Investigation of Comprehensive Two-Dimensional Gas Chromatography Coupled to Time-of-Flight Mass Spectrometry for the Analysis of Vapour Phase Mainstream Cigarette Smoke

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The present study seeks to develop a method for the analysis of vapour phase mainstream cigarette smoke using comprehensive two-dimensional gas chromatography coupled to time-of-flight mass spectrometry (GC × GC-TOFMS) system. The analysis includes two parts: (a) optimisation of sample preparation, and (b) optimisation of separation space or chromatogram. For achieving these objectives, the research cigarettes 3R4F were smoked using Borgwaldt RM20D smoking machine using Federal Trade Commission (FTC), International Organisation for Standardisation (ISO) or other recommend conditions. The vapour phase smoke is separated from particulate phase smoke with a standard Cambridge filter pad. The vapour phase is collected either in a gas bag and followed by solid-phase micro extraction (SPME) or directly trapped on thermal desorption (TD) tubes. Six different SPME fibres namely Polyethylene Glycol (PEG), Polyacrylate (PA), Polydimethylsiloxane (PDMS), Carboxen/Polydimethylsiloxane (CAR/PDMS), Polydimethylsiloxane/Divinylbenzene (PDMS/DVB) and Divinylbenzene/Carboxen/Polydimethylsiloxane (DVB/CAR/PDMS) were tested. For TD analysis six different stainless steel TD tubes namely Tenax TA, Carbograph 1TD, Teanx TA/Carbograph 5TD, Tenax TA/Carbopack B, Tenax TA/Sulficarb and Tenax TA /Carbograph 1TD/Carboxen were tested. A comparison study was carried out for the SPME and TD analysis in terms of various classes of volatile organic compounds extract from vapour phase smoke. For chromatographic optimisation a convex Hull Delaunay Triangulation approach was utilised for finding the best GC × GC column set. The advantages and disadvantages of SPME and TD along with GC × GC optimisation for the analysis of vapour phase smoke will be discussed.