

# Migration of selected hydrocarbon contaminants into dry pasta packaged in direct contact with recycled paperboard



**Acknowledgments:** authors of this work are **Laura Barp** and **Sabrina Moret** ([sabrina.moret@uniud.it](mailto:sabrina.moret@uniud.it)), University of Udine, Dept. Food Science, Via Sondrio 2/A, Udine, Italy and **Michele Suman** and **Francesca Lambertini**, Barilla G. R. F.lli SpA, Food Research Labs, Parma, Italy.

-) Barp L., Suman M., Lambertini F., Moret S. Migration of selected hydrocarbon contaminants into dry pasta packaged in direct contact with recycled paperboard. *Food Addit Contam Part A*, 2015; 32(2):271-83.  
-) Barp L., Suman M., Lambertini F., Moret S. Migration of selected hydrocarbon contaminants into dry semolina and egg pasta packed in direct contact with virgin paperboard and polypropylene film. *Food Addit Contam Part A*, 2015; 32(9):1542-51.



Legislation governing the use of recycled paper in food contact materials made of paperboard has not yet been harmonized in the European Union. Italy and some others European countries such as Germany and the Netherlands explicitly allow the use of recycled paperboard with some limitations, while Switzerland and Austria recommend to not use it in direct contact with food. In Italy the use of recycled paperboard is allowed only in contact with dry, non-fatty foods, such as pasta, cereals, flour, sugar and rice. Migration of undesirable hydrocarbon contaminants such as diisopropyl naphthalene (DIPN) and Mineral Oil Hydrocarbons (MOHs) can occur in food during its shelf life (Lorenzini et al. 2013).

It has been recently recognized that exposure to MOHs via packaging could contribute significantly to the total exposure to these contaminants and may pose a human health hazard, which has not yet been fully elucidated (EFSA 2012).

Moreover, migration of polyalphaolefins (PAO), mainly co-eluting with MOSHs (Saturated Hydrocarbons), and sometimes also with MOAHs (Aromatic Hydrocarbons), can occur from hot-melt adhesives used to seal cardboard packaging. They have a synthetic origin and their presence can be recognized because they form rather narrow humps of unresolved branched hydrocarbons with a regular distance between them (Biedermann & Grob 2012).

In the present work, migration of MOHs and DIPN from recycled paperboard boxes in direct contact with dry pasta (both semolina and egg pasta) has been monitored during shelf life at regular times (up to two years). Since some paperboard boxes were sealed with a hot-melt adhesive, the contribution due to the migration of PAO from this adhesive was also evaluated.

# Migration of selected hydrocarbon contaminants into dry pasta packaged in direct contact with recycled paperboard



## Instrumental Setup:

### Instrumentation:

LC-GC 9000, Brechbühler, Zurich, Switzerland (<https://www.brechbuehler.ch/LC-GC.1329.0.html>)

**LC column:** Lichrospher Si 60, 5  $\mu\text{m}$ , 25 cm x 2.1 mm i.d. (DGB, Schlossboeckelheim, Germany).

LC conditions: gradient elution starting with hexane (0.1 min) and reaching 30% of dichloromethane (at 300  $\mu\text{L}/\text{min}$ ) in 0.5 min.

Injection volume: 20-100  $\mu\text{L}$ .

LC-GC interface: Y-interface.

### GC instrument and conditions:

Trace GC Ultra from Thermo Scientific (Milan, Italy).

Oven program: 53°C (5.5 min), 40°C/min 350°C (4min).

Carrier Gas: hydrogen, 4 mL/min (constant flow).

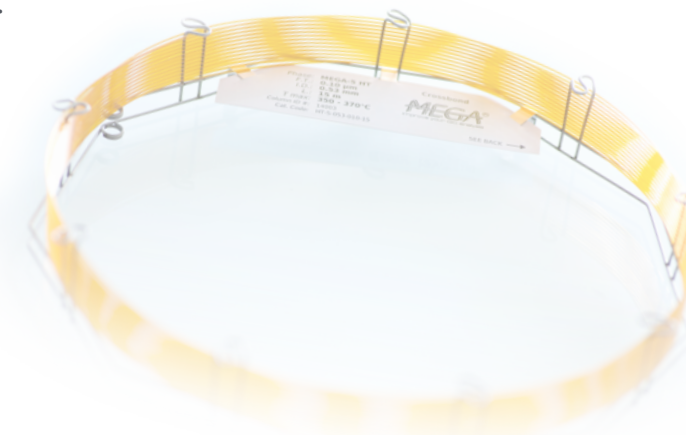
Detector: FID 360°C.

### GC column set:

**Pre-column (Retention-Gap):** MEGA, 10m, 0.53mm I.D., DPTMDS deactivated (MEGA catalog code: RETGHT-DPTMDS-053-10).

**GC column:** MEGA-PS255 - 0.25mm x 0.15 $\mu\text{m}$  x 15m (MEGA catalog code: C-PS255-025-015-15).

20 min total analysis time.



**Acknowledgments:** authors of this work are **Laura Barp** and **Sabrina Moret** ([sabrina.moret@uniud.it](mailto:sabrina.moret@uniud.it)), University of Udine, Dept. Food Science, Via Sondrio 2/A, Udine, Italy and **Michele Suman** and **Francesca Lambertini**, Barilla G. R. F.lli SpA, Food Research Labs, Parma, Italy.

### Complete works references:

-) Barp L., Suman M., Lambertini F., Moret S. Migration of selected hydrocarbon contaminants into dry pasta packaged in direct contact with recycled paperboard. *Food Addit Contam Part A*, 2015; 32(2): 271-83.

-) Barp L., Suman M., Lambertini F., Moret S. Migration of selected hydrocarbon contaminants into dry semolina and egg pasta packed in direct contact with virgin paperboard and polypropylene film. *Food Addit Contam Part A*, 2015; 32(9):1542-51.

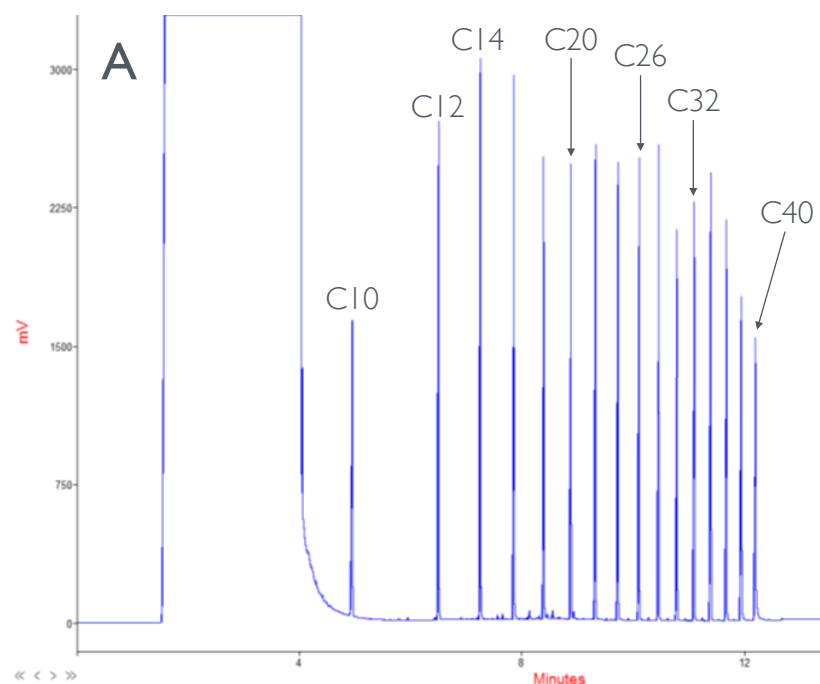


[www.mega.mi.it](http://www.mega.mi.it)

# Migration of selected hydrocarbon contaminants into dry pasta packaged in direct contact with recycled paperboard

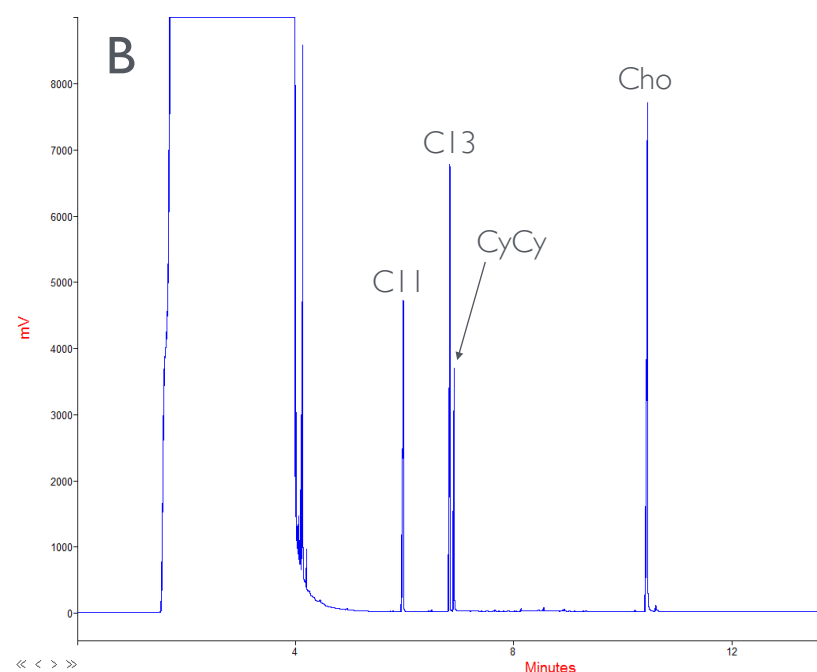


On-line LC-GC-FID chromatograms of an n-alkane standard mixture (C10-40, 0.25 µg/mL each) (**A**) and of the internal standard mixture used for quantifications and to check efficient MOSHs and MOAHs separation and volatile losses (**B** and **C**):



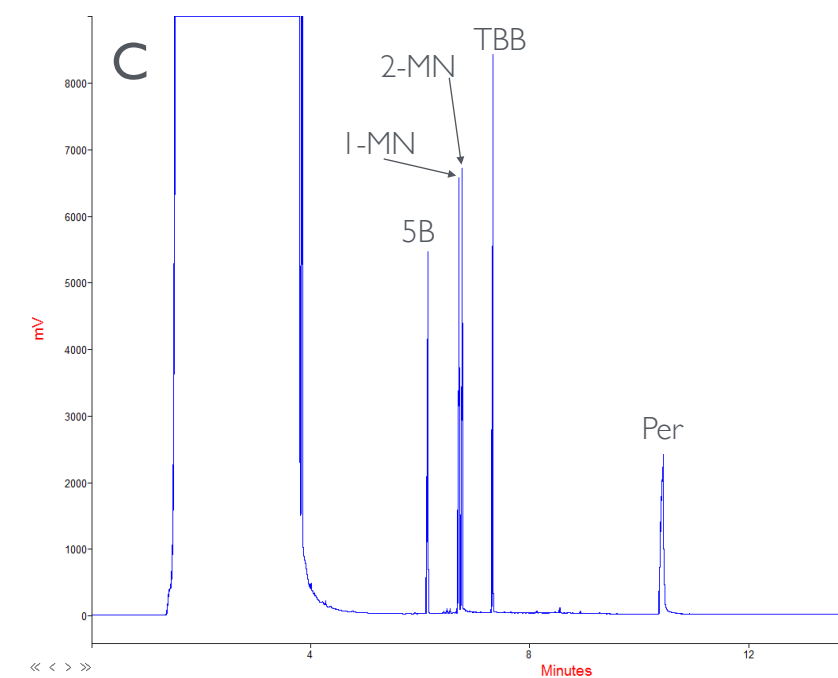
N-Alkanes C10-C40

**A:**  
C10 - C40 mix (0.25 µg/mL each)  
n-alkanes standard reference.



MOSHs (Mineral Oil Saturated Hydrocarbons)

**B:**  
-) n-C11 (0.6 µg/mL)  
-) n-C13 (0.3 µg/mL)  
-) CyclohexylCyclohexane (CyCy) (0.6 µg/mL)  
-) 5-alpha-cholestane (Cho) (1.2 µg/mL)



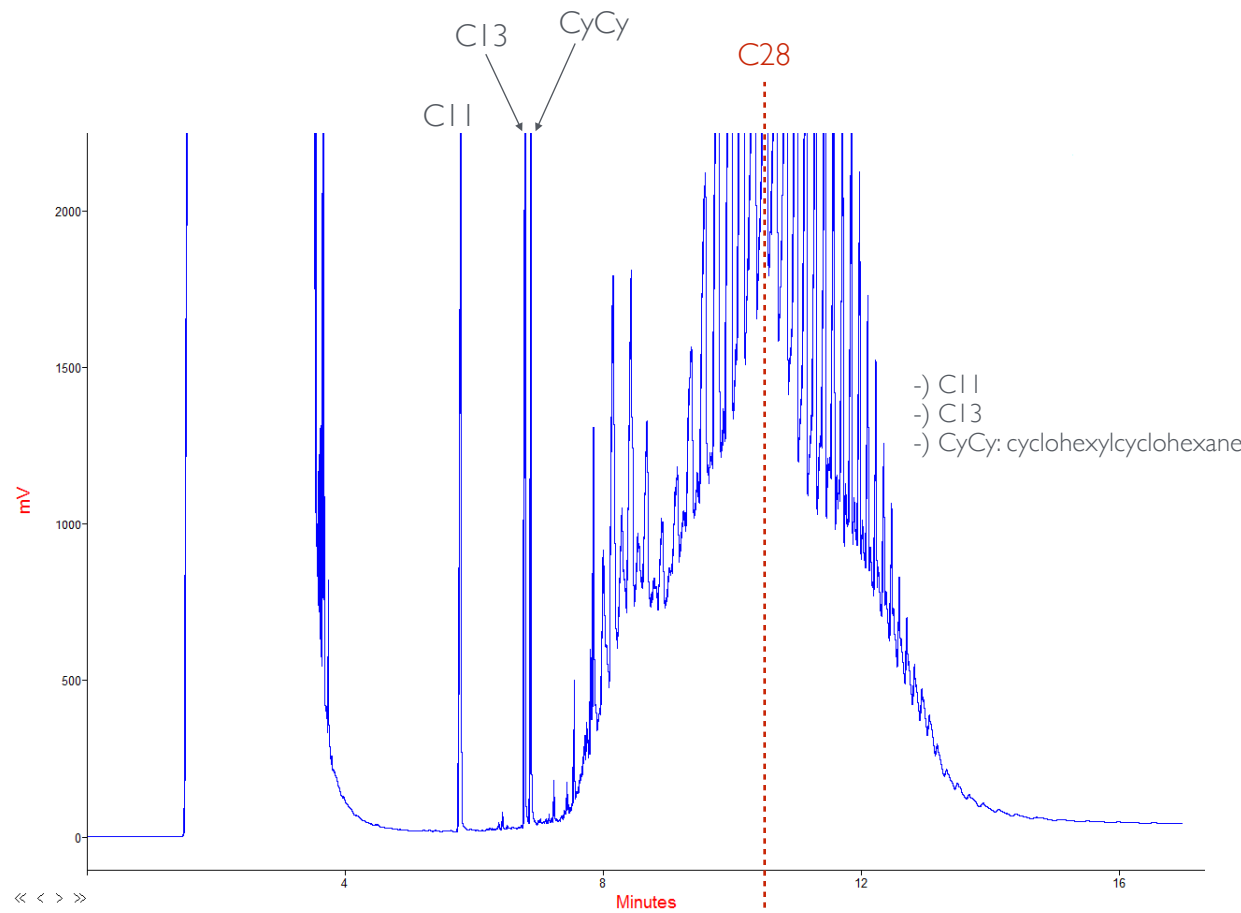
MOAHs (Mineral Oil Aromatic Hydrocarbons)

**C:**  
-) n-pentylbenzene (5B) (0.6 µg/mL)  
-) 1-methylnaphthalene (I-MN) (0.6 µg/mL)  
-) 2-methylnaphthalene (2-MN) (0.6 µg/mL)  
-) Tritert-butylbenzene (TBB) (1.2 µg/mL)  
-) Perylene (Per) (1.2 µg/mL)

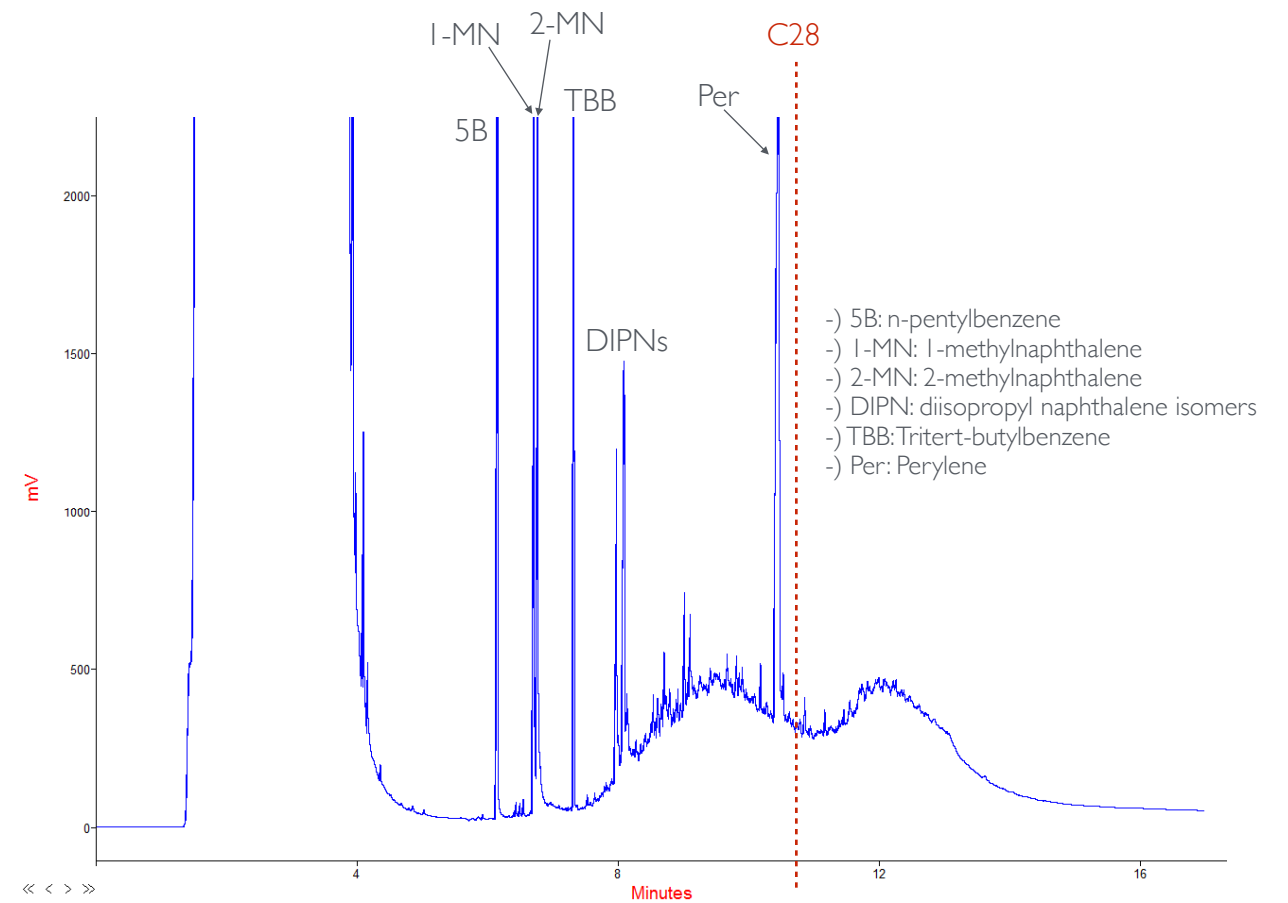
# Migration of selected hydrocarbon contaminants into dry pasta packaged in direct contact with recycled paperboard



On-line LC-GC-FID (MOSHs and MOAHs fraction, with internal standards) chromatograms of a recycled paperboard packaging before food contact:



Recycled Paperboard packaging MOSHs fraction

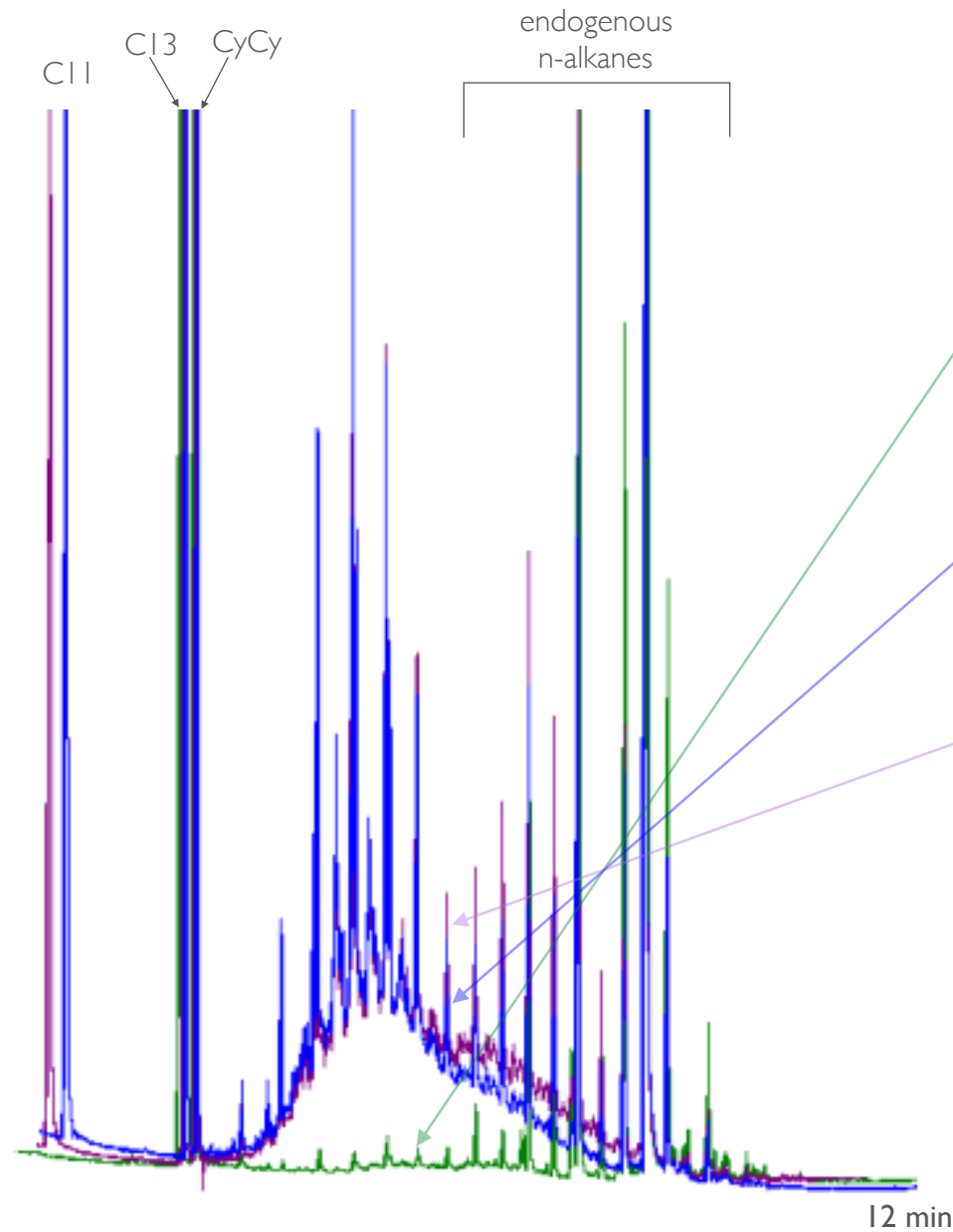


Recycled Paperboard packaging MOAHs fraction

# Migration of selected hydrocarbon contaminants into dry pasta packaged in direct contact with recycled paperboard



Monitoring during time of MOSHs traces profile of a semolina pasta in contact with recycled paperboard:



**T0:** MOSHs profile of a semolina pasta before the contact with recycled paperboard

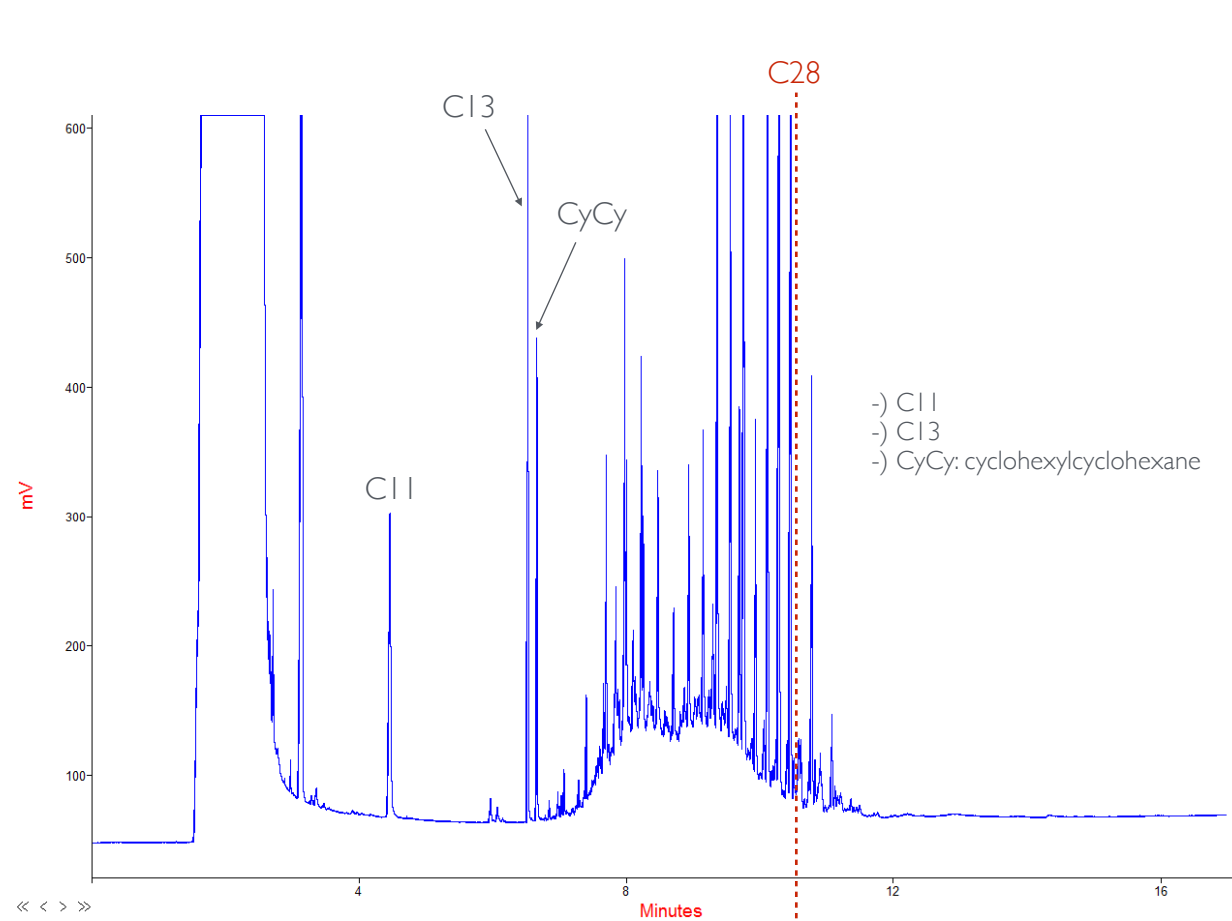
**T1:** MOSHs profile of a semolina pasta after **1 month** of contact with recycled paperboard

**T3:** MOSHs profile of a semolina pasta after **3 month** of contact with recycled paperboard

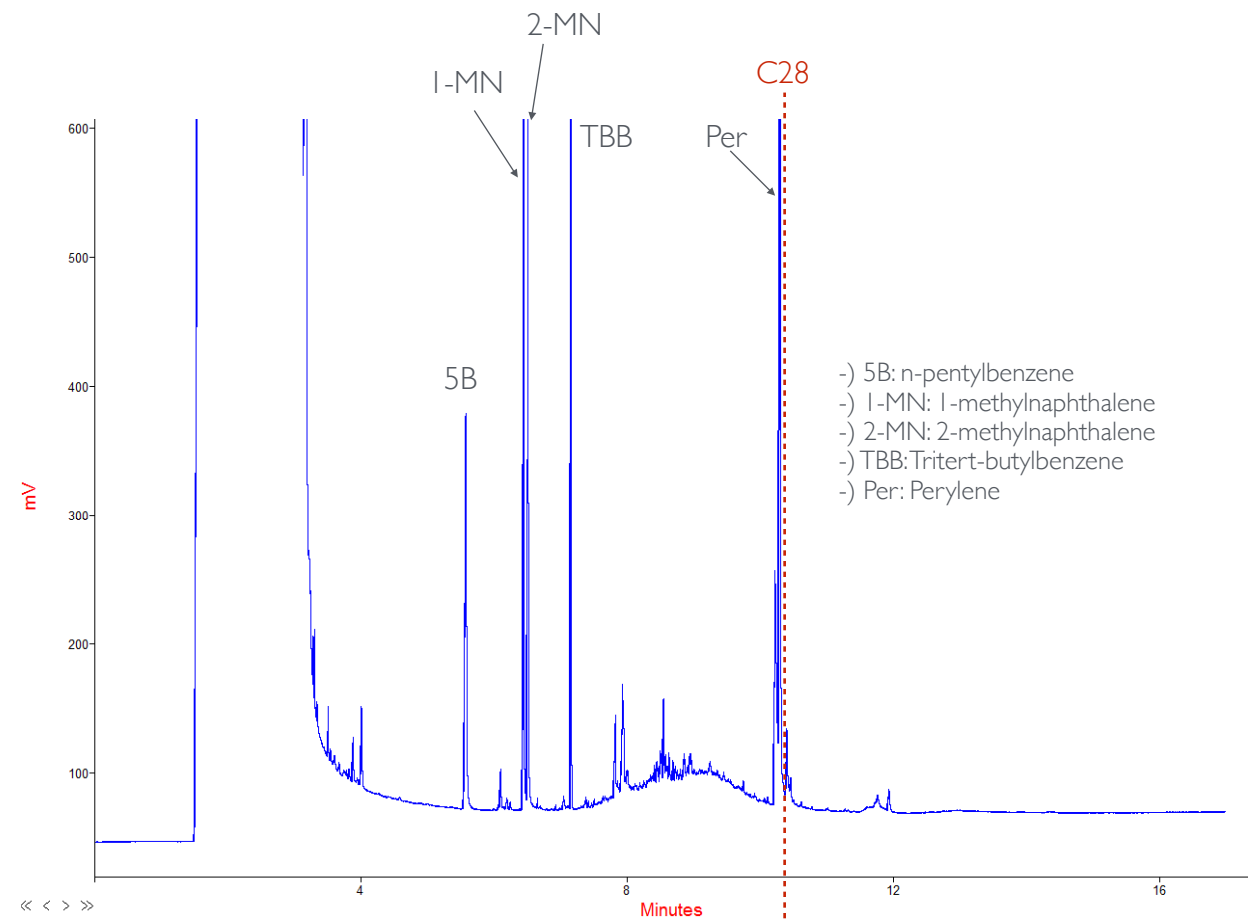
# Migration of selected hydrocarbon contaminants into dry pasta packaged in direct contact with recycled paperboard



On-line LC-GC-FID chromatograms (MOSHs and MOAHs fraction) of an egg pasta sample stored (15 months) in direct contact with the recycled paperboard:



MOSHs fraction of egg pasta stored for 15 months in contact with Recycled Paperboard packaging



MOAHs fraction of egg pasta stored for 15 months in contact with Recycled Paperboard packaging



**Acknowledgments:** authors of this work are **Laura Barp** and **Sabrina Moret** ([sabrina.moret@uniud.it](mailto:sabrina.moret@uniud.it)), University of Udine, Dept. Food Science, Via Sondrio 2/A, Udine, Italy and **Michele Suman** and **Francesca Lambertini**, Barilla G. R. F.lli SpA, Food Research Labs, Parma, Italy.

**Complete works references:**

- ) Barp L., Suman M., Lambertini F., Moret S. Migration of selected hydrocarbon contaminants into dry pasta packaged in direct contact with recycled paperboard. *Food Addit Contam Part A*, 2015; 32(2):271-83.
- ) Barp L., Suman M., Lambertini F., Moret S. Migration of selected hydrocarbon contaminants into dry semolina and egg pasta packed in direct contact with virgin paperboard and polypropylene film. *Food Addit Contam Part A*, 2015; 32(9):1542-51.

Many thanks to all the authors for the continuous cooperation and availability and for the great analytical results shared.



[www.mega.mi.it](http://www.mega.mi.it)