

General Comments:

The research investigates the biodegradation of soil-biodegradable agricultural mulch films in freshwater lake sediments. The study highlights the importance of preventing the transport of these films from agricultural fields to neighboring aquatic ecosystems for sustainable waste management in agriculture. The method section provides a clear description of the experimental setup, although some aspects could be further improved for a more comprehensive analysis.

Major Comments:

Sample Variance and Trends: The paper should address the observed large individual sample variance and discuss the different trends shown in Figure 3, even though they are statistically insignificant. This could help readers better understand the variability in the results.

Re: We have currently explained the different trends of the treatments in the results (line 240-269), while also stressing that these were not statistically significant. We have added and adjusted several sentences in this piece, also in reaction to comments by Reviewer 1.

We have chosen to not further discuss the findings on the trends between the treatments in the discussion, because of their statistical insignificance. Discussing them in the discussion section would give more value to them than we considered appropriate given the statistics.

We have added extra text on the individual sample variation within treatments to the discussion, to give possible explanations for this variation. This will allow the reader to assess the within- and between treatment variations better, we hope. (lines 315-325).

Inclusion of Non-Results: Lines 223-234 appear to be non-results from another study and should be removed from the Results section. Focus solely on the findings of the current research.

Re: Thank you for this observation, which is completely correct. We have removed this part from the results section.

Microscope Results: The visualization of plastic film surfaces using microscopy is a significant aspect of the study. The results of the visualization, including details on fragmentation (micro and nanoplastics) and the presence of microbes, should be explicitly presented in the main text to enhance the paper's clarity.

Re: We have deliberately given the microscopy part of this study a relatively small role, because it is not quantitative. We consider it an interesting extra method of assessing the degradation, but we have not used it in enough detail to allow a quantification of the fragmentation, for example. Therefore, we have included it in its current form.

Photodegradation Overlooked: The study's limitation of conducting experiments in dark conditions overlooks the potential of photodegradation, especially in shallow freshwater environments with strong sunlight (UV) penetration to sediment. This limitation should be discussed to provide a more comprehensive understanding of the degradation process.

Re: Thank you for this suggestion. We have added text to the discussion on the relevance of photodegradation for plastic degradation in soil, shallow water, and deep water environments (lines 362 – 369).

Minor comments:

Duration of Incubation Period: While the 40-week incubation period appears reasonable, it would be beneficial to discuss whether this duration aligns with similar studies or if any limitations arise due to this timeframe.

Re: In the discussion, we mention the duration and degradation during that time, of other studies (296-300) and we mention the potential problems regarding oxygen limitation in the methods section (153-156 and 194-197).

Generalization to Other Environments: The research is conducted in Lake Lucerne, Switzerland, which may have unique environmental conditions. Therefore, caution should be exercised when generalizing the findings to other freshwater systems with different sediment and microbial characteristics. This should be mentioned in the paper's discussion section.

Re: we have now added text on the need for future research on both priming effects of soil pre-incubation, and on the relevance of the lake sediment characteristics, to the discussion (383-395).

Overall, the paper contributes new insights into the degradation of soil-biodegradable agricultural mulch films in freshwater lake sediments. Addressing the above-mentioned concerns would enhance the scientific robustness of the study and improve its potential impact in the field of sustainable waste management practices in agriculture.

Re: Thank you for your help in improving this manuscript!