EGUsphere, referee comment RC2
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Comment on egusphere-2022-1153

Anonymous Referee #2

Referee comment on "Nitrous oxide (N_2O) synthesis by the freshwater cyanobacterium *Microcystis aeruginosa*" by Federico Fabisik et al., EGUsphere, https://doi.org/10.5194/egusphere-2022-1153-RC2, 2022

The work by Fabisik et al shows that the cyanobacteria Microcystis aeruginosa produces nitrous oxide. This work confirms predictions already made that organisms harbouring CYP55 and FLV genes are able to generate N_2O in conditions that favour intracellular NO_2^- production (Plouviez et al, 2017; Burlacot et al, 2020). The novelty of this work relies on showing that these predictions already made for eukaryotes are valid in procaryotes.

The written of the article could be improved as some parts of sentences are difficult to understand (i.e. line 76 "Intracellular NO2 was not possible" or line 41-42 "N2O was only significan in cultures...")

Major comment: while the evidence shown in the article are clear that Microcystis is producing N_2O when supplied with NO_2^-; it is unclear why the amount of cells does not seem to change the production of N_2O (in Fig. 2). This discrepency is not discussed by the authors who instead state wrongly that "Further assays showed a positive correlation between biomass concentration and N2O production (Fig. 2), confirming the biological origin of N2O synthesis" line 43-44. This should be discussed.

Minor comment:
Line 69 the authors discuss the possibility of a light-dependent mechanism that could impact enzymatic activity for N2O production.
However, they do not consider O2 production by photosynthesis...It has been shown at least for one the enzymes (FLV) that it can also catalyze the conversion of O2 into H2O , making it's production of N2O sensitive to O2 (Burlacot et al, 2020). Given the close chemical properties of NO and O2, it is likely the case for all enzymes converting NO to N2O.
Therefore, the hypothesis that the O2 (produced by photosynthesis during the light) would hamper N2O production by competitively limiting the number of enzymes available for converting NO to N2O is probably the most parcimonious (and already shown for one enzyme involved) and should be discussed.