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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

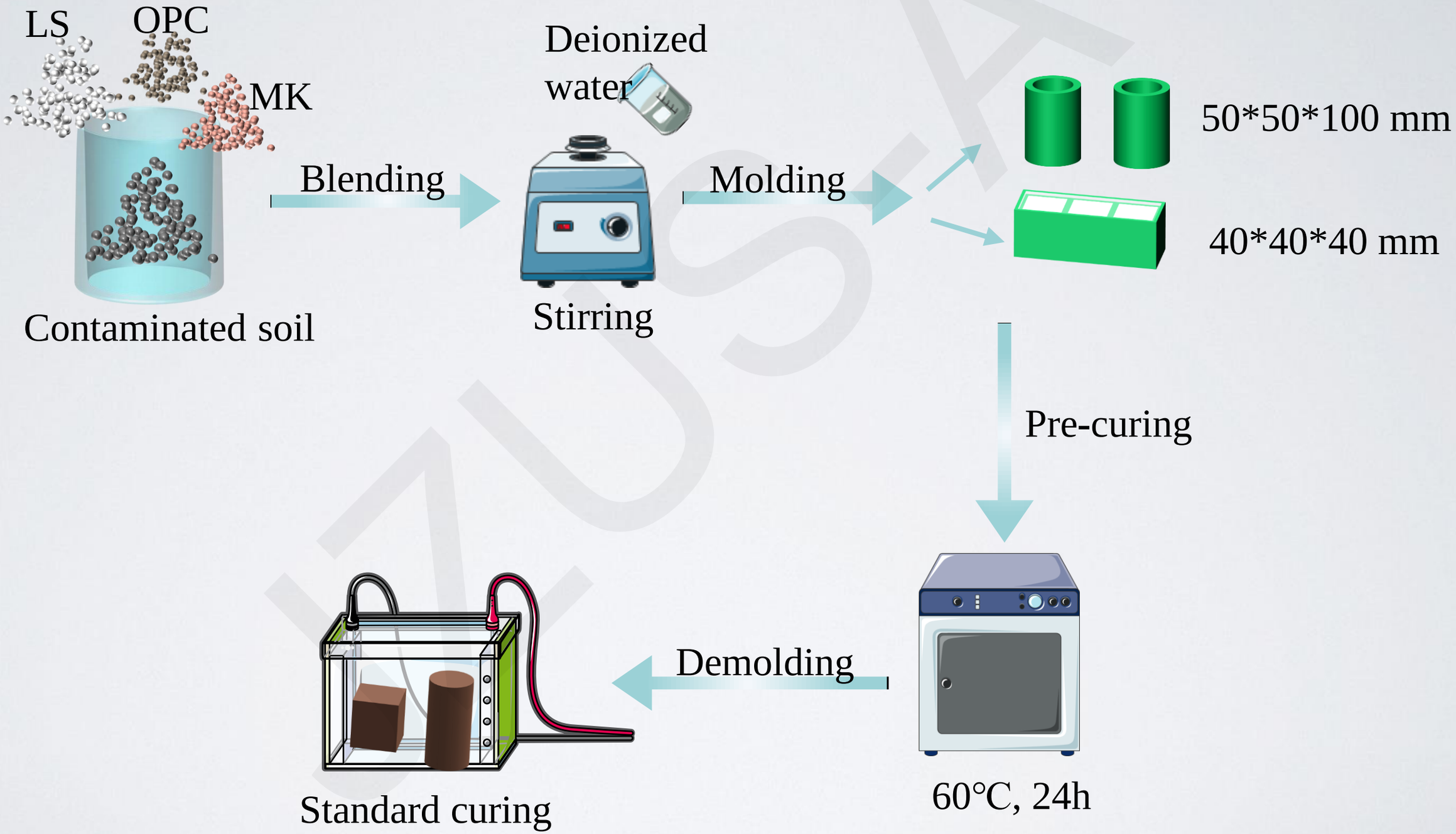
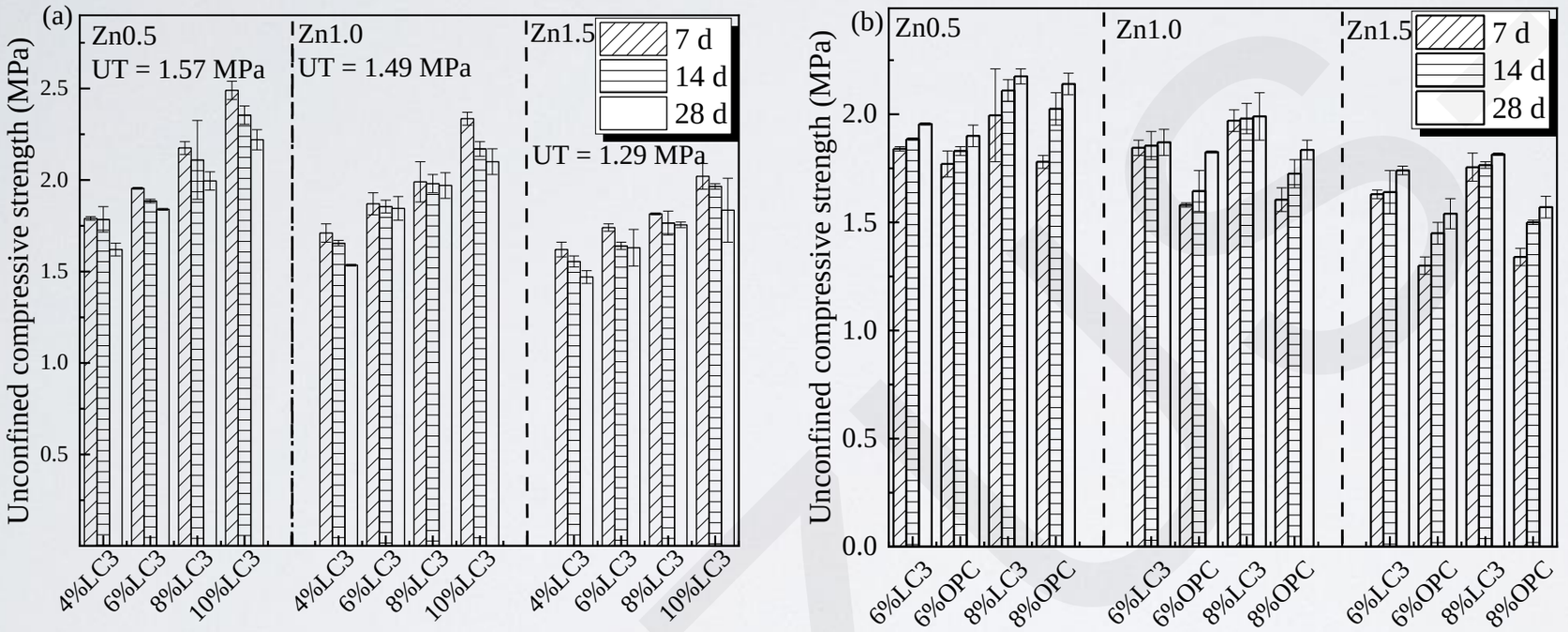


Fig. 1 Schematic illustration for the preparation of LC3 S/S Zn-contaminated soil samples

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



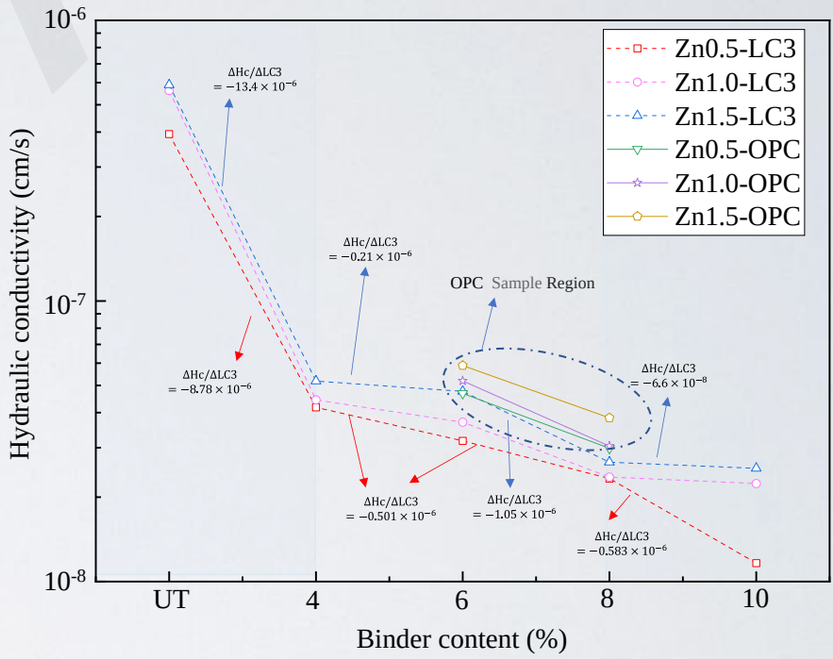


Fig. 2 Variation of UCS at different Zn concentrations and cur-ing ages (a) LC3 content (b) LC3 vs. OPC

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

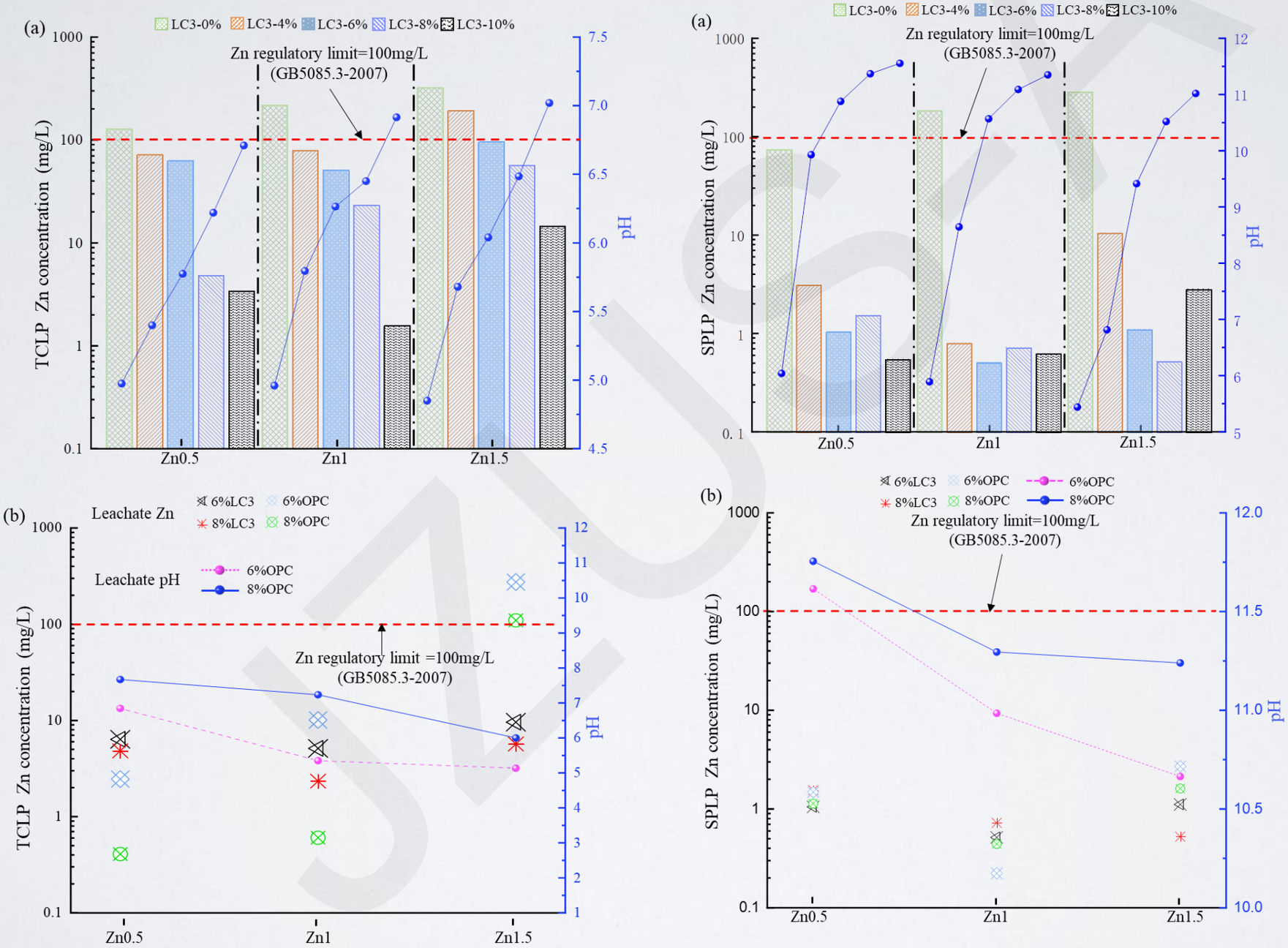
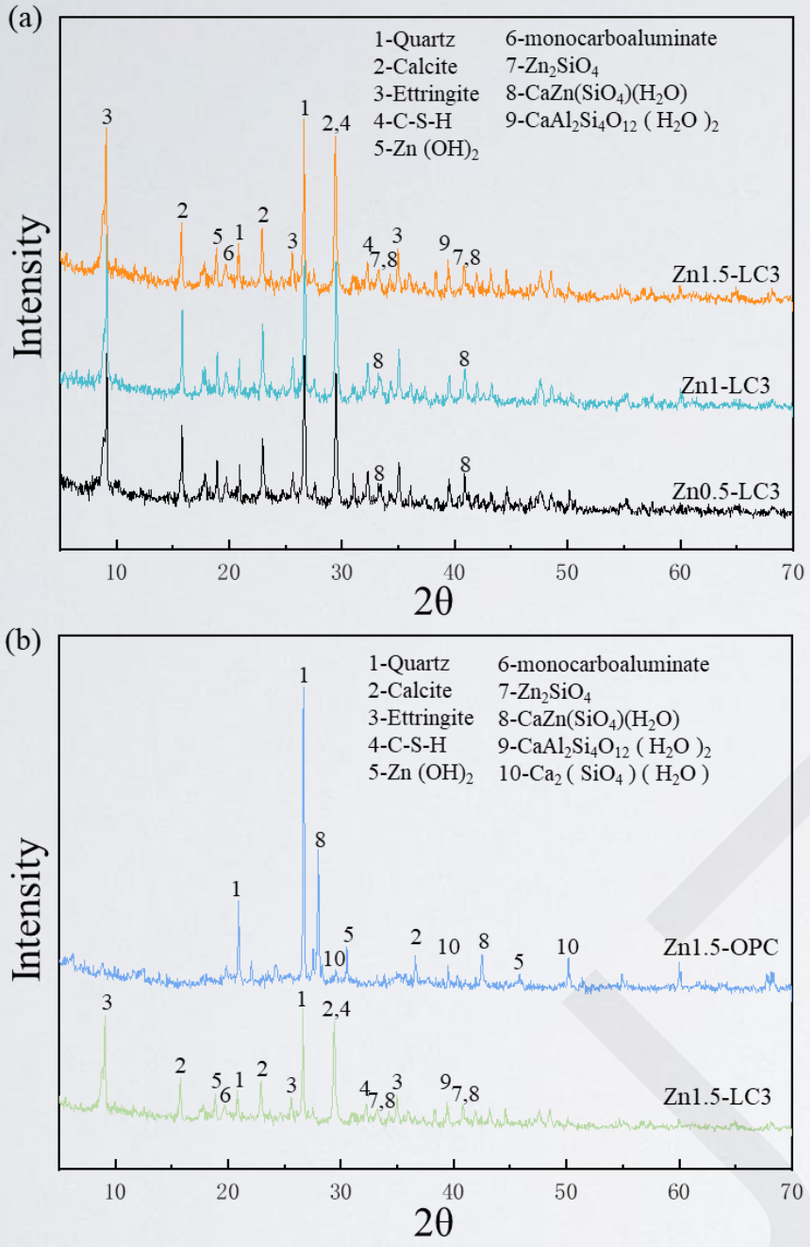
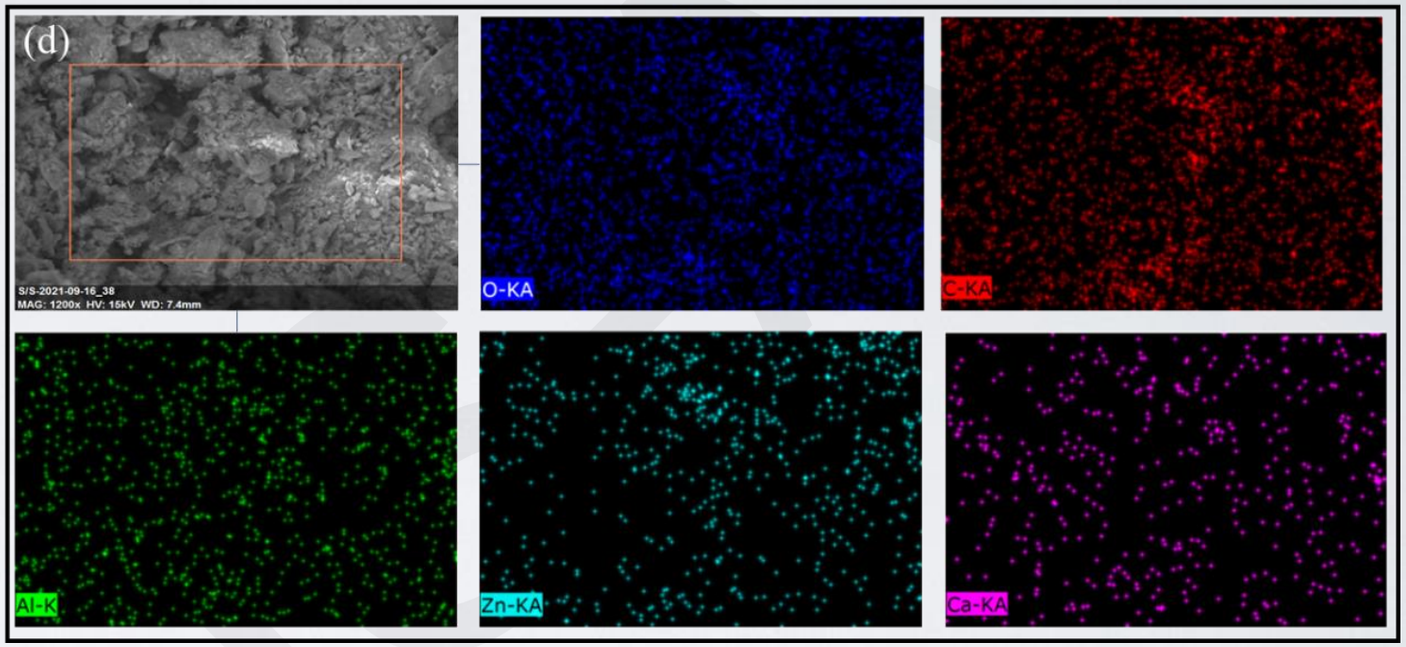


Fig. 3 Measurement of TCLP and SPLP leachate concentration

Micro- anaylsis of LC3 S/S Zn-contaminated soil





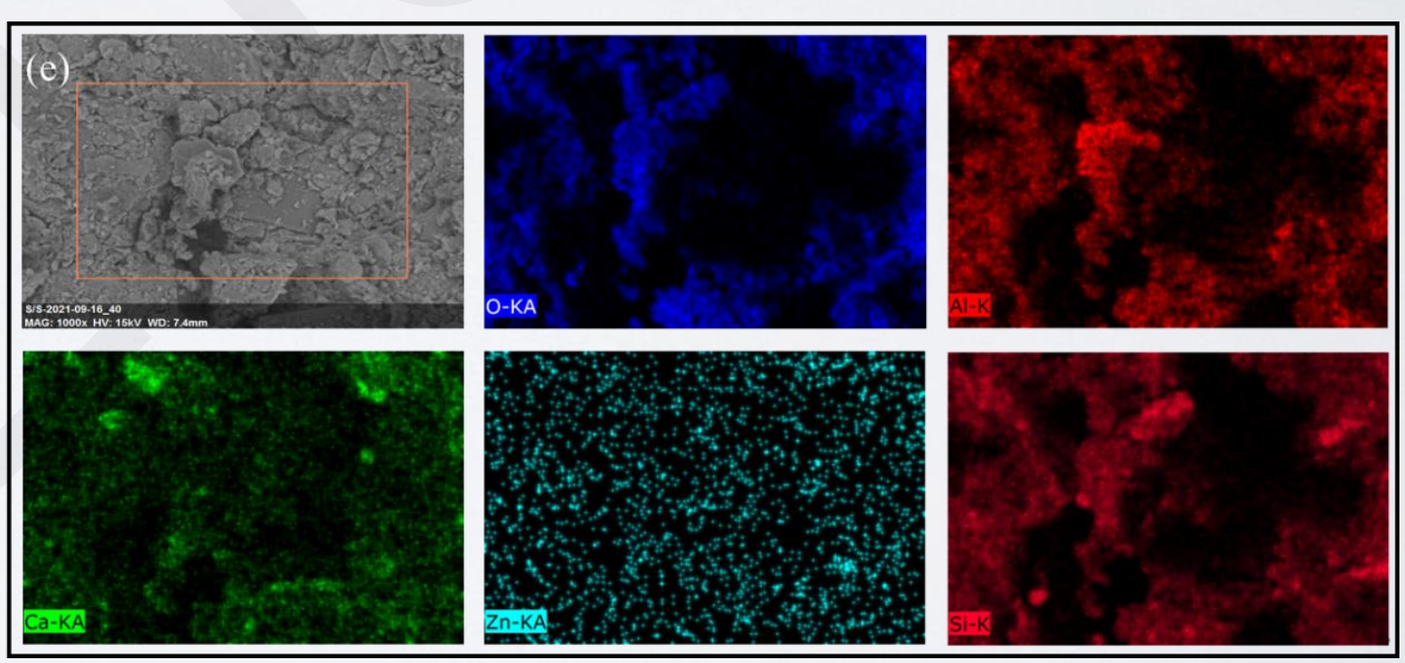


Fig. 4 XRD and SEM image with elemental mapping of 28d cured soil

Solidification mechanism of LC3 S/S Zn-contaminated soil

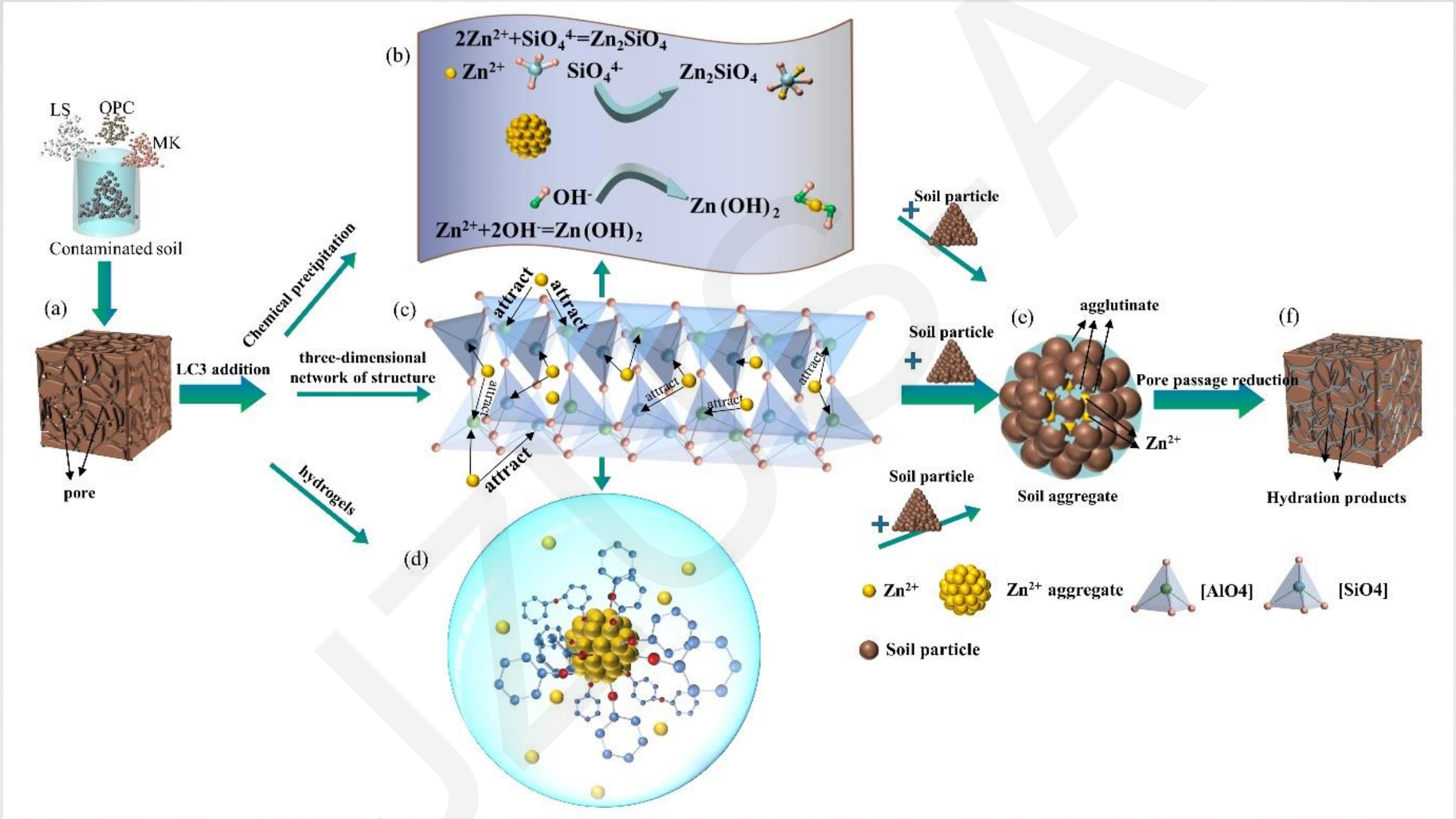


Fig. 5 S/S mechanism diagram: (a) contaminated soil; (b) chemical precipitation;(c) 3D network structure of charge balance in Si-Al System; (d) hydrogels; (e) soil aggregate; (f) treated soils

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