Sustainable Remediation of Sulfate-Chloride Contaminated Soils Through Fungal Biogeochemical Processes

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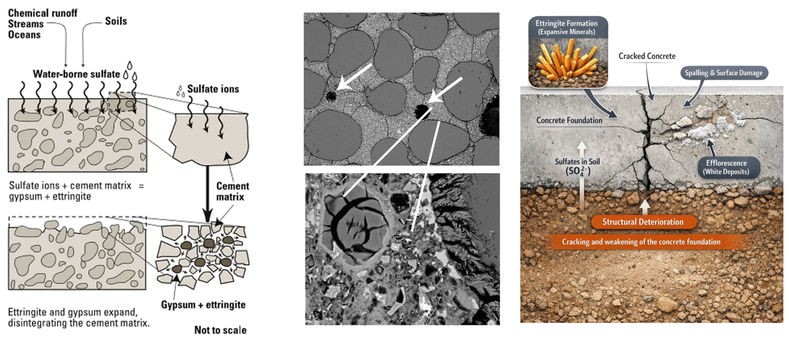
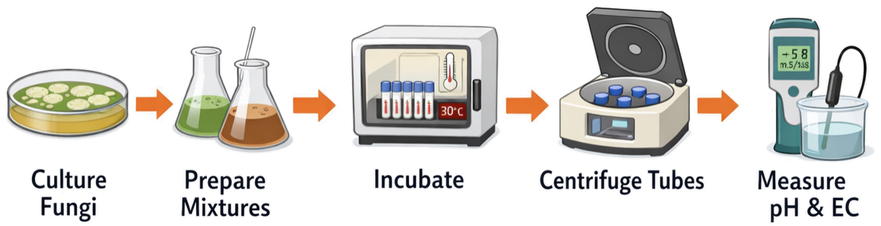
INTRODUCTION

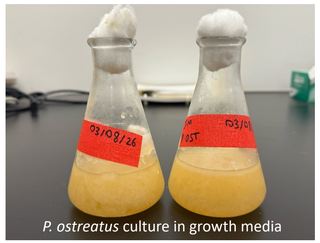


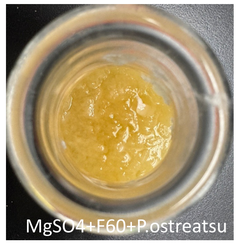
Mechanisms of sulfate-induced damage 'sulfate-attack'[1,2]

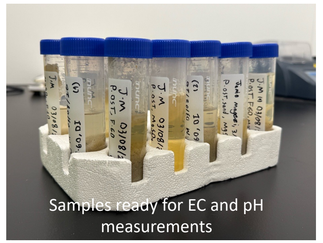
- Sulfate-rich soils weaken and damage subsurface infrastructure.
- Conventional treatments are costly, carbon-intensive, logistically challenging.
- Alternative, cost-effective, eco-friendly solutions are needed.
- A Fungal-based approach is explored to mitigate sulfate impacts and improve soil performance.

METHODS




P. ostreatus culture in growth media


MgSO4+F60+P.ostreatsu


Samples ready for EC and pH measurements

Fungal Culture Preparation

- Strain: *Pleurotus ostreatus*
- Growth medium: Potato Dextrose Broth
- Cultured at 25.0°C, 150 rpm for 7 days

Soil–Sulfate Treatment Setup

- 8000 ppm $MgSO_4$ solution prepared and mixed withF60 sand, and fungal mycelium biomass.
- Samples:
  - *F60 only, MgSO4 only*
  - *MgSo4 + F60*
  - *P. ostreatus + F60*
  - *P. ostreatus + MgSO4*
- Samples incubated at 25.0±1°C for 4 days, then refrigerated for 3 days.

Test Methods

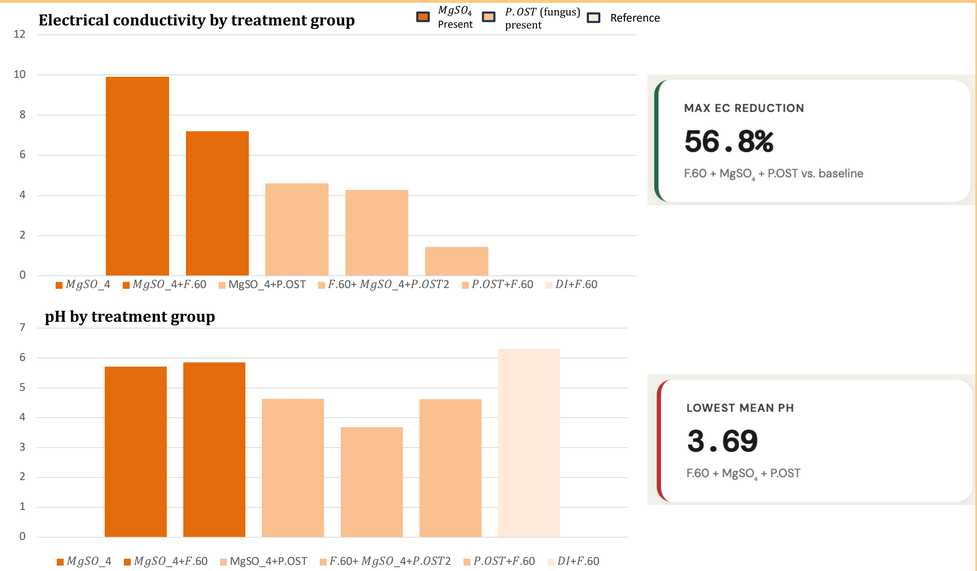
- Electrical conductivity (EC) and pH measured to assess treatment effects.

RESULTS

Group means

EC and pH measured after 41 hours
P.OST = Pleurotus ostreatus | F.60 = fine sand

Treatment Group	n	Mean EC (mS/CM)	SD EC	Mean PH	SD PH
$MgSO_4$	1	9.900	-	5.710	-
$MgSO_4 + P.OST$	2	4.590	0.212	4.625	0.233
$F.60 + MgSO_4 + P.OST$	2	4.275	1.492	3.685	0.474
$MgSO_4 + F.60$	2	7.190	0.113	5.850	0.141
$P.OST + F.60$	2	1.431	0.013	4.620	0.042
$DI + F.60$	2	0.058	0.0015	6.290	0.099



MAX EC REDUCTION
56.8%
F.60 + $MgSO_4$ + P.OST vs. baseline

LOWEST MEAN PH
3.69
F.60 + $MgSO_4$ + P.OST

CONCLUSION

- *Pleurotus ostreatus* substantially reduced EC => reduced ionic availability.
- Fungal treatments lowered pH; with strongest acidification in the F60 + $MgSO_4$ + *P. ostreatus* group.
- Results suggest fungal activity has potential for sustainable sulfate remediation.

Future Work

- Evaluate long-term stability of fungal sulfate mitigation.
- Determine the mechanisms involved
- Quantify changes in sulfate speciation and mineral formation.
- Assess impacts on soil strength and hydraulic behavior.

Reference:

1,2: Credit: Paul Stuttzman, National Institute of Standards and Technology, USA.

FURI

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