



Persistent Organic Chemicals in the Irish Waste Stream

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Identifying pressures

The EU is transitioning to a circular economy, in which resources are kept in use for as long as possible, for example by maximising recycling. A potential obstacle is the presence of regulated brominated persistent organic pollutants (POPs) in waste plastics, as articles containing recycled material may be contaminated with such chemicals. To minimise contamination, there are limits on the maximum permissible concentrations of POPs in waste, such that material exceeding these limits may not be recycled. Effective implementation of such limits presents enormous technical and economic challenges, as conventional methods for measuring POPs are technically demanding and expensive. This project evaluated the feasibility of using hand-held X-ray fluorescence (XRF) spectrometers to measure bromine in waste articles to check compliance with limit values. It also generated an extensive database on concentrations of POPs and related chemicals in waste plastic articles in Ireland. This permits assessment of whether recent bans on the use of some POPs has reduced their presence in Irish waste and establishes a baseline against which the success of possible future restrictions on other chemicals may be evaluated.

Informing policy

This research identifies ways to improve the effectiveness of hand-held XRF spectrometers to provide a faster, less expensive way of checking whether waste articles comply with limits on brominated POPs. Moreover, it provides the first data on per- and polyfluoroalkyl substances (PFAS) and chlorinated organophosphate esters (CI-OPEs) in the Irish waste stream. These data reveal very few exceedances of permissible limit concentrations of PFAS. In contrast, this research also shows that, if a limit on waste of 1000 mg/kg were to be introduced for CI-OPEs, a substantial proportion of articles tested would exceed this limit. Analysis of waste childcare articles like car

seats reveals that some exceed existing and potential limits on brominated POPs and CI-OPEs. These data can help inform choices on materials used in childcare articles. Concentrations and limit value exceedances for brominated POPs in Irish waste have either declined or remained similar since 2015–2016. The impact of new, lower limits on concentrations of brominated POPs was evaluated. Although lowering limits prevents more brominated POPs from entering the recycling stream, it increases the mass of unrecyclable waste.

Developing solutions

Based on this research, the following recommendations are made.

The duration of XRF measurement of bromine to screen waste articles for compliance with limits on concentrations of brominated POPs should be conducted over a single 5-second period. This would substantially increase the rate at which waste articles may be checked, with minimal reduction in the accuracy with which XRF correctly identifies articles exceeding the limit.

Alongside measurements of total organic fluorine, future studies should measure a wider range of PFAS to ensure that articles containing elevated concentrations of PFAS are not overlooked.

A limit of 1000 mg/kg should be placed on concentrations of CI-OPEs in waste articles above which such articles cannot be recycled. This will substantially reduce the quantity of these chemicals entering the recycling stream.

Further monitoring of concentrations of brominated POPs, CI-OPEs and PFAS in waste (including childcare articles) should be conducted to fully evaluate the impact of legislation designed to eliminate these chemicals from the waste stream.