

## Comments to the manuscript bg-2019-444

### General comments

The article deals with an interesting topic that deserves more attention from the scientific community.

The manuscript has a potential to be acceptable due to the increasing interest on bioformation of carbonates, both from basic science and technological application point of view.

However, in the section "Results and discussion" the authors often refer to articles that are not strictly related to the interpretation of the results obtained, leading to a confused and sometimes inaccurate dissertation. Often, the bibliographic references quoted are nothing but references reported by others authors.

Despite the interesting topic dealt with and some results worthwhile to be circulated among the scientific community, the article is extremely confused, badly written, the results and the discussion are often disorganised and difficult to follow. The discussion is not always coherent with the results reported. I strongly suggest a complete revision by a native English speaker.

The manuscript is still far from be ready.

### Specific comments

In order to help authors to improve their text, I suggest a complete rewrite of the article according to the comments below:

- 1) Abstract - From line 25 onwards, replace the strain codes (71A, VIP, EM4) with the names of the bacterial species (*Lysinibacillus sphaericus*, *Raoultella planticola*, *Streptomyces pluricolororescens*).
- 2) Keywords - Choose keywords not listed in the title and more relevant to the topic: *Lysinibacillus sphaericus*, *Streptomyces pluricolororescens*, *Raoultella planticola*, CaCO<sub>3</sub> bioformation, ...; delete "biocementation"..
- 3) Lines 45-49 - The different biomineralization processes described in lines 45-49 and 69-77 are reported in a confusing way. Please be clear about BCM, BIM, autotrophic, eterotrophic, SRB, etc. mechanisms that are randomly referred to in the text.
- 4) Lines 47-49 - References are not strictly related to the statement.
- 5) Line 51 - I suggest adding the adjective "microbial" to the term "carbonatogenesis".
- 6) Lines 54-55 - It is not clear how MICCP can participate in the solution of the water crisis. I suggest deleting this sentence.
- 7) Lines 82-84 - Ureolytic bacteria does not cause the "calcite disintegration", but the "decay of the calcite formation". Thirumalai states: "The use of aerobic bacteria in urea hydrolysis unable to grow *in situ* due to lack of oxygen, which will results in decay of the calcite formation in time (Van Passen et al., 2010)".
- 8) Lines 91-92 - Report the increase in carbonate precipitation.
- 9) Lines 97-98 - In the manuscript there is no experimental evidence about the suitability of CaCO<sub>3</sub> crystals for the potential applications listed in the section "Results and discussion"
- 10) Line 130 - How was the inoculum standardized?
- 11) Lines 130-137 - How many flasks have been inoculated to carry out what is reported on lines 156-157? Describe the inoculum set more clearly. The flasks analyzed in section "2.5. Study of the parameters associated with CaCO<sub>3</sub> precipitation" are the same described in section" 2.3. CaCO<sub>3</sub> precipitation and crystals collection"?
- 12) Line 158: How long were the plates incubated?

- 13) Line 160 - Report drying times and temperatures of the crystals before being weighed.
- 14) Line 166 - Have the selected strains been isolated from the same soil?
- 15) From line 172 onwards - Replace the strain codes with their species names.
- 16) Lines 172-174: *Firmicutes*, *Bacillaceae*, *Proteobacteria*, *Enterobacteriaceae*, *Actinobacteria*, *Actinomycetaceae* are written in italics.
- 17) Lines 176-179 - The discussion is not strictly related to the results obtained.
- 18) Line 131 – please make clear the full composition of M9 media. Without such an information, it is impossible to verify the accuracy in the evaluation of precipitated CaCO<sub>3</sub> (lines 238-239)
- 19) Lines 189-190 – please consider the result obtained by Maciejewska et al. (2017) “Assessment of the Potential Role of Streptomyces in Cave Moonmilk Formation”. *Front. Microbiol.* 8:1181. doi: 10.3389/fmicb.2017.01181
- 20) From line 208 onward: results are presented and discussed in a very confusing manner preventing the comprehension of the text.
- 21) The figures are so small and blurry that it is impossible to read them
- 22) 237-244: the units of measure of the precipitated CaCO<sub>3</sub> need to conformed to an unique standard.
- 23) 247-252: the assumptions made by the authors seem to be of speculative nature. Are they any bibliographic references confirming their interpretation of the results?
- 24) 283-286: could the detected P derive from the ingredients used to make the culture broth?
- 25) Please carefully check all the bibliographic references, that are not always compliant with statement made by the authors.
- 26) Wei et al. (2015), Wu et al (2011) and APHA, (1999) are not reported in the References section.
- 27) Lines 241, 436 and 300 and reference section. Please replace “Kaur D.N.” con “Dhami N.K.”
- 28) All what was referred to Figures 3, 4, 5 and 6 are not verifiable. The Figures are small, blurry and illegible.
- 29) 297-298 and 303: how the authors can state that on Figure 6C and 6E a mucous matrix and mucous substance are evident?
- 30) 305-309: spores are notoriously inactive and cannot participate to Ca precipitation.
- 31) Lines 304-309. The statements do not make any sense. The spores in harsh condition remain spores and do not evolve in vegetative forma, the only one able to contribute to the Ca precipitation.
- 32) 313-316: the reference Hou et al. (2011) is not coherent with the discussion and it has been quoted in wrong way.
- 33) 321: Rodriguez-Navarro et Al. (2012) obtained calcite and vaterite precipitation under experimental conditions widely differing from those described in this manuscript
- 34) 327-328: please drop out. The sentence is useless in this context
- 35) 335-483: the discussion is vague and superficial and carried out in a confusing way. In addition, the references quoted refer to article that used experimental protocols widely differing from those described in this manuscript
- 36) Figure 6: The pictures are too small and difficult to read. Please consider a reduction of the photos by eliminating the redundant ones.