Screening tests for visible and non-visible set-off

Area of research interest: Chemical hazards in food and feed
Study duration: 2008-11-01
Project code: FS231076 (A03069)
Conducted by: Pira International

Exposure techniques and analytical methods were developed, which allowed the measurement of individual ink components on the food contact surface of packaging. Finally the extent of migration of these ink components from packaging into food was quantified.

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Background

Set off is defined as: 'the unintentional transfer of substances used in printing inks from the printed (outer) surface of materials and articles intended for food packaging to the inner food contact surface.

As a result of the finding of 2-Isopropylthioxanthone (ITX) in drinks packaged in multi-layer cartons, most likely as a result of set off, ink suppliers are now introducing polymeric photoinitiators (used in printing inks to speed up the drying process of the ink using ultra violet light) and synergists (which take part in the reaction involving the photoinitiator) as partial or complete replacements for monomeric photoinitiators and synergists. There is very little published data on the extent of transfer of these new compounds to food contact surfaces via set off and their subsequent migration into food.

The aim of this project was firstly to further develop screening test procedures capable of measuring the extent of visible set off (which can be seen by the naked eye) of these replacements and other ink components to the food contact surface of packaging. Secondly exposure techniques and analytical methods to quantify individual ink components on the food contact surface of packaging were developed to allow the measurement of non-visible set off. Finally the migration of ink components was measured in a variety of foodstuffs from specially prepared test films. The project will enable laboratories to identify printing ink components on unused food packaging, estimate worst case migration and thereby assist in the prevention of packaging transferring components to foods at undesirable levels.

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Research Approach

The objectives set in this project were to:

- Further develop the technology produced in a previously funded Agency project (A03010/11/12).
- To develop a test procedure for visible set off.
- Develop suitable (non-dietary) exposure techniques and analytical methods to enable identification and quantification of ink/varnish components; in collaboration with industry produce reels of packaged printing with inks/varnishes of known composition and quantify the extent of set off.
- Measure the extent of migration of selected components into food; and use the results of the above to develop a rapid screening method for set off.

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Results

The first part of this project successfully developed a scanner capable of detecting and measuring visible set off on the food contact surface of packaging. The scanner would be suitable as a quality control test for regulators and the food packaging industry to measure set off.

The second part developed exposure techniques and analytical methods for the measurement of individual ink components which may be present on the food contact surface of packaging, as a result of set off. The ink components were photoinitiators and synergists. A list of commonly used photoinitiators and synergists was established to create a library to enable the identification and measurement of the compounds looked for in this work.

Having developed exposure techniques, the next phase of this project successfully developed a procedure for measuring non visible set off (that cannot be seen by the naked eye) using extraction solvents. The measured set off was not always the same along the length of a roll of printed film. There was no significant effect on the set off results obtained after storage or in the different extraction solvents. Similarly, the application of pressure had no significant influence on results. Whilst it was not possible to replicate the storage pressures packaging may be subjected to on a roll in a factory setting, and it was not always possible to replicate 'real life' conditions in the laboratory, results tended to demonstrate that set off is not a food safety issue because of the low levels of printing ink components found to set off from the prepared films.

Finally, migration experiments were undertaken on a variety of foodstuffs using the specially prepared test films. These films contained known ink compositions at levels higher than would be expected in commercial applications. The objective was to promote set off to test the developed method and allow comparison of data. Migration often approaching 100% across the range of ink components was measured in a variety of foodstuffs. Significant migration (30 to 50%) was also observed into ‘Tenax’, a dry food simulant. Food simulants are used in the laboratory to mimic the characteristics and properties of foods. The developed procedure for testing printed packaging can be carried out within one working day to assist laboratories in identifying photoinitiators and synergists on unused packaging and estimate worst case migration for shelf life applications of six months or longer at room temperature. This work concentrated on method development and did not test examples of actual food packaging. It is intended for the methodology to be discussed with relevant stakeholders and used to inform future work on food packaging where set off could occur.

This research fits into the our strategic aim of 'safer food for the nation' and its objective of improving food safety by ensuring that the food produced or sold in the UK is safe to eat, by tackling contamination in the food chain.

Research report

England, Northern Ireland and Wales

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