

## Deliverable 5.2

### Technical report on the migration tests carried out on bottles Specific migration of colorant

In order to evaluate the color migration into edible oils, from colored PET and R-PET bottles, according to Reg UE 10/11, colorant migration tests have been carried out using sunflower oil as simulant D.

In particular, the oils in contact with colored packages have been analyzed by VIS spectrophotometer at a wavelength range from 400 to 750 nm. A comparison was also made analyzing the same sunflower oils filled in clear PET. According to the above mentioned EU regulatory, it is possible to assess that no colorant migrate into the oils if the analyzed value of Transmittance is greater than 95%. The determination of migration of the colorant was also carried out after 40 and 90 days of contact at 40°C, in order to evaluate the packaging behavior even in more critical conditions.

#### Method Description

Sunflower oil (provided by Olio Dante S.p.A.) was bottled in 1 liter 31 g PET bottles produced by blow-molding according to the Optimized Blowing Condition described in Deliverable 3.7.

The preform used for this test were produced with different PET material and in particular, they were characterized by different R-PET content. The detail of PET production are described in the report of Deliverable 3.6.

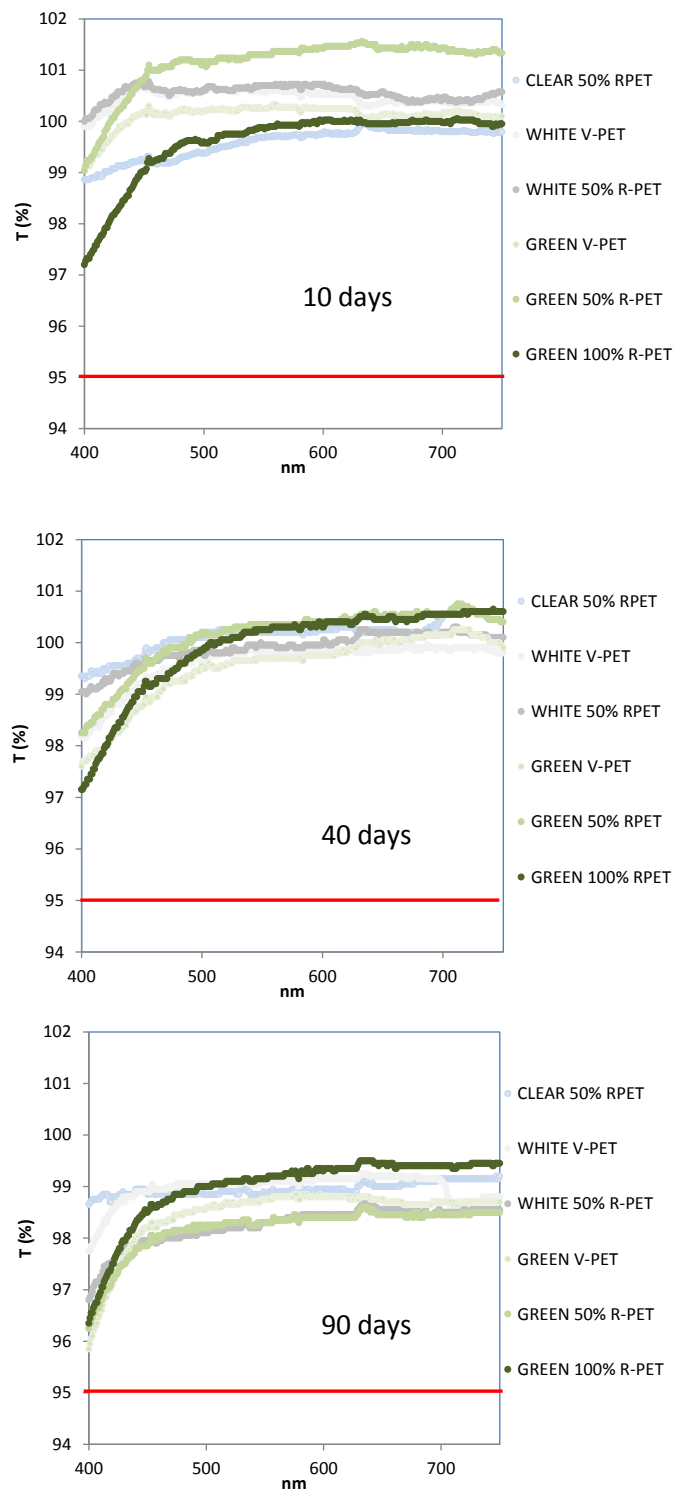
The filled bottles (PET standard or with different R-PET content) were maintained in a climatic chamber at 40°C up to three months and at 10, 40 and 90 days the spectrophotometric acquisition in the 400-750 nm range was carried out. The following table resumes the experimental plan used for the test:

TEST IN ACCELERATED CONDITIONS (oven at 40°C)			
Bottles	Duration of the test	Analysis on the oils	Sampling
Clear PET	90 days	Transmittance (%) from 400 to 750 nm	10, 40 and 90 days



**Photo 1.** PCR-PET and PET bottles filled with sunflower oil stored in a climatic chamber for 90 days at 40°C for the accelerated shelf-life test.

The results are shown in the following Figure 1:



**Figure 1.** Results of specific migration of colorants carried out on clear 50%R-PET bottles, white and green bottles in virgin and recycled PET.

The transmission expressed in simulants was always lower than the 95% and, therefore, all the bottles in the V-R-PET and PET are manufactured in compliance with the law as regards the specific migration of the dye.

Moreover, in order to assess the safety in use of the produced bottle at different percentage of R-PET, Global and Specific Migration analyses were carried out by external certified laboratories.

The following table 2 reports the results of global migration tests performed on the produced bottles using the D simulant according to Reg EU 10/11.

**Table 2: Global migration analyses results carried out with Simulant D on PET and R-PET bottles produced for RepackEdoils Project**

Global analysis simulant	Migration in D	Surface/Volume ratio	Contact Time [days]	Temperature of storage for the contact [°C]	Global Migration [mg/kg]	Reference values Reg EU 10/11 [mg/kg]
100% V-PET Bottles		0,6	10	40	<2	≤10
100% R-PET Bottles		0,6	10	40	<2	≤10
50% R-PET/V-PET clear bottles		0,7	10	40	<2	≤10
50% R-PET/V-PET colored bottles		0,7	10	40	<1,5	≤10

Finally, the specific migration tests were carried out on the produced bottles to verify the migration of PET’s monomers such as Glycols, Phthalic acids and of the Antimony used as catalyst of PET synthesis. All these substance, regulated by Reg EU 10/11, are present in the PET polymer and could migrate from the package to the food.

Table 3: Specific migration analyses results carried out with Simulant D on PET and R-PET bottles produced for RepackEdoils Project

Specific analysis simulant	Migration in D	Surface/Volume ratio	Contact Time [days]	Temperature of storage for the contact [°C]	Glycols Migration [mg/kg]	LMS(T) Reg EU 10/11 [mg/kg]
100% V-PET Bottles		0,6	10	60	n.r.	≤ 30
100% R-PET Bottles		0,6	10	60	n.r.	≤ 30
50% R-PET/V-PET clear bottles		0,7	10	60	Traces	≤ 30
50% R-PET/V-PET colored bottles		0,7	10	60	n.r.	≤ 30
Specific analysis simulant	Migration in D	Surface/Volume ratio	Contact Time [days]	Temperature of storage for the contact [°C]	Phthalic Acids Migration [mg/kg]	Reference values Reg EU 10/11 [mg/kg]
100% V-PET Bottles		0,6	10	60	n.r.	≤5
100% R-PET Bottles		0,6	10	60	n.r.	≤5
50% R-PET/V-PET clear bottles		0,7	10	60	n.r.	≤5
50% R-PET/V-PET colored bottles		0,7	10	60	n.r.	≤5
Specific analysis simulant	Migration in D	Surface/Volume ratio	Contact Time [days]	Temperature of storage for the contact [°C]	Antimony	LMS Reg EU 10/11 [mg/kg]



100% V-PET Bottles	0,6	10	60	n.r.	=0,04
100% R-PET Bottles	0,6	10	60	n.r.	=0,04
50% R-PET/V-PET clear bottles	0,7	10	60	n.r.	=0,04
50% R-PET/V-PET colored bottles	0,7	10	60	n.r.	=0,04