Bisphenol A and its structural analogues in household waste paper

Bisphenol A (BPA) is an industrial chemical produced in large volumes. Its main use is associated with polycarbonate plastic, epoxy resins and thermal paper. In contrast to other applications, thermal paper contains BPA in its un-reacted form as an additive, which is subjected to migration. Receiving a significant amount of attention from the scientific community and beyond, due to its controversial endocrine-disrupting effects, the industry is attempting to substitute BPA in variety of applications. Alternative phenolic compounds have been proposed for use in thermal paper; however, information to what extent BPA alternatives have been used in paper is sparse. The aim of the present work was to quantify BPA and its alternatives (bisphenol S (BPS), bisphenol E (BPE), bisphenol B (BPB), 4-cumylphenol (HPP) and bisphenol F (BPF)) in waste paper and board from Danish households, thermal paper receipts, non-carbon copy paper and conventional printer paper. BPA was found in all waste paper samples analysed, while BPS was identified in 73% of them. Only BPB was not identified in any of the samples. BPA and BPS were found in the majority of the receipts, which contained no measurable concentrations of the remaining alternatives. Although receipts showed the highest concentrations of BPA and BPS, office paper, flyers and corrugated boxes, together with receipts, represented the major flux of the two compounds in waste paper streams.