

Cite this as: Haoliang WU, Heng SONG, Xinpo SUN, Yuzhang BI, Shenjing FU, Ning YANG, 2023. Geo-environmental properties and microstructural characteristics of sustainable limestone calcined clay cement (LC3) binder treated Zn-contaminated soils. *Journal of Zhejiang University-SCIENCE A (Applied Physics & Engineering)*, 24(10):898-911. <https://doi.org/10.1631/jzus.A2200531>

## **Geo-environmental properties and microstructural characteristics of sustainable limestone calcined clay cement (LC3) binder treated Zn-contaminated soils**

### **Key words:**

Limestone calcined clay cement; stabilization/solidification; zinc-contaminated soil; microstructural characteristics

# Preparation of LC3 S/S Zn-contaminated soil samples

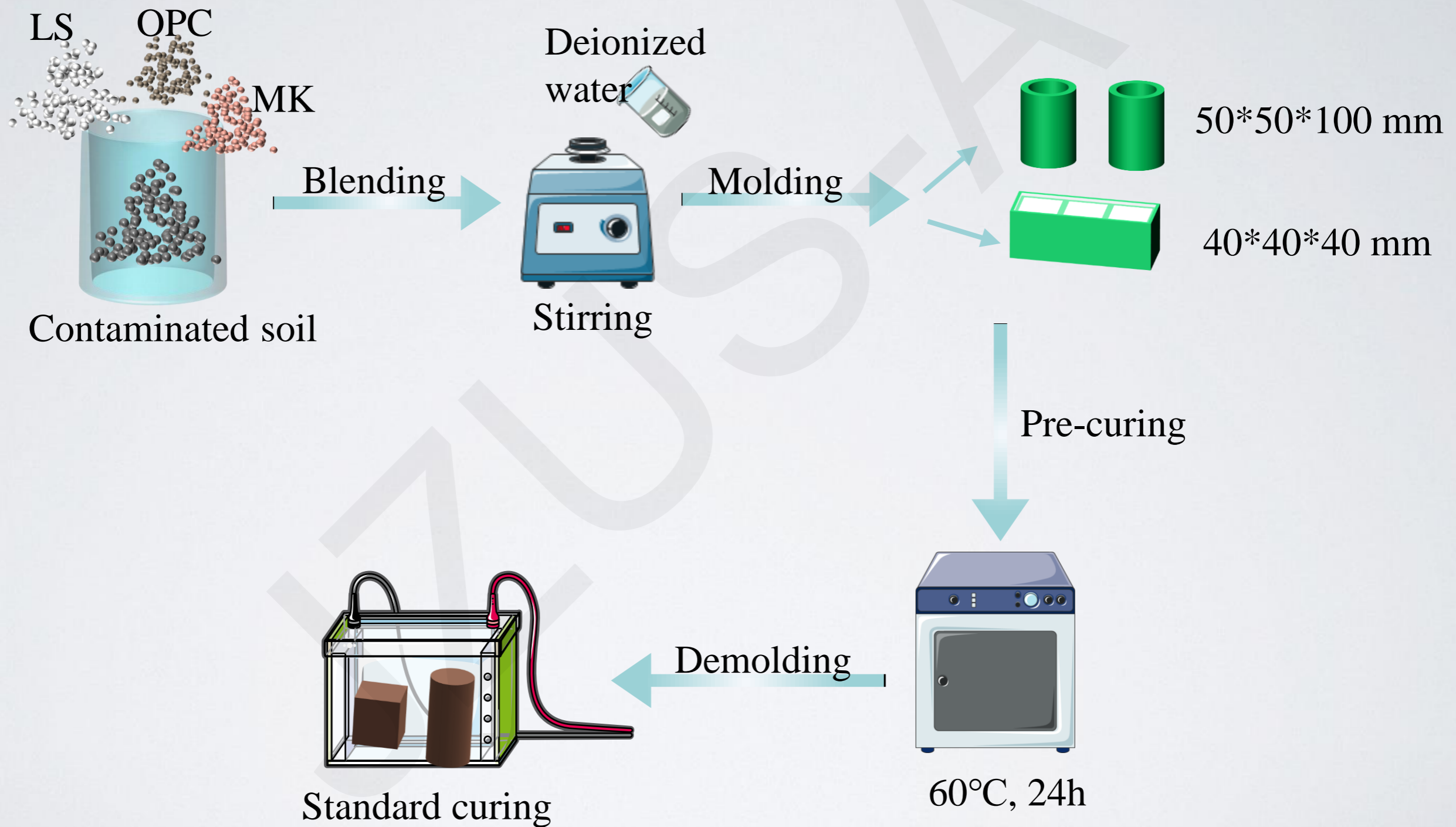


Fig. 1 Schematic illustration for the preparation of LC3 S/S Zn-contaminated soil samples

# LC3 S/S Zn-contaminated soil with acceptable hydraulic conductivity and strength

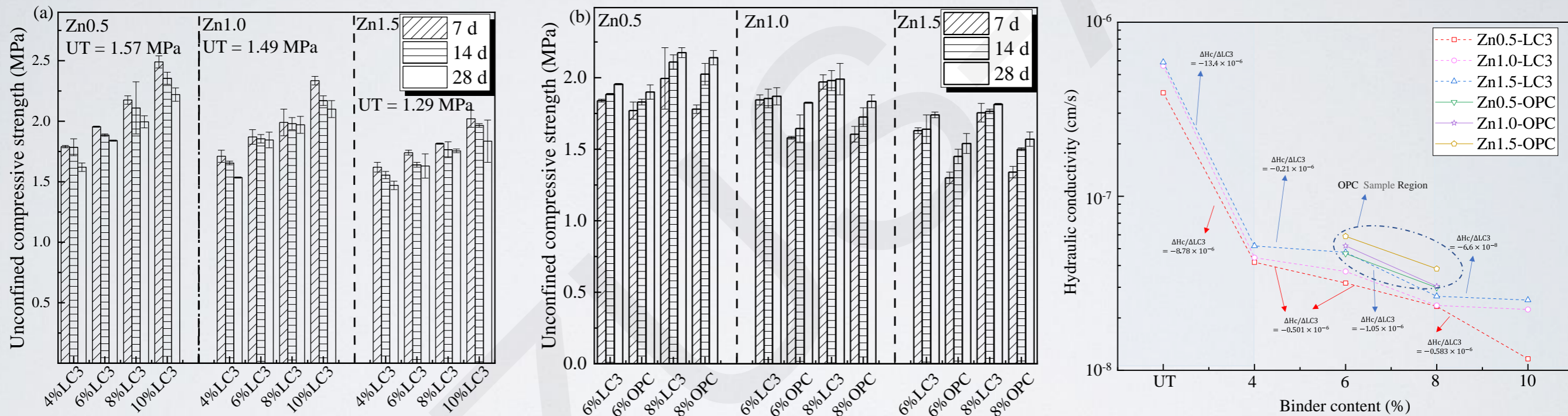


Fig. 2 Variation of UCS at different Zn concentrations and curing ages (a) LC3 content (b) LC3 vs. OPC

# LC3 S/S Zn-contaminated soil with lower leaching concentration

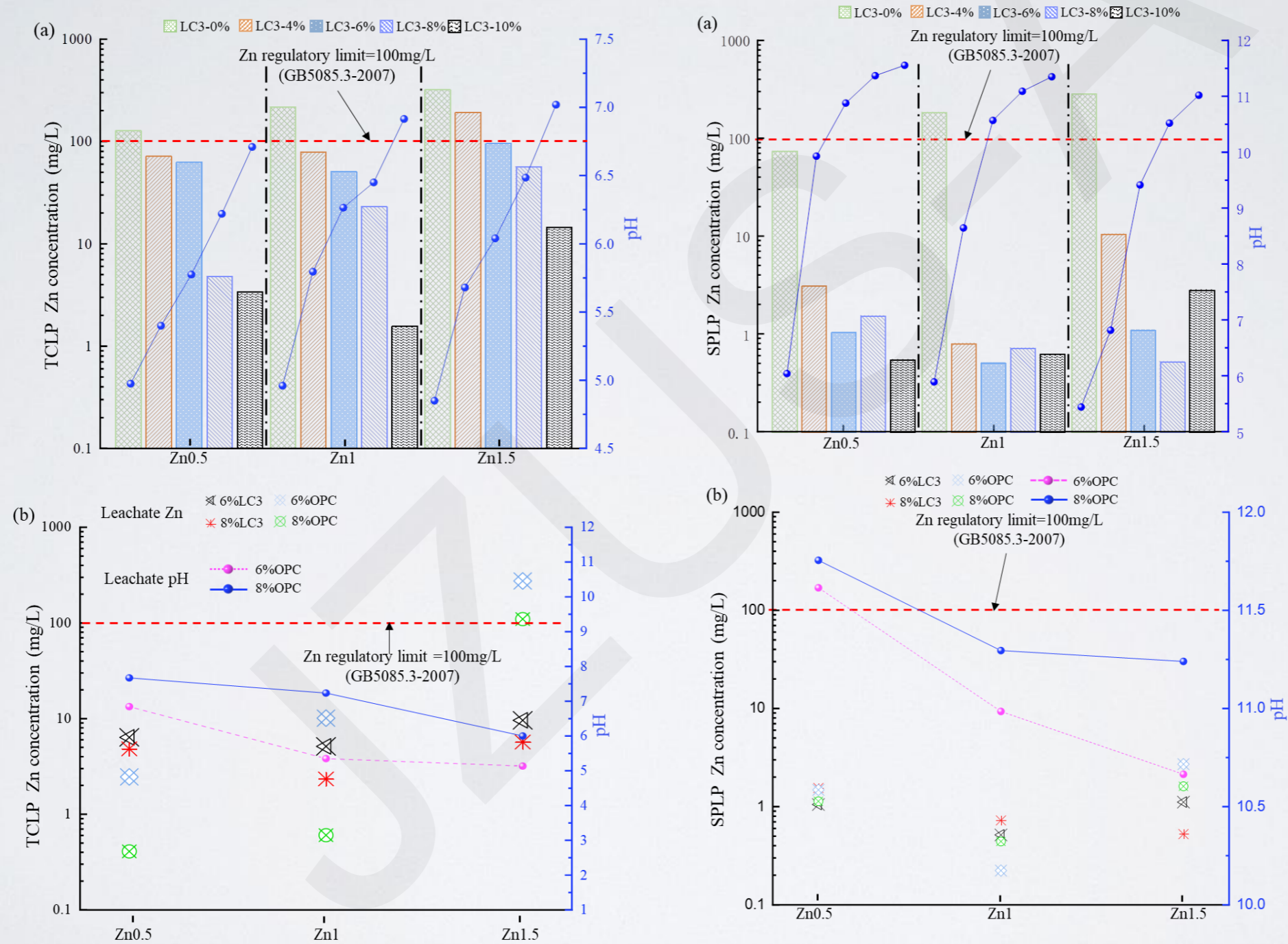


Fig. 3 Measurement of TCLP and SPLP leachate concentration

# Micro- analysis of LC3 S/S Zn-contaminated soil

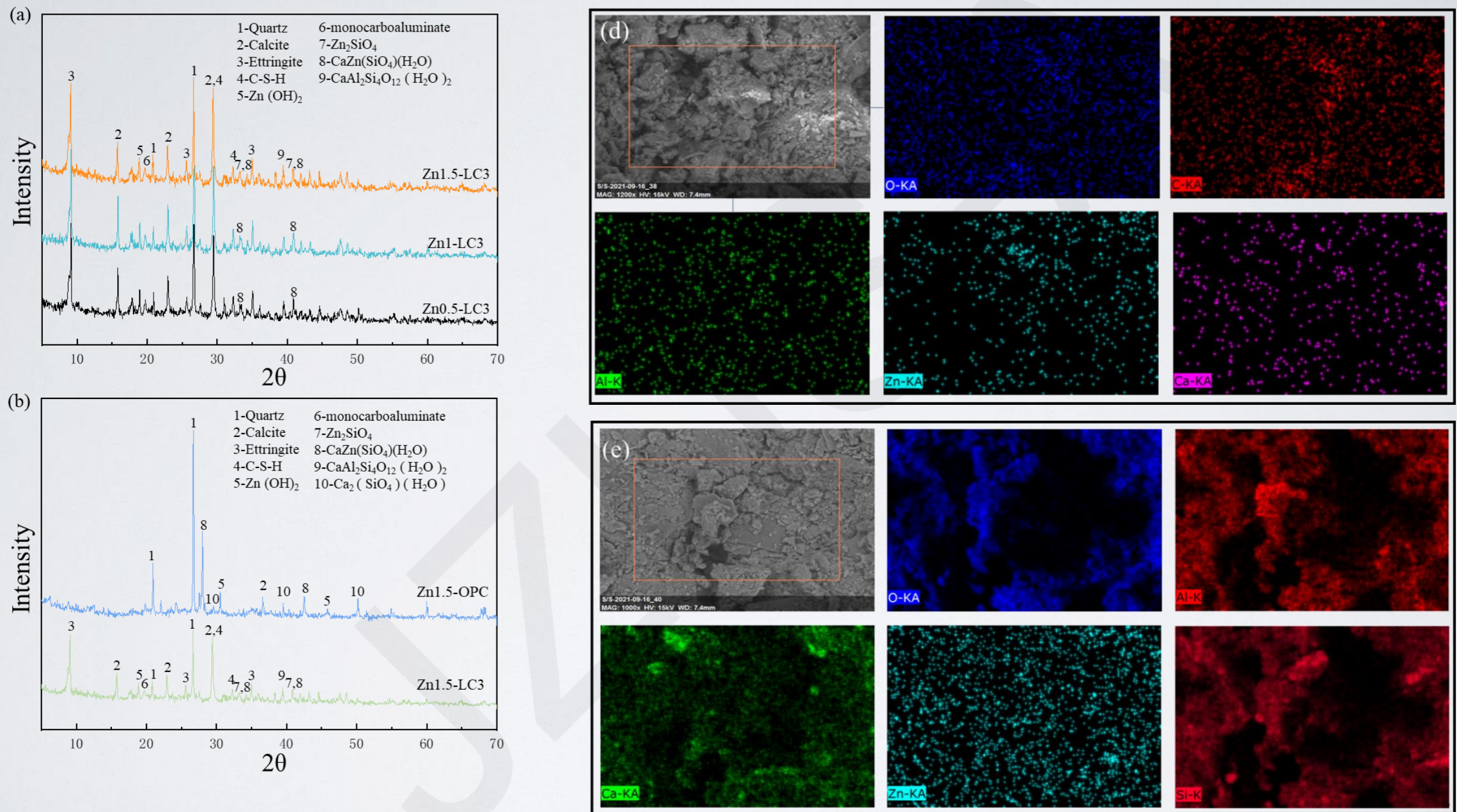


Fig. 4 XRD and SEM image with elemental mapping of 28d cured soil

# Solidification mechanism of LC3 S/S Zn-contaminated soil

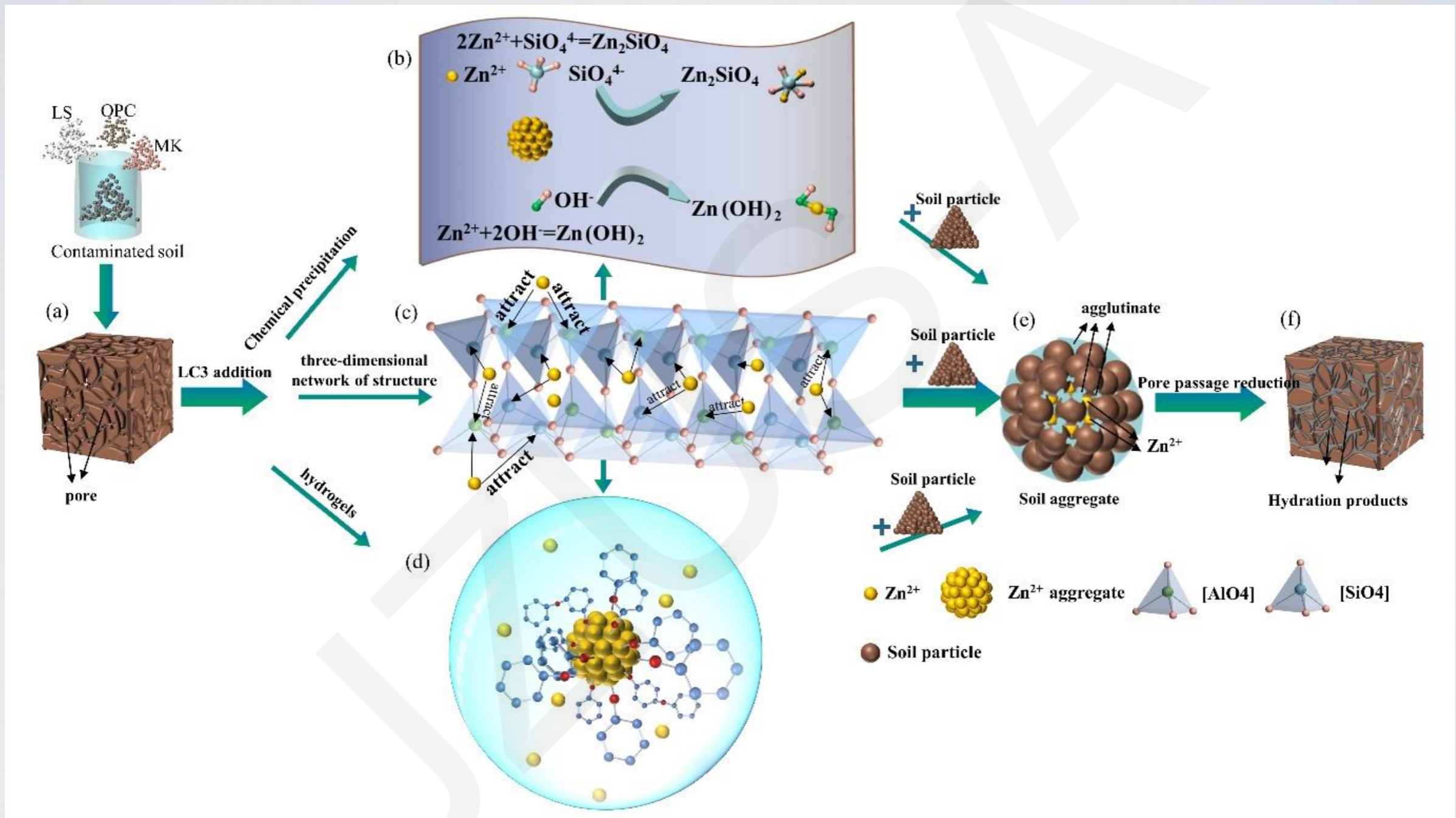


Fig. 5 S/S mechanism diagram: (a) contaminated soil; (b) chemical precipitation; (c) 3D network structure of charge balance in Si-Al System; (d) hydrogels; (e) soil aggregate; (f) treated soils

# Research Priorities and limitations

## Research Priorities:

- This research ascertained the feasibility of de-veloping an effective LC3 binder to replace the OPC in treating Zn-contaminated soils and investigated its engineering properties and immobilization po-tential. The UCS and  $k$  of the LC3 treated Zn-contaminated soils increase and decrease with the increase of curing time and binder content, re-spectively. A negative correlation between UCS and  $k$  of LC3 and OPC-solidified contaminated soils is observed as the binder content and Zn concentration.

Admittedly, further research should consider scenar-io-contaminated soils as compared to an artificially contaminated ones. Further, the X-ray Photoelectron Spectroscopy (XPS) test and oxidation reduction potential (ORP) value should also be conducted in future investigations