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Comment on bg-2021-146

O.S. Pokrovsky (Referee)

Referee comment on "Manifestations and environmental implications of microbially-induced calcium carbonate precipitation (MICP) by the cyanobacterium *Dolichospermum flosaquae*" by Refat Abdel-Basset et al., Biogeosciences Discuss., https://doi.org/10.5194/bg-2021-146-RC1, 2021

This paper is devoted to experimental study of cyanobacterium-induced precipitation of CaCO3. The topic is generally well studied, and fits the scope of the journal. However, the overall quality of this research, its design and interpretation are below the standards of academic journal and rather suit for some applied journal audience.

The major problems are the following:

1) There is no information on $CaCO_3$ saturation state during the experimental run and even at the beginning of experiments. One cannot study CaCO3 precipitation without having an idea of solution saturation state

2) There is no kinetic assessment of pH and Ca concentration evolution in the course of experiment. It is thus impossible to assess the rate of the process and the dynamics of bacterially induced precipitation. The 4-weeks duration of experiment is not justified; the growth curve Is not presented.

3) The effects of anions and Ca are not distinguished. In addition to Ca salts, Na salts should be used if the authors aim to characterize the effect of citrate, for instance.

4) 100% BG-11 used in the experiments contain unreasonably high PO4 concentration, totally irrelevant to natural settings, especially for P-limited lakes. Not only PO4 is a strong inhibitor of calcite precipitation, it also provide unrealistical conditions for cyanobacterial growth. The application of obtained results to lakes is unwarranted.

5) Alkalinity titration of unfiltered solution is not suitable. Part of H+ will be used for i) cell surface adsorption, ii) HCO3- neutralization, and iii) CaCO3 dissolution. The authors cannot distinguish between these 3 processes

Several specific comments below.

L 27-29 unclear. What is the driving force, photosynthesis or precipitation?

L32, unclear, why Chl a is not dependent on cell number in a monocultural experiment

L64 Ca does not coprecipitate. It precipitates as $CaCO_3$

The link between 2nd and 3rd § of the Introduction is unclear

L179 It is unclear where these ratios are shown

L203-205 How do we know that this release is not dependent on the identity and concentration of anion? Otherwise it is inconsistent with what is stated in L 154-157

L 246-248 This is not shown in the resent work ; no phosphate analysis !

L252-253 contradicts to what is state din L203-204

L257-258 This is self-contradictory. Why 1.5 ppm if cells released 2.26 ppm?

L263265 unclear, and unsupported. What about bicarbonate level and buffering?

L277 Not really? S.I. of $CaCO_3$ is more important

L287-288 Irrelevant without pH/pCO_2 parameters

L290 What does it mean, solid phase

L290-293 This is not correct. There are many quantitative laboratory studies of $CaCO_3$ precipitation kinetics and mechanisms in the presence of cyanobacteria

L294-297 This is irrelevant to the discussion of results of this study

L308 This is not correct. The OH^-/HCO_3^- exchange during photosynthesis is by far the most important process

L345-346 This is not assessed in this study

L364-366 This has been shown well fifty years before Berry

L354-382: The purpose of this § and its relevance to the present work are unclear. This is not a discussion of obtained results

L393-394 Unclear

L400-401 The cost will be quite elevated and thus commercially not interesting

Figures: legend is unclear

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