"Barriers on recycled paperboard" Project Description – Phase 2

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The present description of the project phase 2 is basically based on that of the phase 1. From the learnings gained of the 1st project phase, the method for the second phase will be adjusted and specified, so that the model conditions of the measurement are as close as possible to reality.

Learnings and outcome of project 1

The first project phase, started in summer 2015 and completed in May 2016, was an important piece for learning. In short: the test method needs revision, because most samples were not really suitable (the barrier was not applicated on recycled paperboard), and with respect to the used criterion of the "SVI Guideline 2015.01_internal bags", performance was mostly unsatisfactory. Improvement is needed on numerous aspects, which will be tackled in the project phase 2. The scope is finding solutions that are acceptable for all stakeholder, including food industry and authorities. The solutions should be sustainable, i.e. cover all potential migrants, not only mineral oil.

The first project phase showed that the migration through the barrier strongly depends on the properties (in particular the adsorptivity or absorptivity) of the paperboard carrying the barrier; the paperboard influences the pressure onto the barrier. As a consequence, the testing procedure was adjusted during phase 1: in a first step, the paperboard carrying the barrier was loaded with the surrogate substances and the load measured. In a second step, the migration through the barrier was determined with the donor no longer being attached. In this way, unequal partitioning of the surrogate substances between the donor and the sample was matched (in many cases only a small proportion of the surrogate substances was transferred to the support of the barrier, which made the results look worse). However, the migration still depended on the characteristics of the support material. Hence, barriers should be tested with a support corresponding to the real application, i.e. recycled paperboard.
The adjusted version of the testing procedures still struggles with the problem of the slow absorption into recycled paperboard: the polar surrogate substances are slowly absorbed into solid parts, which reduces their pressure onto the barrier over time. As an example, in one of the tests of a recycling paperboard with a barrier, migration rather rapidly exceeded 1 % for MBP (4-Methylbenzophenon), while that of C17 (n-Heptadecan) remained clearly below 1 %. This test was performed without conditioning, as the procedure used does not allow conditioning of the paperboard carrying the barrier without that migration into and through the barrier starts. It seems likely that with a conditioned paperboard much of the loaded MBP would have penetrated solids. This would have reduced the vapor pressure and, hence, the migration of MBP. It is uncertain which "reality" should be simulated in the test and how this could be achieved. For the application of the barrier onto paperboard previously stored for some time, preconditioning would be appropriate (accounting for the time the substances had to enter the solids), but how is the situation of a freshly prepared paperboard to which the barrier is immediately applied? The same problem is encountered for the set-off test. Accurate simulation is particularly important, when barriers do not have a margin in efficiency.
Tests at 60°C seem to be prone to change the barrier performance. Warming to accelerate migration is inevitable to avoid exceedingly long durations of tests, but results obtained for some of the samples may have been affected by too high a temperature.
Preliminary data on the set-off during storage of the paperboard in stacks or on reels indicate that this transfer needs to be taken serious. Simulation for 1 year of set-off contact by 2 weeks at 60 °C

resulted in transfer exceeding 1 % in most cases, i.e. the migration exceeded the specification even when transfer through the barrier was negligible. A drastic case are food contact layers consisting of polyolefins (e.g. protecting the barrier layer), since these rapidly extract the adjacent recycled paperboard. As a rule of thumb, efficient barrier materials at the food contact surface also reduce set-off, since the contaminants from the contacted paperboard penetrate them less deeply. It remained an open question whether (and possibly under what conditions) set-off is the dominant mechanism of transfer to the food.
The barrier efficiencies determined in the first project phase were mostly modest or insufficient to fulfil the specification set out by the "SVI Guideline 2015.01_internal bags". It should be kept in mind that for barriers on the paperboard the migration starts at the moment the barrier is applied, which may be quite some time before packaging the food. For this reason, the efficiency of a barrier on paperboard should be higher than for internal bags.

Proposal for project 2

Project outline

It is proposed to amend tests in the following respects:

1. Test material: support of the barrier to be tested should consist of recycled paperboard.
2. Test material: The food contact layer should consist of an efficient barrier material to minimize set-off.
3. Test material: It might be possible to improve the efficiency of the barrier, e.g. by a thicker or doubled coating.
4. Test material: Samples should be stored/shipped in a way ruling out set-off by C17 from the mineral oil in the recycled paperboard. This can be achieved with an aluminum foil between the sheets or by placing barrier on barrier and paperboard on paperboard, i.e. by reversing every second sheet. Otherwise, blank tests will be needed to determine set-off before migration testing.
5. The 2-stage testing procedure outlined above will be applied, with measured load of surrogates from a donor onto the recycled paperboard.
6. The highest testing temperature will be 50°C (instead of 60°C), assuming acceleration by a factor of 12 compared to the regulatory ambient temperature of 25°C. If, as a modest requirement, it should be possible to store the paperboard before packaging the food during 6 months and the packed food has a shelf life of 6 months, the barrier should respect the 1 % specification during 1 year, which corresponds to a test during 1 month at 50°C. Of course, also tests at 40°C will be needed in some cases.
7. Tests on set-off will be performed for all samples. As no procedure is established, the applied method still needs refinement. It is anticipated that the food contact surface of barrier will be brought into contact with a donor prepared with recycled paperboard during 2 and 4 weeks at 50 °C (0.5 and 1 year) as well as 5.5 weeks at 40 °C (0.5 years). The barrier (together with the supporting paperboard) will be extracted. It is assumed that half of the material will diffuse outwards again into the food.

In parallel, an alternative testing procedure will be explored and, if successful, applied to the samples: instead of surrogate substances, substances selected from those commonly present in recycled paperboard will be used. This circumvents the uncertainty around the absorption into solids. The envisioned procedure starts with the extraction of the sample for quantitation of the substances originally in the paperboard. These values will then be used to calculate the migration into the

silicone paper (receptor). Since concentrations are lower and chromatograms disturbed by other substances, possibly also by blank problems, the analysis will be more demanding and rely either on GCxGC or GC-MS (GC: Gas chromatography, MS: Mass spectrometry). This new procedure will enable to evaluate the procedure with surrogate substances and provide the base for further decisions.

Test material

In order to obtain a more complete picture of the situation, also samples from the market of producers not participating at the project will be welcome. If there is no paperboard available as such, these samples may also be boxes of packed food.

For the analyze we request test materials in DIN A4 format.

The test materials should be accompanied by a detailed description of the structure. If it's necessary the surface of contact should be marked.

Particularly in the case of test materials with a coating, a specification of the pages is required, for coat the surrogat substance on the rigth side.

Project phase 2 is characterized by the following features :

- more efficient barrier coatings (test materials) to reduce "set-off "
- Acceleration of migration at max. 50 ° degrees (instead of 60 ° degrees), if required also at 40 ° degrees
- Advancement of the phase 1 test "Migration through set-off", examination of all submitted test materials

Option 1: Testing of selected packaging already introduced in the market

Option 2: Migration by creasing, folding, relief embossing and cutting edges

Option 3: Development of a measurement method to verify the migration with selected known contaminants present in recycling carton.

For further information please contact us:

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Financing

The costs for project phase 2 are budgeted to CHF 50,000.
The project costs per participant are dependent on the number of participants as well as on the number of submitted and tested materials.
The project participants are invited to become JIG Supporter, as well.

Timeline

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