Interactive comment on “The stable carbon isotope signature of methane produced by saprotrophic fungi” by Moritz Schroll et al.

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Received and published: 16 April 2020

Schroll and co-authors studied the stable carbon isotope values of methane emitted during the aerobic decomposition of organic matter by two fungal species. Methane production by fungi during plant litter decomposition is a novel pathway of methane formation, that was recently documented by the authors and others. This manuscript, however, is the first study of the stable carbon isotope (d13C) values associated with this novel pathway and their relationship to the substrate d13C values.

This study addresses a knowledge gap in the isotope systematics of atmospheric methane that is relevant to the Biogeosciences readership. The authors used state of the art methods, and their conclusions are well supported by their results. The manuscript is well structured and easy to follow.

The study’s strength is that this is the first study of its kind and provides unique stable isotope fractionation factors between biomass and methane produced by fungi. The study also used very robust measurement methods (GC/IRMS with preconcentration) that exceed the precision, accuracy, and specificity of laser-based analysers. The main limitation of the study is that the authors did not test for contaminations by other microbial species during this study (this was, however, tested by the authors in similar incubations in a previous study). Another limitation is that the authors were not able to identify controls over relatively large variations in methane isotope values besides differences between C3 and C4 plants. This, however, is understandable given that the biochemistry of aerobic methane production in fungi remains poorly understood, and the authors’ contribution will surely help elucidate these pathways in the future.

Main comments: - The authors used two distinct fungal species, and state that these species include both white rot and brown rot fungi. However, I was unable to find where in the manuscript the authors identify which fungal species belongs to which group.

Minor comments. L53: remove ‘applications of’ for easier sentence structure. L54: clarify what ‘they’ refers to in ‘they might be used.’, also, avoid ‘fingerprints’ (‘characteristic d13C values?’). L57: ‘global isotopic pattern’: Do you mean the d13C values of atmospheric CH4? L63: ‘isotope patterns’: stable isotope values? L74f: clarify which fungi is the white rot and which one is the brown rot one. L142: is 0.06mg correct? This seems a very low sample in weight for EA/IRMS, although not impossible. Also, did you analyse analytical replicates? A single 0.06mg in weight is likely associated with a significant subsampling error. L164: You could add a note that the low R2 resulted from the lack of a change in d13C values (emission d13C was similar to background d13C). In this case, a low R2 does not indicate a poor relation between concentration and d13C value. L167: ‘The SDs are given with a confidence interval of 1 σ’: sentence not needed and meaningless. L173-179: not needed, can be removed. L185: ‘where’: use ‘in which’ instead.

C2
nmol/mmol would improve clarity. L302: ‘distinct differences in the patterns’: redundant structure, could be simplified. L305-311: This section could use some language editing for better flow. e.g. L306: ‘the used growth substrates’: The growth substrates used for this study... or similar. L306: ‘consist of various amounts’: contain distinct amount of cellulose, [...], and other compounds. L307: structure in parenthesis: grammar L309: .. source signatures might _depend_ on the metabolic pathway _used by_ the fungal species _as well as_ the chemical composition of the substrate (or similar) L310: Therefore, we suggest: remove this phrase. "The selected ..." L313: Figure 5 _compares_ _the_ d13C-CH4 values.. L320: ‘depending on the photosynthetic pathway (C3, C4, or CAM)’