

---

# Microplastic contamination in croplands: Investigation of microplastics at asparagus and strawberries comparing conventional and organic farming systems

Kolja Enste<sup>\*†1</sup>, Levke Borchers<sup>1</sup>, and Elke Kerstin Fischer<sup>‡1</sup>

<sup>1</sup>Center for Earth System Research and Sustainability – Bundesstraße 55, 20146 Hamburg, Germany

## Abstract

The potential uptake of microplastics by humans is currently in the focus of many studies dealing on croplands.

For our study we chose the seasonal crops asparagus and strawberries, as their cultivation usually require the use of plastic mulch film and thus, fruits are expected to be prone for microplastic contamination. Samples of asparagus and strawberries were collected during the growing season of 2021 around the Hamburg region in northern Germany. Sample category groups included freshly harvested and packaged (fresh versus frozen) products. Packaging consisted both of paper and plastics.

Overall, 36 different samples were analyzed at the MRC laboratory. In brief, fresh asparagus were peeled and peels and peeled fruit were treated separately. Concerning strawberries, the fruit and the calyx leaves were treated accordingly. Sample suspensions were prepared by adding samples to (1) filtered MilliQ water and (2) ethanol followed by shaking the suspensions in a standardized manner. Suspensions were transferred to filters followed by staining with Nile Red (1 mg/ml in chloroform) and fluorescence microscopy (Axioscope 5/7 KMAT, Zeiss). A subset of identified microplastic particles were randomly selected and investigated for their polymer composition via  $\mu$ Raman spectroscopy (DXR2xi Raman Imaging Microscope, Thermo Fisher Scientific).

Microplastics are detected within all samples investigated, concentrations however differ between categories, most notably between fresh and frozen products. Within asparagus samples, lower concentrations were detected in freshly harvested samples compared to packaged samples. Peeling asparagus results in a distinct reduction of microplastic contamination. Strawberry samples show significantly higher concentrations in frozen products compared to their fresh counterpart. The predominant morphology within all samples consisted of fragments, though, the share of fibers in fresh samples of strawberries is elevated compared to frozen samples. Polymer composition of microplastics found were predominately PE and PA (fragments) or PET (fibers).

**Keywords:** plastic consumption, croplands, conventional farming, organic farming, packaging, raman, nile red

---

<sup>\*</sup>Speaker

<sup>†</sup>Corresponding author: kolja.enste@posteo.de

<sup>‡</sup>Corresponding author: elke.fischer@uni-hamburg.de