SKIN ABSORPTION KINETICS OF BISPHENOL A ALTERNATIVES IN THERMAL PAPER

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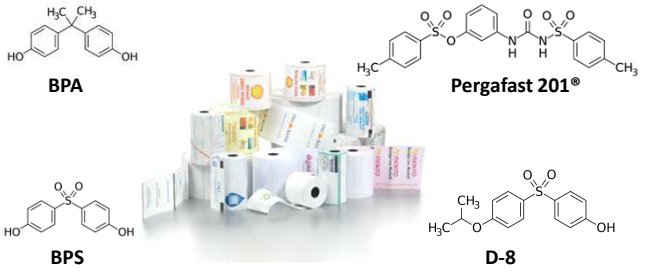
Introduction

Bisphenol A (BPA) is a colour developer in thermal papers used for cashiers receipts, labels and tickets. Upon handling these papers, BPA can migrate onto the skin and be absorbed. BPA analogues are replacing BPA, due to its endocrine-disrupting effects. In thermal paper the most frequent BPA analogues are bisphenol S (BPS), D-8, and Pergafast 201®. No skin absorption data exist for these three chemicals.



Methods

Skin absorption kinetics measurements (OECD guideline 428) of BPS, D-8, and Pergafast201® through ex-vivo human skin:

Ex vivo human abdominal skin dermatomed to 200 µm

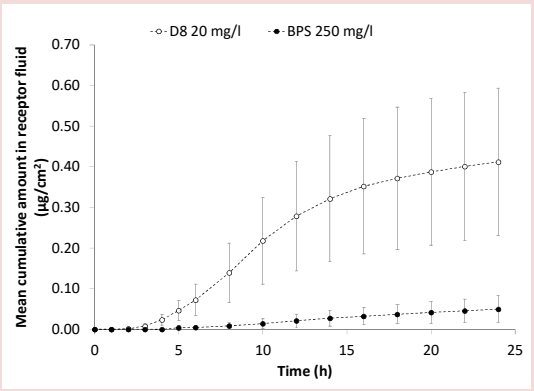
Flow through diffusion cell system (cell diameter 11 mm jacketed, Permegear ®)

Applying 100 µl aqueous solutions of BPS, D-8 or Pergafast 201® onto skin flaps

Collecting receptor fluid samples at specific times up to 24 h

Analyzing samples with LC-MSMS

Results



Chemical	n[a]	Concentration (mg/l)	Volume (µl)	t_{lag}[b] (h)	Permeation rate[c] J (µg/cm²/h)	Permeability coefficient[d] K_p (cm/h)	Amount in receptor fluid (% of applied dose)[e]
BPS (aq)	12	250	100	7.6	0.6 (±0.9) x 10^{-2}	2.4 (±3.5) x 10^{-5}	0.2% (±0.1%)
D-8 (aq)	10	20	100	3.7	4.1 (±2.0) x 10^{-2}	1.9 (±1.0) x 10^{-3}	20% (±9%)
Pergafast 201® (aq)	11	3[f]	100	n.a.	n.a.	n.a.	<LOQ

[a] Number of skin samples tested from three skin donors.
[b] Lag time to achieve the steady state.
[c] Mass permeating per unit area and per unit time, observed when the steady-state was reached.
[d] Permeation rate per unit concentration, expressed in distance/time.
[e] Amount in receptor fluid after 24 h of exposure.
[f] Water solubility has been reported to be 35 mg/l but we could only dissolve 3 mg/l.

Discussion

- **D-8**'s K_p was similar to values reported for BPA (data not shown), while **BPS**' K_p was approximately two orders of magnitude lower.
- **D-8**'s J was 5-fold higher compared to **BPS** despite the 10-fold lower applied concentration.
- **D-8**'s t_{lag} was half of **BPS**' of ~8 hours.
- **Pergafast 201®**'s skin permeation kinetic parameters could not be determined because it was not quantifiable in the receptor fluid in our test conditions. This could be due to its low water solubility or instability at skin pH.
- Infinite doses were applied, not as a powder or as receipts per se, to reach steady-state.

Conclusion

The permeability coefficients were in decreasing order: BPA > D-8 >> BPS. These results are in agreement with these chemicals' log K_{ow}. No conclusions could be drawn for Pergafast 201®, but its skin permeability is likely to be low.

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