

The Consumer Voice in Europe

MORE THAN A PAPER TIGER

European consumer organisations call for action on paper and board food contact materials



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On its way from farm to fork, our food comes into contact with many different materials and products, such as food processing machines, plastic packaging or paper wraps, kitchen aids and ceramic tableware. While these materials are essential to how we transport, preserve, and ultimately consume our food, they may also negatively impact the quality and safety of foodstuffs. Chemicals present in food contact materials (FCM) are known to migrate into, and thus contaminate foodstuff, thereby potentially creating risks for consumer health.

Existing EU legislation is meant to safeguard consumers against such risks; however, the current rules are deficient and provide insufficient protection of consumers.¹ Previous tests by European consumer groups have thus highlighted² the problematic use in paper and board food packaging of fluorinated compounds, a group of chemicals with suspected adverse effects on human health.

New evidence by consumer organisations now demonstrate that chemicals of concern are also present in – and migrate from – coloured paper and board food contact materials, such as coffee cups, paper straws, printed napkins and grocery products packaged in paper or board. These results again underscore the need for strict EU rules governing the safety of paper and board FCMs.

FCM legislation in Europe: a regulatory patchwork

According to current EU legislation, all FCMs should be safe and inert – that is, not influence the food in a negative way. With the exception of plastic food contact materials, harmonized EU rules to determine compliance with these generic provisions have however not been established. Consequently, demonstrating that food safety is consistently achieved for materials other than plastics has proven difficult, as illustrated by several food contamination scares³ originating from food packaging, such as cardboard.

In 2016, the European Parliament concluded⁴ that the lack of uniform EU rules is detrimental to public health. Parliament therefore urgently called on the Commission to achieve comprehensive, harmonized regulation of *all* FCMs; as a priority, Parliament emphasised in particular the need to develop EU rules for paper and board and printing inks.

Paper and board are the second most used type of FCMs in Europe, superseded only by plastics. Specific EU legislation for paper and board FCMs does not exist, however. While Member States can adopt their own national measures in the absence of harmonized EU rules, only nine Member States have such rules in place. Moreover, of the estimated 1,710 substances covered by these measures, only nine per cent are regulated by three or more Member States, according to a 2017 review by the Joint Research Centre (JRC).⁵

¹ See BEUC. [Reform EU food packaging rules to better protect consumers](#). May 2019.

² BEUC news. [Harmful substances found in fast food packages across Europe](#). March 2017.

³ For example, in 2005, reports emerged in Italy that liquid baby milk had been contaminated with isopropyl thioxanthone, a chemical used in the printing process of the milk cartons. In 2009, hundreds of boxes of noodles were withdrawn from sale in Germany after levels of benzophenone almost three times above the European legal limit were found to have migrated from the packaging.

⁴ European Parliament. [Report on the implementation of the Food Contact Materials Regulation \(\(EC\) No 1935/2004\)](#). 2015/2259(INI). July 2016.

⁵ Joint Research Centre. [Non-harmonised food contact materials in the EU: regulatory and market situation](#).

Printing inks are primarily used on food packaging to give information to consumers about the food product or for marketing purposes. The EU Plastics Regulation⁶ regulates the use of certain printing inks on plastic materials; for all other material types, such as paper and board, no specific EU rules exist.⁷ While some European countries, notably Switzerland,⁸ have adopted national rules, there are significant difference in risk assessment schemes and regulated substances.⁹

This regulatory patchwork implies that European consumers are not guaranteed the same level of protection against harmful chemicals in printed FCMs depending on where they live; the European Commission has thus acknowledged¹⁰ that the health of consumers is not adequately safeguarded with respect to printed food contact materials. In 2017, the Commission initiated preparatory work for specific EU rules on printed FCMs,¹¹ although a proposal has yet to be finalised.

A colourful cocktail: chemicals of concern in printed FCM

Food packaging inks¹² are complex chemical mixtures of colorants (pigments and dyes), binders, solvents and additives, such as photoinitiators (*i.e.* UV-filters). More than 5,000 different substances are used to produce various printing inks. Only a fraction of these substances has been systematically evaluated by EFSA; for 90%, insufficient toxicological data means that it is currently not possible to comprehensively assess their health risk.¹³

Printing ink substances can migrate from packaging materials to food either through direct contact, from migration through food contact layers or through 'set-off' transfer of contaminants from one printed surface to another. Previous research has for example shown migration of certain chemicals of concern such as primary aromatic amines¹⁴ or photoinitiators¹⁵ from printed packaging into food.

Primary aromatic amines (PAAs) are used in the manufacture of certain yellow, orange, and red colorants, but can also be present in inks as impurities or breakdown products. Several PAAs are known or suspected to have carcinogenic properties and may therefore pose a health risk if they transfer to food. The German Federal Institute for Risk Assessment (BfR) thus recommends¹⁶ that consumer exposure to such PAAs should be limited to the greatest possible extent.

[Baseline study](#). January 2017.

⁶ Commission Regulation (EU) No. 10/2011.

⁷ Commission Regulation (EC) No. 2023/2006 on Good Manufacturing Practice requires that printed surfaces shall not come into direct contact with food; nonetheless, this requirement does not cover migration of printing ink chemicals *through* food contact layers or by 'set-off' transfer where contaminants are dissolved in the food contact layer during storage, *e.g.* from stacked cups.

⁸ Specifically, Annex 10 of the [Ordinance of the FDHA on materials and articles intended to come into contact with foodstuffs](#).

⁹ Joint Research Centre. *Non-harmonised food contact materials in the EU: regulatory and market situation. Baseline study*. January 2017.

¹⁰ See [Answer to Parliamentary question E-007333/2016 given by Mr Andriukaitis on behalf of the Commission](#). November 2016.

¹¹ See European Commission. [pFCM – Regulating Printed Food Contact Materials](#). May 2017.

¹² See Food Packaging Forum. [Printing inks in food contact materials](#). October 2012.

¹³ Bundesinstitut für Risikobewertung. [Frequently Asked Questions about Printing Inks and Primary Aromatic Amines in Food Contact Materials](#). June 2017.

¹⁴ See *e.g.* Food Packaging Forum. [PAAs in colored paper napkins](#). May 2016.

¹⁵ See *e.g.* Food Packaging Forum. [Printing ink exposure from FCM significantly underestimated](#). October 2013.

¹⁶ Bundesinstitut für Risikobewertung. [Frequently Asked Questions about Printing Inks and Primary Aromatic Amines in Food Contact Materials](#). June 2017.

Photoinitiators (PIs) are highly photoactive compounds used in certain printing inks and varnishes. PIs cover a diverse group of chemicals, including relatively well-known substances such as isopropylthioxanthone (ITX) and benzophenone. Some photoinitiators are suspected to cause cancer and/or have been linked to endocrine disrupting properties. Benzophenone was for example recent included in the Commission's list of potential endocrine disruptors in cosmetics.¹⁷

A Consumer Survey: chemicals of concern in printed food packaging

Against this background, four consumer organisations, *Altroconsumo* (Italy), *Forbrukerrådet* (Norway), *Forbrugerrådet TÆNK* (Denmark), and *OCU* (Spain) decided to investigate the presence of PAAs as well as selected PIs and related substances in printed paper and board FCMs in different European countries. Whereas PAAs have previously been detected in e.g. printed napkins,¹⁸ the present survey sought to investigate their presence in other types of printed paper and board FCMs as well. Building on previous studies¹⁹ demonstrating migration of benzophenone and ITX from printed packaging, the survey further focused on these two well-known PIs as well as 14 other less-investigated PIs and related substances.

The survey sampled 76 different highly printed paper and board food contact materials, such as coffee and soda cups (board), paper plates and straws, napkins, muffin forms, paper bags from bakeries and from 'pick and choose' candy shops, as well as paper and board packaging from grocery items like pastas, grains, and noodles. All 76 samples were sent to a laboratory for further analysis.²⁰

Results: prevalence of PAAs and PIs in printed food packaging

All 76 samples were analysed to verify the presence of primary aromatic amines as well as selected photoinitiators, such as benzophenone. In the absence of official EU guidance values for printed paper and board FCMs, the results were assessed against the following reference values:

- According to the Plastics Regulation, **primary aromatic amines** that have not been specifically assessed shall not migrate into food or food simulants in a detectable amount. The detection limit is 0.01 mg/kg or 10 µg/L and applies to the sum of released PAAs.
- The BfR recommends²¹ that transfer of individual PAAs classified as carcinogenic category 1A or 1B should not transfer into food (or food simulants) based on an analytical detection limit of 0.002 mg/kg or 2 µg/L.
- Annex 10 of the Swiss FCM Ordinance establishes various limits for substances used in the printing of FCM including for **photoinitiators**: Part A sets out specific migration limits (SMLs) for toxicologically evaluated substances, such as benzophenone (0.6 mg/kg). Part B establishes an analytical limit of 10 ppb (10 µg/kg) for non-evaluated substances.

¹⁷ See European Commission. [Call for data on ingredients with potential endocrine-disrupting properties used in cosmetic products](#). May 2019.

¹⁸ See Food Packaging Forum. [PAAs in colored paper napkins](#). May 2016.

¹⁹ See e.g. Food Packaging Forum. [Printing ink exposure from FCM significantly underestimated](#). October 2013.

²⁰ Further details on data and methods are available with the authors.

²¹ Bundesinstitut für Risikobewertung. [Frequently Asked Questions about Printing Inks and Primary Aromatic Amines in Food Contact Materials](#). June 2017.

PAAs were extracted from the packaging with cold or hot water as recommended by the BfR; the subsequent analysis was performed through liquid chromatography-mass spectrometry with a level of detection between 2-10 µg/L depending on substance.

Photoinitiators were extracted with methanol; gas chromatography-mass spectrometry was used for substance analysis with a quantification limit between 0.1 and 0.5 mg/kg. In a second step, migration testing was performed for samples with the highest content of PIs and where potential migration was most likely to exceed the limits set out in the Swiss Ordinance (for Part A substances, the relevant SMLs; for Part B substances, the general 10 ppb limit). Specific test conditions, including time, temperature and simulant (acetic acid, ethanol *etc.*), were determined depending on the foreseeable use of each sample use. The quantification limit in food or food simulant was between 0.01 and 0.1 mg/kg depending on substance.

Of the 76 samples, **primary aromatic amines** were detected in 17% (13 samples); nine samples contained PAAs above the limit set in the Plastic Regulation or the BfR recommendation. The results varied from 5 µg/L to 65 µg/L, or 6.5 times the limit for plastics. These samples were mainly single-use products, such as drinking straws, and children's products, such as candy bags. 4-aminotoluene-3-sulfonic acid was the most frequently detected PAA and in the highest concentrations. The substance has no CLP classification. PAAs with a harmonized CMR classification, such as aniline (Cat. 2), were found in three products.

Photoinitiators and other substances that can relate to the printing inks were detected in almost all of the 76 tested packaging samples; only five sample tested negative. Two samples contained the suspected endocrine disruptor, benzophenone in high levels and in total 50 samples showed potential migration above the limits in the Swiss Ordinance. Based on their relatively high content of one or more PIs, 21 samples were selected for further testing.

The migration analysis found PIs or a related substance either in the food or the food simulant in eight samples, or more than 10% of the total samples – in six samples, the migration levels exceeded either the relevant SMLs or the general limit set out in the Swiss Ordinance. Among the six products were three single-use products as well as three grocery items, including a small, child-friendly box of raisins, where four different PIs were detected in the raisins above the recommended Swiss limits.

In total, the migration analysis of the six products detected eight different substances; for five of these substances the migration exceeded the Swiss limits. This also included the substance, bis(2-ethylhexyl) fumarate (DEHF), that according to the Swiss Ordinance is used in printing inks as a binder or monomer, not as a photoinitiator. DEHF can also be present as an impurity or degradation product from other substances used in the production. The substance was detected at levels more than 400 times higher than the recommended 10 ppb limit. Previous studies²² have associated DEHF with endocrine disrupting properties *in-vitro*, including anti-estrogenic activity. For the remaining four PIs identified in the test, no or limited information on their possible health effects is available. Given the prevalence – and migration into food – of these substances, this lack of information is thus a cause for concern.

Overall, the results demonstrate that printed paper and board food packaging materials contain – and release – chemicals of concern, including some that have not been risk assessed by EFSA. While none of the tested products in isolation may endanger human health, they nonetheless contribute to overall consumer exposure to problematic – and in

²² See e.g. Food Packaging Forum. [New study identifies candidates for hormonal activity in bottled waters](#). September 2013.

some cases non-evaluated – chemicals. The substances included in this survey are not an exclusive list, as there are other substances that could be relevant to investigate both from a use and a safety perspective.

More than a paper tiger: the EU must improve the safety of paper and board FCMs

The European Commission has previously acknowledged²³ that the health of consumers is not adequately safeguarded with respect to printed food contact materials. This new evidence corroborates that conclusion; the Commission must therefore complete the work²⁴ to establish specific EU rules on printed FCMs without delay.

In combination with previous tests by European consumer organisation, **the present survey however also underscores the need to develop harmonized EU rules for the presence of chemicals of concern in all paper and board FCMs.** In 2017, five consumer organisations for example found²⁵ high levels of fluorinated compounds in one third of 65 tested fast food packaging made from paper and board. These compounds, known as PFAS, are problematic for the environment, but are also suspected to have adverse effects on human health, such as cancer, infertility, obesity. Consequently, scientists call²⁶ for limits to the production and use of PFAS; nonetheless, the test results indicate that fluorinated compounds are used intentionally for surface treatment of paper materials. Despite mounting concern about their impact on health, the safety of these compounds remains however essentially unregulated.

Last year, consumer organisations in Belgium, Italy, and Spain likewise found²⁷ high level of mineral oil hydrocarbons (MOH) in various food samples, such as pasta, rice, breakfast cereals and chocolate, likely originating from recycled paper and board packaging. Despite a 2012 EFSA scientific opinion²⁸ which concluded that exposure to certain MOH is of potential concern to human health, including a potential cancer risk, the presence of MOH in paper and board FCMs escapes effective control.²⁹ Danish consumer group, Forbrugerrådet TÆNK, has further documented³⁰ the presence of chemical contaminants, such as bisphenol A, phthalates, and nonylphenol, in cardboard pizza boxes, likely originating from recycled materials.

The Commission's Plastics Strategy, and the recent decision to ban certain single use plastics, such as plastic cutlery, plates and straws, is set to further exacerbate these concerns as business operators switch to alternatives for which adequate EU rules are not in place, such as paper and board or bamboo. The present survey thus found that half of the tested paper straws either contained PAAs and/or released non-evaluated substances at high levels. While we fully support³¹ the initiatives to reduce the amount of single use plastics, developing in parallel new, stringent EU rules for materials other than plastics is crucial to prevent consumer exposure to harmful chemicals migrating from new plastic alternatives.

Against this background, BEUC welcomes³² the ongoing review of EU FCM legislation as a long overdue opportunity to achieve better consumer protection. In view of the results of

²³ See [Answer to Parliamentary question E-007333/2016 given by Mr Andriukaitis on behalf of the Commission](#). November 2016.

²⁴ See European Commission. [pFCM – Regulating Printed Food Contact Materials](#). May 2017.

²⁵ BEUC news. [Harmful substances found in fast food packages across Europe](#). March 2017.

²⁶ See e.g. [The Madrid Statement on Poly- and Perfluoroalkyl Substances \(PFASs\)](#). May 2015.

²⁷ See AltroConsumo. [Scivolati sull'olio](#). Inchieste N°332. February 2018.

²⁸ EFSA. 2012. [Scientific Opinion on Mineral Oil Hydrocarbons](#). EFSA Journal 10(6).

²⁹ See BEUC. [Reform EU food packaging rules to better protect consumers](#). May 2019.

³⁰ Forbrugerrådet TÆNK Kemi. [Unwanted chemicals found in pizza boxes](#). October 2015.

³¹ See BEUC. [How to bring down the use of single-use plastics?](#) October 2018.

³² See BEUC. [Reform EU food packaging rules to better protect consumers](#). May 2019.

the present survey, it is imperative that the evaluation delivers credible answers to known deficiencies in the current regulatory framework, including on non-intentionally added substances, combination effects, and new and emerging risks, such as endocrine disruptors. BEUC recommends³³ that a reformed FCM regime draws inspiration from EU chemicals and product laws to achieve a more coherent and protective approach to the safety of food contact materials and articles. We insist in particular on the need for comprehensive, harmonized regulation of *all* FCMs, including paper and board as well as printing inks, based on a precautionary approach, combined with a shift in the effective burden of proof from public regulators to industry, better enforcement and improved transparency for consumers.

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