Affect of additives on the migration of substances originating from colourants used in food contact plastics

Area of research interest: Chemical hazards in food and feed
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Project code: A03066
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Background

The aim of this project was to systematically investigate the effect of several common additives on the migration of colourants and associated substances. In particular, where applicable, the effect of slip agents and anti-stats that are designed to 'bloom' to the surface of plastics was investigated.
This was a follow-on project building on work undertaken in the Food Standards Agency Project A03045, which reported on the migration of colourants and colourant impurities into food simulants. However, in order to avoid over complicating the analyses and to allow colourant related migrants to be readily identified, one variable that was deliberately not investigated in project A03045 was the effect of additives such as slip agents and anti-static. In the process of 'blooming' it is possible that the additives may also exaggerate the migration of other substances present, including those originating from colourants.

Research Approach

In collaboration with industry, 24 of the most commonly used colourants with plastic food contact applications were selected. The colourants were obtained from a number of different sources and countries of origin and screened, using solvent extraction, for the presence of impurities and potential migrants. The solvent extracts were analysed using gas chromatography-mass spectrometry (GC-MS) and liquid chromatography-mass spectrometry (LC-MS) procedures.

Following this initial screening, 7 colourants were selected for further investigations and suitable colourant/additive/plastic combinations were prepared for migration testing. In total, 15 different plastic/additive/colourant blends were prepared. For each plastic there were 2 blends each with a different additive. The plastics used in the testing were high density polyethylene (HDPE), low density polyethylene (LDPE), polypropylene (PP) and polyethylene terephthalate (PET). Additives were slip agents, antistats or colourant carriers (used in PET only). A third blend of plastic and colourant with no additive was also prepared to act as a control sample. In all cases the colourants and additives were incorporated into the plastic at their highest level to give the worst case values.

Test conditions were selected to represent the most severe conditions that the plastic would encounter in practice. In some cases, to give as much information as possible, more than 1

colourant was blended into a sample. Migration from the samples was measured both on receipt and after storage for approximately 3 months.

Results

It was possible to identify 75% of the potential chemical migrants found in the 24 colourants investigated. As in the previous project, those colourants produced in China and India appeared to contain more potential chemical migrants than those originating from Europe.

In general, migration was found to be low with no migration found from LDPE. Migration into the simulant 95% ethanol was found to be more severe than into isooctane for PET but was less severe than isooctane for the HDPE and LDPE. No migration was detected into the aqueous simulants 10% ethanol and 3% acetic acid from any of the test samples.

The presence of additives in PET did not effect the migration of colourant associated substances to any significant extent, however, the additives used in this polymer were not intended to bloom to the surface. Long term storage did increase migration of Solvent Yellow 114 by a factor of at least 4 fold in all samples including the control sample. For high density PET in general migration was not affected by the additive, however, for 1 compound, which could not be identified, migration increased by a factor of 2.7 over the control sample, when the anti-static additive blend was present. The mass spectrum indicated that this was a chlorinated compound. PP was blended with Pigment Blue 15:1, 3 of the 10 components found in the colourant migrated, all long chain fatty acid esters. The presence of additives increased migration both when the samples were tested on receipt and when tested after storage.

These findings could hold true for other migrants not related to colourants, therefore prediction of migration using migration modelling may give underestimations when additives that are designed to bloom to the surface are present.

Additional Info

A03045: To identify chemicals that could migrate into foodstuffs from pigments and dyes, and measure the migration of these chemicals into food simulants

Research report

England, Northern Ireland and Wales

PDF
View Investigation into the effect of additives on migration of substances originating from colourants used in food contact plastics as PDF(Open in a new window) (226.68 KB)