# *Supplementary Material*

# Fungal community remediate quartz tailings soil under plant combined with urban sludge treatments

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## 1 Supplementary Data

### 1.1 Supplementary Table

**Table S1 Effect of plant and plant combined with urban sludge treatments on plant biomass**

| Plant species combination | Treatments | Dry weight of overground (g) | Dry weight of underground(g) | Total dry weight(g) | Overground length（cm） | Underground length(cm) | Total length(cm) |
|---|---|---|---|---|---|---|---|
| Y | KY | 0.03273±0.00376d | 0.0085±0.00116a | 0.04123±0.00427c | 21.25±1.22878d | 5.54667±0.58504ab | 26.79667±1.29137c |
| | WY | 0.0717±0.00589ab | 0.00547±0.000680995bc | 0.07717±0.00614a | 29.99333±1.51719a | 5.03333±0.4178ab | 35.02667±1.65331a |
| | KYH | 0.03267±0.00437d | 0.00593±0.000635959bc | 0.0386±0.00469c | 22.21333±1.35428cd | 6.2±0.34282a | 28.41333±1.38927bc |
| | WYH | 0.07293±0.00561ab | 0.0064±0.000888015ab | 0.07933±0.00575a | 27.38±1.16407ab | 5.67333±0.45539ab | 33.05333±1.25177ab |
| | KYZ | 0.04607±0.00724cd | 0.003±0.00039036cd | 0.04907±0.00752bc | 22.37333±1.1218cd | 3.30667±0.27106c | 25.68±1.20068c |
| | WYZ | 0.08347±0.00864a | 0.00193±0.000492483d | 0.0854±0.00873a | 31.69333±2.21775a | 4.72±0.42731abc | 36.41333±2.41936a |
| | KYHZ | 0.0606±0.00877bc | 0.0047±0.00148bcd | 0.0653±0.00863ab | 24.82±2.0923bcd | 4.02±0.43609bc | 28.84±2.2115bc |
| | WYHZ | 0.0841±0.0121ab | 0.0035±0.000909823bcd | 0.0876±0.01238a | 26.55±2.14643abc | 3.19±0.62795c | 29.74±2.30445bc |
| H | KH | 0.05977±0.00743d | 0.05687±0.01059c | 0.11663±0.01647d | 26.01±0.82892c | 17.82667±0.99892bc | 43.83667±1.52363d |
| | WH | 0.38623±0.0249c | 0.22253±0.03456b | 0.60877±0.04902c | 45.93667±1.11132a | 16.44±0.90068c | 62.37667±1.39712b |
| | KHZ | 0.09433±0.0178d | 0.04713±0.01984c | 0.14147±0.03642d | 29.3±1.33606bc | 16.86±1.14359c | 46.16±2.12645cd |
| | WHZ | 0.6±0.07663b | 0.43653±0.07893a | 1.03653±0.11597b | 49.37333±0.89344a | 21.68667±1.40803a | 71.06±1.94213a |
| | KYH | 0.08847±0.01005d | 0.04347±0.00753c | 0.13193±0.01637d | 32.50667±1.30232b | 14.89333±1.57191c | 47.4±2.64213cd |
| | WYH | 0.5188±0.02788b | 0.2358±0.0201b | 0.7546±0.03908c | 48.45333±1.43061a | 18.74±0.92874abc | 67.19333±1.77226ab |
| | KYHZ | 0.1166±0.02d | 0.0675±0.01167c | 0.1841±0.0275d | 33.16±2.65373b | 17.96±2.16673abc | 51.12±3.58589c |
| | WYHZ | 0.7812±0.11788a | 0.5094±0.12271a | 1.2906±0.22005a | 46.76±2.27704a | 21.56±2.01771ab | 68.32±3.68332ab |
| Z | KZ | 0.01407±0.00131c | 0.0037±0.000404429b | 0.01777±0.00141c | 7.06667±0.63823cd | 7.28667±0.45609bc | 14.35333±0.84305c |
| | WZ | 0.10273±0.01681b | 0.01707±0.0037a | 0.1198±0.02025b | 18.06±1.65624b | 10.09667±0.59406b | 28.15667±2.09338b |
| | KHZ | 0.00587±0.00108c | 0.00267±0.000360775b | 0.00853±0.00134c | 4.43333±0.5284cd | 7.14±0.67934bc | 11.57333±0.92667cd |
| | WHZ | 0.01127±0.00242c | 0.00647±0.00141b | 0.01773±0.0037c | 5.97333±0.63692cd | 10.29333±0.79297b | 16.26667±1.22212c |
| | KYZ | 0.00827±0.00229c | 0.00173±0.000462567b | 0.01±0.00258c | 5.11333±0.67343cd | 3.96667±0.41435c | 9.08±0.85719d |
| | WYZ | 0.14147±0.01728a | 0.01487±0.00239a | 0.15633±0.01863a | 26.05333±2.2178a | 10.04667±0.55932b | 36.1±2.17573a |
| | KYHZ | 0.0059±0.000737111c | 0.0036±0.000686375b | 0.0095±0.00117c | 3.38±0.23702d | 7.13±0.51641bc | 10.51±0.52035cd |
| | WYHZ | 0.0276±0.00646c | 0.0099±0.00218ab | 0.0375±0.00837c | 8.44±1.51879c | 17.01±5.93971a | 25.45±5.85524b |
| YH | KYH | 0.06057±0.00747b | 0.0247±0.00509b | 0.08527±0.01204b | 27.36±1.32872b | 10.54667±1.12973a | 37.90667±2.29317b |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | WYH | 0.29587±0.04369a | 0.1211±0.02348a | 0.41697±0.06563a | 37.91667±2.15625a | 12.20667±1.31535a | 50.12333±3.34427a |
| YZ | KYZ | 0.02717±0.00512b | 0.00237±0.000319782b | 0.02953±0.00533b | 13.74333±1.72667b | 3.63667±0.25086b | 17.38±1.70319b |
| | WYZ | 0.11247±0.01091a | 0.0084±0.0017a | 0.12087±0.01206a | 28.87333±1.62748a | 7.38333±0.60348a | 36.25667±1.59886a |
| HZ | KHZ | 0.05557±0.00809b | 0.02508±0.00621b | 0.08065±0.01352b | 18.66±1.76414b | 10.85167±0.87234b | 29.51167±2.37812b |
| | WHZ | 0.30563±0.06638a | 0.2215±0.05567a | 0.52713±0.11044a | 27.67333±4.06549a | 15.99±1.32264a | 43.66333±5.21085a |
| YHZ | KYHZ | 0.06103±0.01095b | 0.02527±0.00672b | 0.0863±0.0164b | 20.45333±2.57153a | 9.70333±1.32812a | 30.15667±3.37225b |
| | WYHZ | 0.29763±0.07421a | 0.17427±0.05912a | 0.4719±0.12885a | 27.25±3.11436a | 13.92±2.49312a | 41.17±4.27951a |

Y, H and Z represent *Vicia sepium* L. *Lolium perenne* L., and *Medicago sativa* L., respectively. a, b, c, d, and e indicate significant differences (*P*<0.05).

**Table S2 The information of keystones in PT and PUT fungal network**

| Fungal Network | OTU | Network roles | Genus |
|---|---|---|---|
| PT | OTU3079 | connectors | g__Pisolithus |
| | OTU2797 | connectors | g__Arnium |
| | OTU413 | module hubs | g__Trichophaeopsis |
| | OTU2502 | module hubs | g__Didymella |
| | OTU1620 | Network hubs | g__Strelitziana |
| PUT | OTU3391 | connectors | g__Scopulariopsis |
| | OTU4520 | connectors | g__Talaromyces |
| | OTU3567 | connectors | g__Fusarium |
| | OTU754 | connectors | g__Lentithecium |
| | OTU5310 | connectors | g__Cutaneotrichosporon |
| | OTU4099 | connectors | g__Myrmecridium |
| | OTU4312 | module hubs | g__Alternaria |
| | OTU3567 | module hubs | g__Fusarium |
| | OTU688 | module hubs | g__Cerrena |
| | OTU5242 | Network hubs | g__Fusarium |

## 1.2 Supplementary Figures

**Fig. S1** The difference in fungal community composition were analyzed using Multiple group comparisons based on Welch's t-test. *, ** and *** indicate $P<0.05$, $P<0.01$, $P<0.001$, respectively.

**Fig. S2** Taxa at the genus level were displayed on the stacked column, and the taxa with relative abundances less than 1% were combined into others. (a) plant treatments. (b) plant combined with urban sludge treatments.

**Fig. S3** The correlation and heatmap of modules in different networks. (a) and (b) represented the PT and PUT fungal network respectively. (c) and (d) represented the relationship between module and soil properties.

**Fig. S4** Key species of all modules were shown based on Module Eigen-Gene analysis. (a) and (b) represent modules in PT and PUT fungal network respectively. The relative abundance of each species was showed in the heatmap of each sample.

**Fig. S5** The relative abundance of keystone species in PT and PUT fungal network. (a) and (b) represented the PT and PUT fungal network respectively.