CHARACTERIZATION OF FOOD-CONTACT POLYCARBONATE BY UHPLC/MS*

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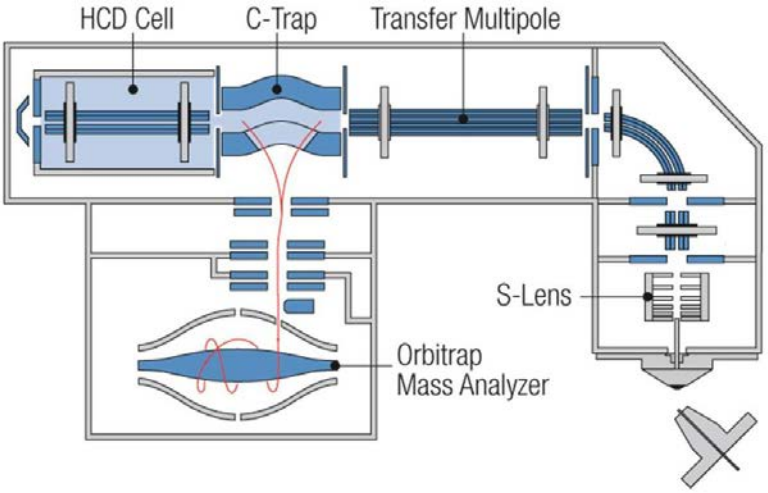
In this work, a new line of hybrid high resolution-mass spectrometer was employed for characterization of food-contact polycarbonate. After a total dissolution of the plastic material and the extraction of its components, data-dependent experiments were conducted with the aim of unequivocally identifying plastic additives, potential BPA-polycarbonate degradation products and organic dyes.



Construction details of the Q-Exactive

Caratterizzazione di materiale plastico destinato al contatto con alimenti mediante UHPLC/MS
Il presente lavoro riguarda la caratterizzazione di materiale plastico in policarbonato destinato al contatto con gli alimenti. A tal fine è stato utilizzato uno spettrometro di massa ibrido ad alta risoluzione. Dopo la completa dissoluzione del materiale plastico ed estrazione dei componenti sono stati identificati additivi plastici, coloranti organici e potenziali prodotti di degradazione.

Food contact materials are all materials and articles intended to come in contact with food, such as packaging and containers, kitchen equipment, cutlery and dishes. The safety of materials in contact with food must be evaluated as molecules can migrate from materials into food. Plastic additives, which are present in small amounts in plastics (generally ranging from 0.1% and 1%) are dispersed in the polymer matrix to avoid effects like the thermo-oxidative deterioration, which initiates scission and cross-linking of the macromolecular chains and, consequently, the deterioration of the polymer. The polymer has got an inert structure with a high molecular weight. Since the organism cannot absorb molecules with a molecular weight greater than 1,000 Da, the polymer represents a low potential risk for human health. On the contrary, as plastic additives have generally low molecular weight, they represent potential migrants from plastics into foods and, for this reason, a potential risk for human health. Moreover, in polymer matrices it is possible to find colorants, monomers and oligomers that have not reacted in the polymerization reactions, and non-intentionally added substances (NIAS) such as impurities of plastic additives.

In order to protect consumer, European Commission Directives 1935/2004/CE, 2023/2006/CE and 10/2011/UE are the most important regulations that governs plastic materials intended to come in contact with food. The last one, Directive 10/2011/UE, also defined as Plastic Implementation Measure (PIM), summarizes a guideline concerning the manufacture of plastic to come in contact with food. Regarding colorants, they are regulated by the national legislation; in particular, in Italy, all colorants (organic and inorganic) can be used providing that no migration occurs in food or in simulants. Polycarbonate is a very widespread plastic, and the ubiquity of its monomer bisphenol A in the environment is a worldwide scientific and public concern due to the persistence and endocrine disrupting properties of this compound.

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Until now, a lot of scientific data regarding bisphenol A and plastic additives migration in food simulants are reported[1]. However, characterization of plastic material composition is of paramount importance considering the possible occurrence of the several unknown molecules above cited.
In this work, a new line of hybrid high resolution mass spectrometer (Q-Exactive) after capillary-UHPLC separation was exploited for characterization of BPA-polycarbonate employed for food contact. Data-dependent experiments (DDA) for targeted and untargeted analysis were employed after a total dissolution of polycarbonate samples and extraction of its components without any other sample treatment. In the field of food-contact plastics the utility of this acquisition mode has not yet been evaluated and exploited[2]. DDA combined with high mass accuracy of orbitrap technology allowed to identify for the first time some possible polycarbonate degradation products and organic colorants. As the best's author knowledge there are no scientific data about organic colorants effectively used in polycarbonate plastics intended to come in contact with food. Organic colorants are generally low-molecular weight compounds and, for this reason, represent a potential risk for human health. This project can be useful for supporting food companies which have obtained declarations of conformity for plastic material involved in food processing but are not aware of its composition.

References

[1]A. Ballesteros-Gómez, S. Rubio, D. Pérez-Bendito, *J. Chromatogr. A,* 2009, **1216**, 449.
[2]C.W. Klampfl, *Trends Anal. Chem.,* 2013, **50**, 53.