

SOIL Discuss., referee comment RC1
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Comment on soil-2021-70

Anonymous Referee #1

Referee comment on "Are agricultural plastic covers a source of plastic debris in soil? A first screening study" by Zacharias Steinmetz et al., SOIL Discuss.,
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The manuscript reports an assessment of plastic covers used commonly in the agricultural industry and aims to link use with concentrations of microplastics in the soil on the fields. Three plastics are investigated, using a range of techniques including FTIR-ATR on particles >2 mm and Pyrolysis-GCMS to quantify concentrations of plastics <2 mm. Studies on the impact of the agricultural industries use of plastic materials on end user food items are important, particularly as more studies are reporting microplastics in various food, so the topic is of high interest. However, there are questions around the methodology in this study that need further description or additional information added, and there is not enough data to support the conclusions made in the manuscript. More specific comments follow.

General comments:

Method

- The authors have not included any information on laboratory quality control measures which are a must for microplastics studies. Were laboratory and field blanks analysed and how? What were concentrations in the blank samples? Were deposition blanks conducted during the FTIR analysis? Were samples extracted in a fume hood, were lab coats (what sort) worn during extraction? Were duplicates conducted to assess heterogeneity in the sample? What were your internal standard recoveries, were polymer concentrations recovery corrected? Please include a section for QA/QC in the manuscript.
- More information is needed on the Py-GC-MS quantification. Why were the dienes chosen for quantification of the polyethylene (PE), was this from a previous published method? Were the samples analysed in full scan or SIM mode?
- Styrene is not an ideal pyrolysis product for monitoring polystyrene (PS) as it is not

selective. It can originate from organic material (although this may have been removed in your TD analysis) as well as being a pyrolysis product of many other polymers. Typically, the dimer or trimer or polystyrene is monitored. This will increase the MDLs but improve your selectivity. Also, how can you be certain the PS isn't a sampling/analysis artefact without any blank information? Combined with the poor matrix spike recoveries of PS in the reference soil, your method is not optimised or validated for analysis of PS and you cannot confidently report these results.

- Details on PET, PMMA and PVC standards need to be included. What were your tyre wear debris? Were these obtained from a chemical standards company, were they prepared in house and from what type of tyres? Did you really not see a styrene peak from pyrolysis of PVC or from the styrene-butadiene rubber in tyre tread? This suggests your analysis or extraction method is not optimised.
- Your samples are filtered at 4 µm. Can you comment on possibility of micro/nanoplastics in the smaller size range that may have been missed.

Validation

- You cannot state your method is validated for plastics in soils when one of your two soil reference materials returned unacceptably low recoveries. Further, your LODs (MDLs) are the concentration where you have acceptable method extraction and analysis recoveries. Considering you have <30% recovery for a 2 µg/g spike in the second reference soil, the method LODs certainly are not 0.3-0.8 µg/g. The extraction method needs further assessment to determine which types of soils are applicable and what the actual MDLs are. I also suggest removing PS from the analysis due to the above mentioned issues.
- Line 248 needs to be rewritten, as highlighted above, your method is not sensitive, robust or selective. Similarly, Lines 252-254 needs to be rewritten as I would argue your MDLs are definitely not 1-100 times lower than previously published studies.

Results

- If you didn't find any evidence of the plastic covers in the >2mm size fraction, how can you know the PE and PP detected in the <2mm size fraction are from the covers? There is not enough data to make the conclusion that the edge of the sheets are the source of the PE and PS detected on the edges of the field. Are there other common farming sources of the three plastics analysed e.g. tractors/farming equipment? Fertiliser bags? Can these sources be discounted from the study areas?
- I would suggest the low detection and variable PS results are due to the extraction method not performing for clay type soils (which are most of the sites). Did the soil type differ between the field and the periphery where the PS was detected? Again, it would be good to have field blank information here and confirmation from another PS pyrolysis product.
- There is not enough data to state that PE detected at sites 1,7,8 are from the perforated foils and there is not enough data to make the conclusion that application of a foil for 4 months results in detectible PE microplastics in the soil (Line 289).

Conclusions

- The method is not robust, as it does not have high recoveries for different soil types. Also, the method is not successfully validated as described above.
- As discussed above I disagree with the statement that 4 months of covering with thinner perforated foils is associated with elevated PE content as there is no evidence that the PE originated from the foil and not other sources.

Specific comments:

Line 90: thermodesorption should be thermal desorption

Line 113: How were the soil cores homogenised?

Line 199: Please expand BHT and please include the spectral matches as a Figure for all the NIST library identified compounds from the TD analysis.

Line 200: Do you have any reference for propyl dodecanoate and oleonitrile being added to agricultural plastic covers?

Line 206: The lower melting temperatures of PP covers (than virgin PP) may indicate addition of additives or impurities to the PP covers.

Line 310: Have these PS beads been used in Germany? Do you know if they were applied to these sites?

Line 315: What size range did the previous studies use and how do they compare to your study (4µm-2mm).

Figure A1: Please overlay the reference spectra with the samples for comparison