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Evaluation of packaging contamination in animal feed containing former food

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Considering the actual population increase and the compelling need of food waste reduction and nutritional resources saving, former food products (FFPs), not more suitable for human consumption, can be recovered and reused in animal feed as sustainable alternative to cereals. However, some packaging residues (paper, aluminum, plastics etc.) may remain in the final product due to mechanical unpackaging and grinding processes and needed to be quantified and characterized to optimize the use of FFPs and reduce the risks involved.

In this work, 14 feeds containing FFPs were taken as part of the official control of packaging residues according to the Italian National Feed Plan. Firstly, a quantitative method for the determination of six phthalates (DBP, DEP, BzBP, DMP, DEHP, DnOP) by gas chromatography (GC-TQ-MS/MS) was developed and validated. Three samples containing detectable concentration of phthalates were selected and the packaging contaminants, isolated by subsequent sieving [1] (mesh from 2 to 0.7 mm), were chemically characterized by vibrational spectroscopy (μFTIR and μRaman) to identify possible plastic residues [2]. This non-destructive technique, allowing to rapidly obtain the analyte specific chemical fingerprint, even with very small amount, and avoiding any difficult preparation step, represents the excellence choice for polymers identification [3].

DEHP was detected in 5 samples (0.210 to 0.898 mg/kg), in two of which it was associated to DMP (0.081 mg/kg) and BzBP (0.113 mg/kg). The three most contaminated samples contained up to 0.08% (w/w) of total packaging residues. Vibrational spectroscopy analysis also evidenced the presence of plastic polymers such as PE. A library of the most common plastic polymers (PE, PP, PET etc.) was obtained measuring standards by both μFTIR and μRaman. Further vibrational spectroscopy analysis of these samples, after digesting the organic matrix, are also intended to identify the possible presence of microplastics < 1 μm.

Since the presence of phthalates and microplastics that can accumulate in the tissues of animals intended for human consumption represents a severe issue due to their xenogeneic activity, measuring and quantifying their occurrence in feed results fundamental for a risk-based approach.

Keywords: former food products, animal feed, microplastics, vibrational spectroscopy, phthalates

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