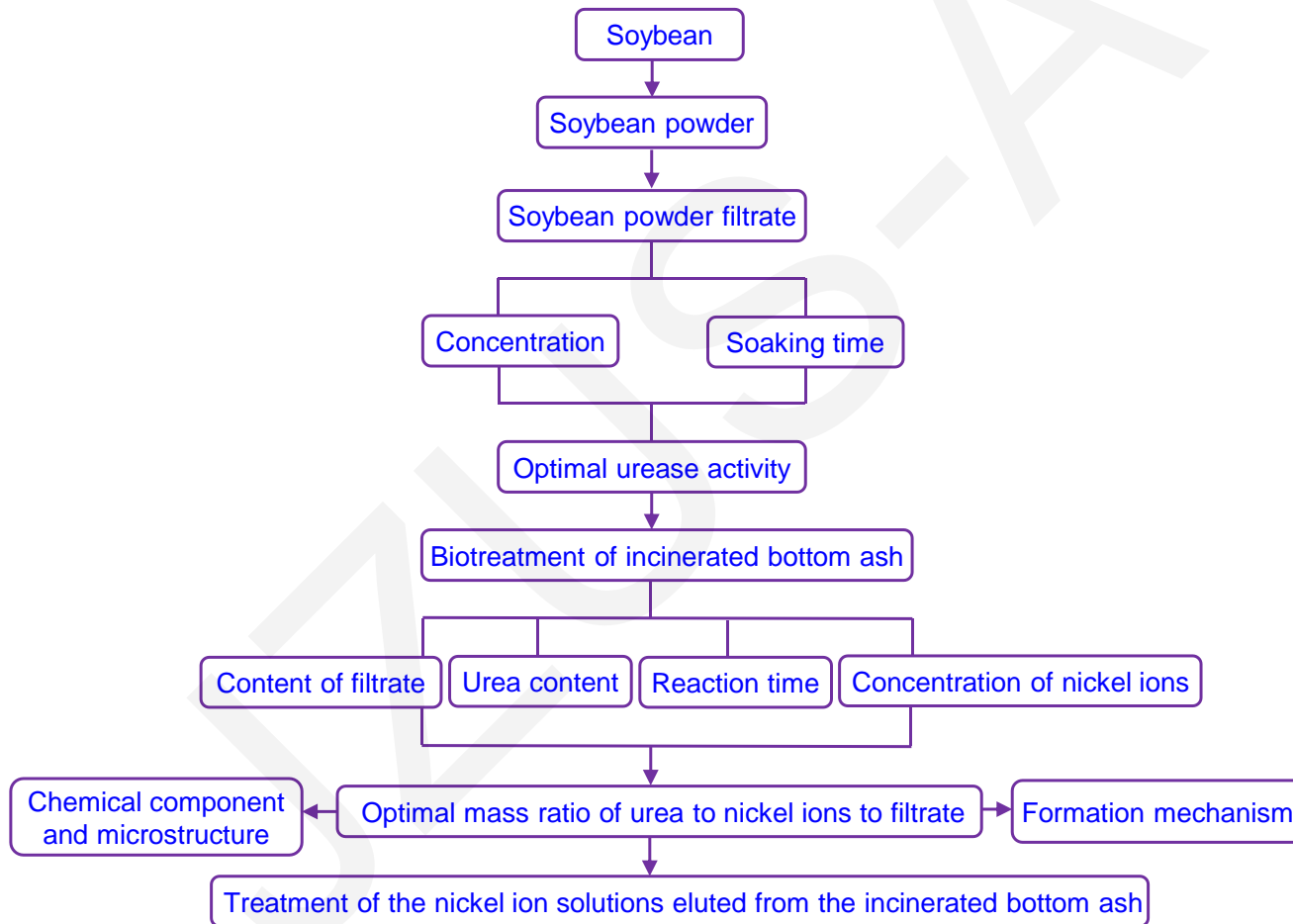


Fig. 1 IBA biotreatment flowchart

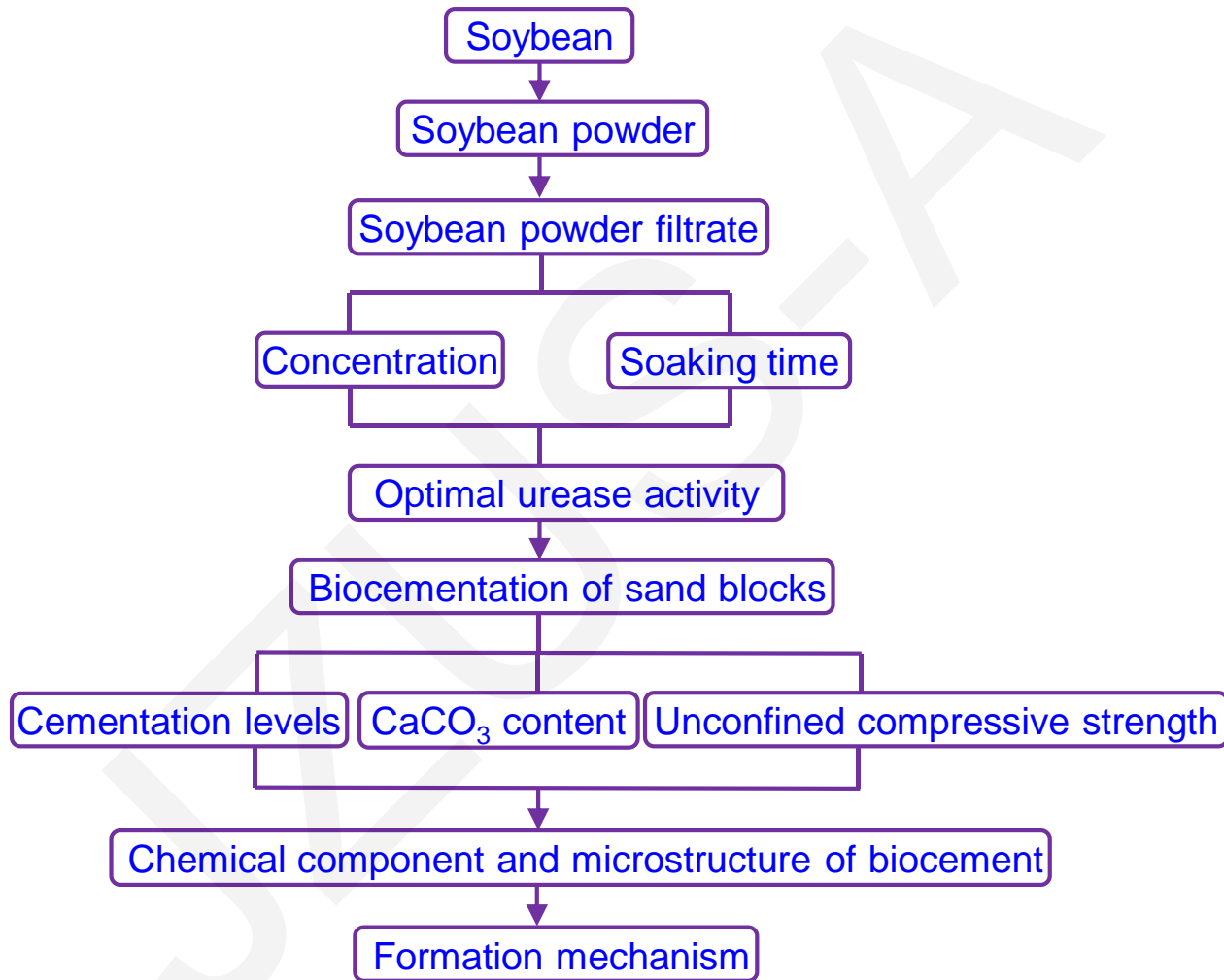


Fig. 2 Sand-block biocementation flowchart

■ Microstructures of bio-carbonate minerals

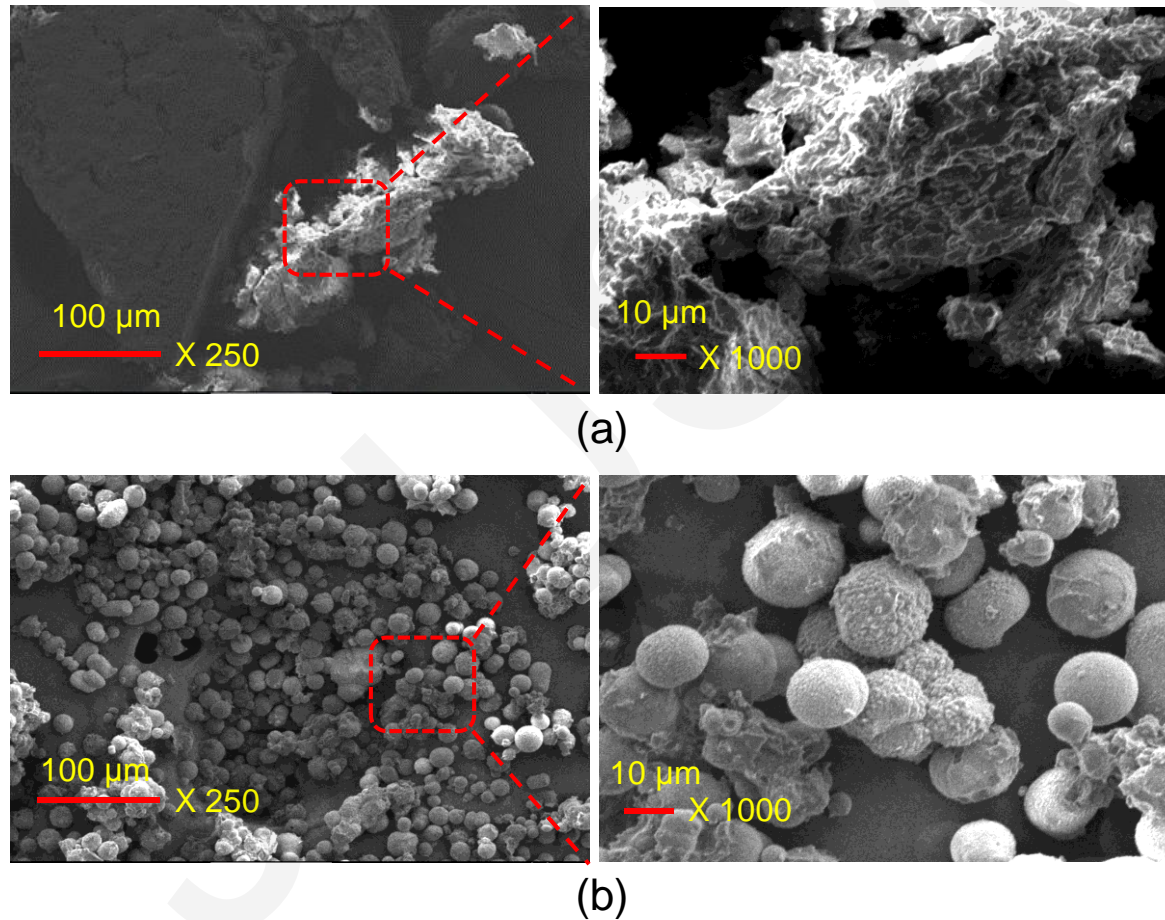


Fig. 3 FESEM images of nickel hydroxide carbonate (a) and calcite (b) precipitated by the SUICP process

■ Treatment of nickel-ion solutions eluted from the IBA

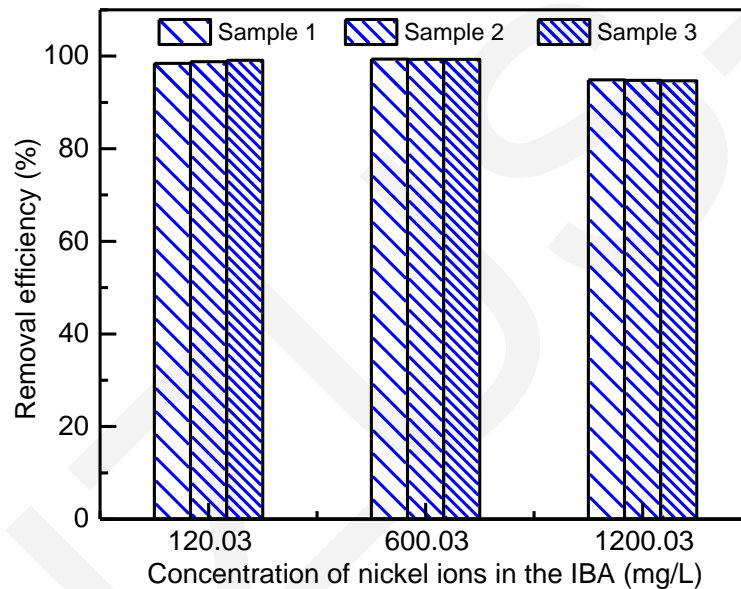
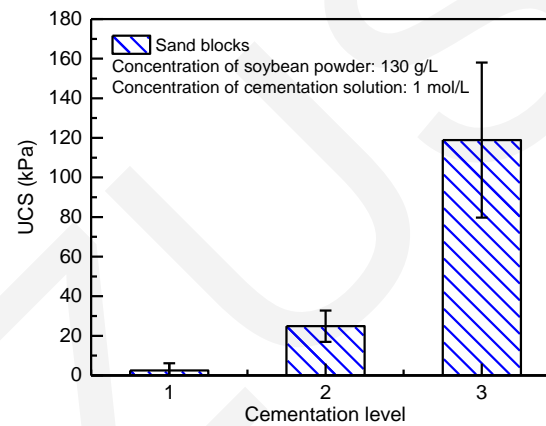


Fig. 4 Removal efficiency of different levels of nickel-ion content from IBA

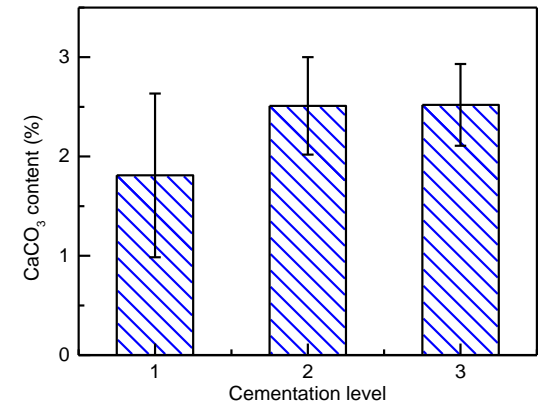
■ Biocementing sand blocks using SUICP



(a)



(b)



(c)

Fig. 5 Cementation state (a), UCS (b), and CaCO₃ content (c) of biocemented sand blocks

Conclusions

- Soybean-urease-based biocements such as those produced by SUICP process can repair cracks in cement-based materials and rock. Unlike UPB, soybeans do not require professional cultivation, which can save costs. It also has broad application prospects for biocementation of sandy soil and biotreatment of heavy metals: 1. Soybean urease extraction was successfully achieved through a water soaking method. 2. The ideal soaking duration and soybean powder concentration were established. 3. An optimal formulation for removing nickel ions was determined. 4. The SUICP process effectively eliminated nickel ions from both solution and solid waste. 5. Comprehensive discussions on the mechanism and process of nickel ion removal by SUICP, including its application to cemented sands, were undertaken.



I do not know what I may appear to the world, but to myself I seem to have been only like a boy playing on the seashore, and diverting myself in now and then finding a smoother pebble or a prettier shell than ordinary, while the great ocean of truth lay all undiscovered before me.