Response to Reviewer 3 Comments

Dear Reviewers:
Thank you for the reviewer's comments concerning our manuscript (ID: applsci-989126). Those comment are all valuable and very helpful for revising and improving our papers, as well as the vital guiding significance to our researches. We have studied comments carefully and have made correction which we hope meet with approval. Revised portion are marked in red in the paper.
The main corrections in the paper and the reply to the reviewer's comments are as following:

Major comments:

Point 1: the language of the text has to be revised. There are several mistkaes, especially in parts of section 3.4.

Response 1: Thanks very much for your careful review. We have carefully revised the manuscript according to your valuable comments.
Line 42 in the manuscript, modification of "bio-treated" to "bio-treatment".
Line 85 in the manuscript, the first word "bacterial" was corrected as "bacteria".
Line 180 in the manuscript, based on the reviewer's comments, the statement of "the vertical direction" was corrected as "the horizontal direction".
Line 196 in the manuscript, the statement of "**Figure 5.** The layering diagram of the bio-treated subsamples along the vertical direction" was corrected as "**Figure 5.** The layering diagram of the bio-treated subsamples along the horizontal direction".
Line 336 in the manuscript, the statement of "MICP mineralization technology" was corrected as "MICP mineralization".
Line 337 in the manuscript, the statement of "*S.pasteurii*-treated" was corrected as "bio-treated".
Line 346-347 in the manuscript, the statement of "*S.pasteurii*-treated" was corrected as "bio-treated".
Line 360 in the manuscript, the statement of "which was visualize qualitatively" was corrected as "which was visualized qualitatively".
Line 363 in the manuscript, the statement of "The phenomenon of the calcite crystal" was corrected as "This phenomenon".
Lines 376-381 in the manuscript: The paragraph has been rewritten in **Response 5.**

Point 2: please explain the abbreviations when they appear first (e.g. in Abstract).

Response 2: The abbreviations of the abstract section were corrected according to the reviewer's comments.
Line 10 in the manuscript, the statement of "MICP" was corrected as "microbially induced

calcium precipitation".
Line 17 in the manuscript, the statement of "UCS" was corrected as "unconfined compressive strength".
Line 20 in the manuscript, the statement of "SEM" was corrected as "Scanning electron microscopy".

Point 3: the authors used XRD analysis to characterize the consolidation products. Please mention which are the other products that could potentially form, besides calcium carbonate. Please add this information in lines 330-331. Please explain, then, why you observed only calcium carbonate.

Response 3: According to your valuable comments, we made the following reply:
On the basis of chemical equation of mineralization mechanism during MICP process [1,2], Calcium bicarbonate $Ca(HCO_3)_2$ and ammonium chloride (NH_4Cl) are the other products that could potentially form, besides calcium carbonate.
"And the calcium bicarbonate $Ca(HCO_3)_2$ and ammonium chloride (NH_4Cl) are the other products that could potentially form, besides calcium carbonate" were added in lines 338-340.
Only calcium carbonate was observed in the test. Because the chemical properties of the calcium bicarbonate $Ca(HCO_3)_2$ are relatively stable below 0℃, and it is easy to decompose to obtain calcium carbonate at room temperature. The test samples were dried at high temperature before XRD test, and ammonium chloride (NH_4Cl) was decomposed under heat.
[1] Duo, L.; Kan-liang, T.; Hui-li, Z.; Yu-yao, W.; Kang-yi, N.; Shi-can, Z. Experimental investigation of solidifying desert aeolian sand using microbially induced calcite precipitation. *Constr. Build. Mater.* **2018,** *172*, 251-262.
[2] Hataf, N.; Baharifard, A. Reducing soil permeability using microbial induced carbonate precipitation (MICP) method: a case study of shiraz landfill soil. *Geomicrobiol. J.* **2020**,37, 147-158.

Point 4: Lines 362-367 are not necessary, since a summary of the findings fits better to the Conclusions section.

Response 4: After careful discussion, we agreed to remove the contents of lines 362-367 in the original manuscript, and the conclusion section summarized this content.

Point 5: Please make more clear the suggestions for future work (lines 368-373).

Response 5: We have made correction in the manuscript according to the Reviewer's comments.
Lines 376-381 in the manuscript: These findings provide insights into the understanding of the inorganic substances in the reactants mentioned above in terms of microscopic observation. To better understand the strength enhancement mechanisms, it is necessary to study that the fine and coarse aggregates are mixed in various percentages. Additionally,

the subject of correlation mechanism between the microstructure and mechanical properties of bio-treated sand bodies is likely to have a more detailed discussion in the future.

Point 6: Please include in the Conclusions section only the main findings of the study.

Response 6: Considering the reviewer's suggestion, we have modified the conclusion section. The conclusion section is revised in lines 383-394 of the manuscript.

A series of mixed levels orthogonal experiments were conducted to examine the effect of particle size range, bacterial suspension concentration and cementation fluid concentration on efficacy of bio-treated sand columns. The following conclusions can be drawn from this study:

- In the present research, the increase of sand particle size is beneficial to improve the effect of bio-treated sand, which may be related to the compact bulk density of sand particles. At low concentration bacterial suspension and low concentration cementation reagent, more calcium carbonate is formed, which increases the unconfined compressive strength.
- As the sand particle size increased, the uniformity of calcium carbonate precipitation was better along its height of the bio-treated column. The coefficient of variation was reduced by up to 52.0%.
- Smaller and denser calcium carbonate crystals are precipitation in the pore matrix when using low concentration cementation reagent for bio-treated loose sand particles.

We tried our best to improve the manuscript and made some changes in the manuscript. These changes will not influence the content and framework of the paper.
We appreciate for Editors/Reviewers' warm work earnestly, and hope that the correction will meet with approval.

Once again, thank you very much for your comments and suggestion.
Best wishes.