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Occurrence of 15 + 1 EU priority polycyclic aromatic hydrocarbons (PAH) in various types of tea (Camellia sinensis) and herbal infusions.

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Abstract

For the analysis of 15 + 1 EU priority PAH in tea and herbal infusions, an online-SPE-LVI-GC-MS method was developed. This method includes sample extraction of the tea and herbal infusions with saponification followed by an automated SPE clean-up step. For brews a liquid-liquid extraction with cyclohexane was performed before an automated SPE clean-up. Gas chromatographic separation was done using an Agilent J&W Select PAH (15 m × 0.15 mm × 0.10 µm) column, which allows the separation of the three benzofluoranthenes as well as triphenylene from chrysene. Method performance criteria such as method linearity, limit of quantitation (LOQ) and repeatability were determined and demonstrated that the method was fit for purpose. The method was used to analyse 15 + 1 EU priority PAH in 91 tea and herbal infusion samples. The levels of PAHs ranged from below 0.5 (LOQ) to 460 µg kg⁻¹, with a median of 4.7 µg kg⁻¹ and a mean of 39 µg kg⁻¹ for BaP, and from below 1.0 (LOQ) to 2700 µg kg⁻¹, with a median of 39 µg kg⁻¹ and a mean of 250 µg kg⁻¹ for total PAH, which were in good agreement with other studies reported in the literature. For the brews prepared under normal house preparation (20 g material in 2 L boiling tap water for 10 min), no total 15 + 1 PAH could be detected above the LOQ. With an extended brewing time of 30 min, a transfer rate between 0.25% and 0.52% could be determined, which results in no exceeding of the maximum limits given by the European Union directive for drinking water (EU Council Directive 98/83/EC).

KEYWORDS: Camellia sinensis; GC-MS; black tea; green tea; herbal infusions; lapsang souchong; oolong; polycyclic aromatic hydrocarbons (PAH); pu erh; white tea

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