Abstract

The pursuit of sustainability in all aspects of public life is currently a fundamental global responsibility, due to the constantly deteriorating state of the environment. Numerous regulations have been introduced in the packaging sector (including the Plastics Directive). Based on these, new biodegradable and recyclable food contact materials (FCMs) have appeared on the consumer market, which may raise food safety concerns. The doctoral dissertation carried out a comprehensive characterization of the interactions between newly introduced FCMs and food. For this purpose, 13 FCMs (of plant origin, bio-based plastics) were selected and subjected to migration tests under different time and temperature conditions, using food or food simulants of different nature. A wide spectrum of chemical compounds (untargeted approach) and migration markers (targeted approach) were determined using analytical, sensory and statistical tools. This enabled the identification and quantification of various organic and inorganic contaminants that can easily migrate from FCMs to food and affect its sensory profile and quality. The obtained results clearly showed that some plant-based FCMs can distort the sensory profile of coffee and tea. Chemical compounds affecting noticeable undesirable changes include saturated and unsaturated carbonyl compounds (e.g., Strecker aldehydes: 3-methylbutanal and 2-methylbutanal), and saturated alcohols (e.g., hexan-1-ol, heptan-2-ol, octan-3-ol). In order to assess the influence of various factors (time and temperature of FCM-food contact, microwave radiation, type of food, chemical composition of food) on the intensity of FCM-food interactions, low-molecular-weight carbonyl compounds were selected as markers of undesirable changes. These compounds are ubiquitous in the environment, are reactive and undergo dynamic changes, and the optimized measurement procedure used allowed their monitoring at low concentration levels (ng/L). Consumer exposure to particularly hazardous compounds migrating (e.g., formaldehyde, bisphenol-A, toxic elements) from new FCMs to food was also estimated using specific migration limits (SML) or tolerable daily intake (TDI). The presented results and discussion provide a basis for deepening knowledge and understanding the nature of currently popular FCMs and their impact on the environment, and especially on food.