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Federal Department of Home Affairs FDHA
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Consumer Protection Directorate

Bisphenol A

Dermal penetration according to OECD TG 428

Dermal absorption of BPA

- **Exposure**
  - Mainly via ingestion
  - Skin contact is generally considered as marginal
  - Skin contact of cashiers via thermal paper ?

- **Precedent results**
  - Few studies focused on dermal absorption of BPA
  - Diverging results

Previous studies

Study	Year	Time	Buffer	Applied dose	n	% in perfusate	% in skin	Skin type	Method
Kaddar et al.	2008	2h	Physiological serum	0.7 µg	6	**0%**	3%	*ex vivo* pig skin	Similar to OECD TG
		5h				**0.1%**	6.9%		
		10h				**0.7%**	11.4%		
Mørck et al.	2009	48h	Ethanol	423 µg	11	**13%**	24.6%	*ex vivo* human skin	Adapted OECD TG 428
Zalko et al.	2011	72h	Ethanol/ Phosphate buffer	11.4 µg	3	**45.6%**	41.5%	*ex vivo* human skin	Organ culture in static diffusion cells
			Ethanol/ Phosphate buffer	11.4 - 182.4 µg	3	**up to 65.3%**	20.8%	*ex vivo* pig skin	
Marquet et al.	2011	1-30h	Acetone	2000 µg	5-11	**up to 38.6%**	up to 12.7%	*in vivo* rat skin	-

Aim of the study

Determine the dermal penetration rate of BPA according strictly to the OECD guidelines, in conditions as close as possible to reality:

- Use water as solution, to mimic sweat (composed of ~99% water, 0.5% mineral salts and 0.5% organic compounds)
- Dose applied in the plausible range:
  - Biedermann et al. (2010): 1.13 µg/finger
  - Dose chosen for the study: 1.82 µg/cm^2

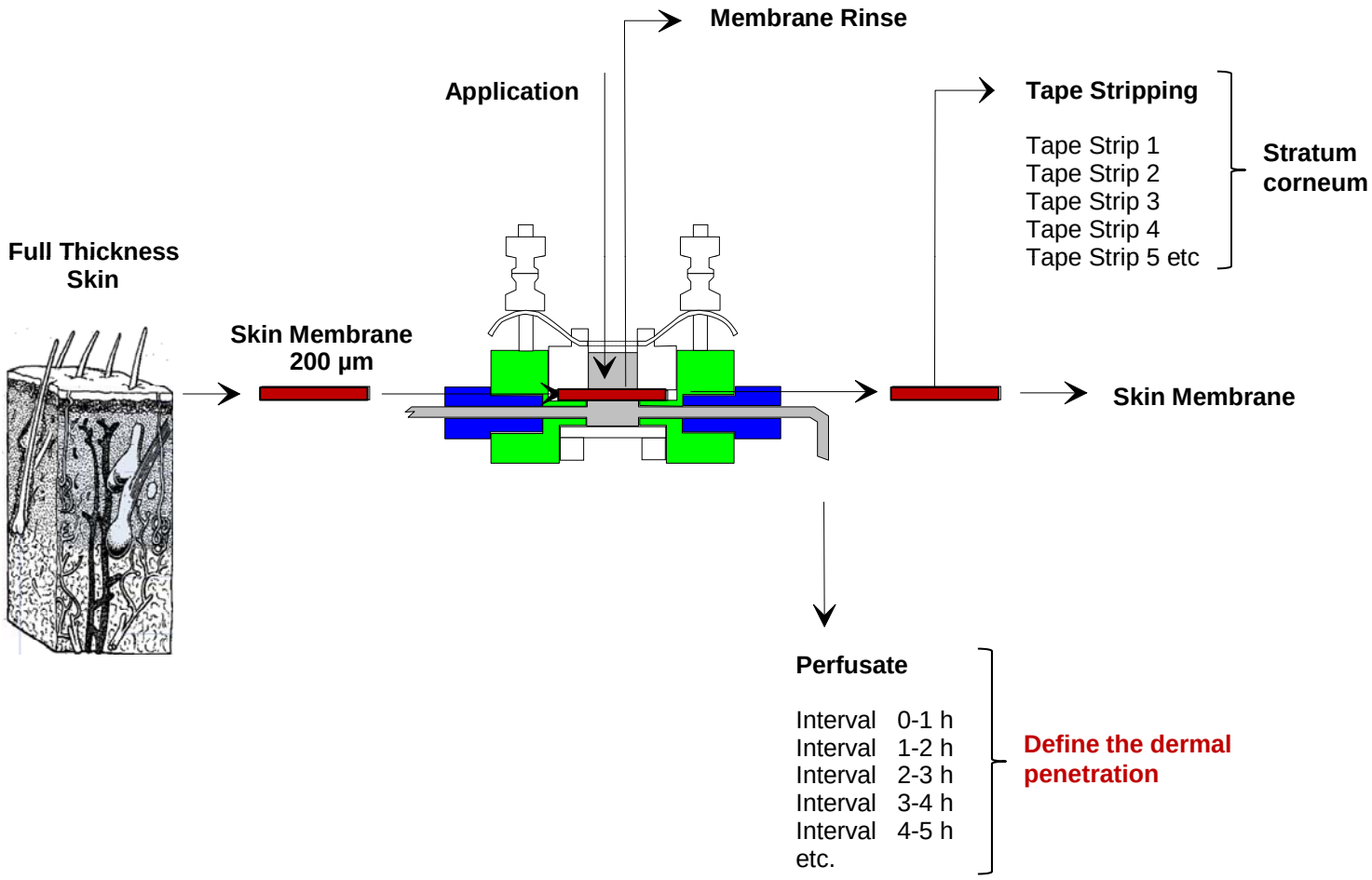
Method

- **Method**: OECD Guideline 428 for the Testing of Chemicals, Skin Absorption: *in vitro* method.
- **Performed**: by Harlan Laboratories Ltd. at Itingen (CH), under GLP conditions.

- **Skin**: Human skin from cadavers. The integrity of the skin has been tested previously.
- **Number of assays**: 7 tests
- **Exposure time** : 24h
- **Chemical**: [^{14}C] Bisphenol A

- **Quantification**: By measuring the radioactivity (liquid scintillation)

Experimental design



Results (1)

Distribution of dose recovered after 24 h incubation [% of dose applied]. The mean results ± SD of the two donors are shown, as well as the limit of quantification (LOQ) in each type of sample.

Fraction	Donor 1 ($n=3$)	Donor 2 ($n=4$)	Total ($n=7$)	LOQ
Skin surface rinse	52.4 ± 2.8	60.3 ± 2.7	56.9 ± 4.9	0.30
Donor cell rinse	0.2 ± 0.0	0.6 ± 0.4	0.5 ± 0.4	0.12
Stratum corneum	41.0 ± 3.9	30.3 ± 3.2	34.9 ± 6.6	0.05
Residual skin membrane	0.5 ± 0.1	0.7 ± 0.3	0.6 ± 0.3	0.03
Receptor fluids	7.8 ± 0.1	9.3 ± 2.7	8.6 ± 2.1	0.09
Total recovery	101.8 ± 2.2	101.3 ± 1.3	101.5 ± 1.6	

Results (2): Perfusate absorption

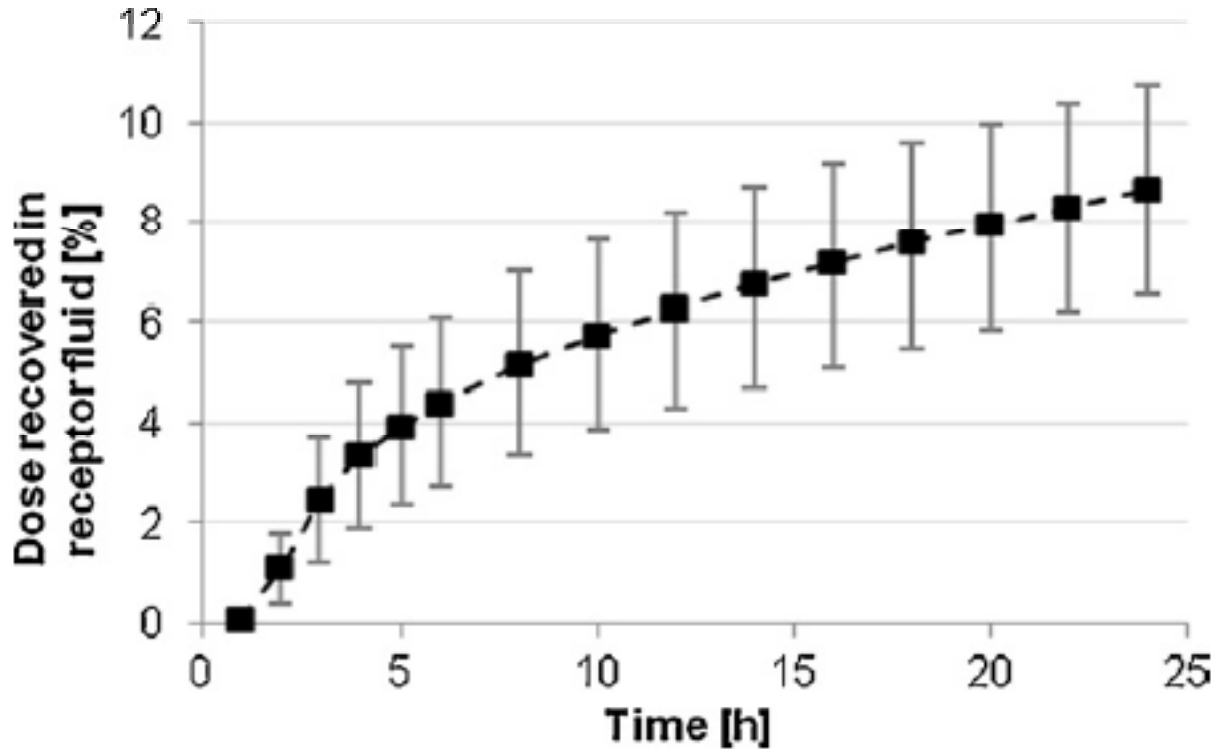


Fig. 1. Kinetics of ^{14}C-BPA penetration. The mean percentages of dose recovered in receptor fluid have been cumulated ($n = 7$).

Results (3): in skin

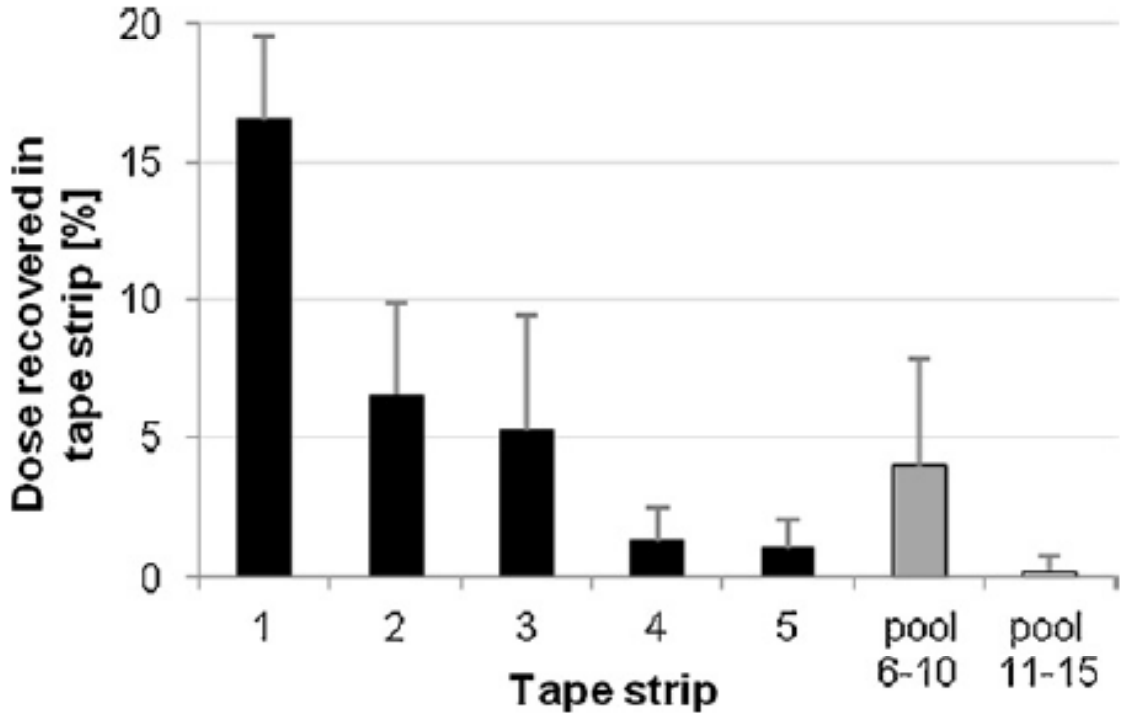


Fig. 2. Distribution of ^{14}C-BPA in stratum corneum after 24 h incubation (mean percentages of dose applied, $n = 7$). The tape strips correspond to layers from most external to internal. The samples 6–10 and 11–15 have been pooled.

Comparison with previous studies

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		5h				**0.1%**	6.9%		
		10h				**0.7%**	11.4%		
FOPH	2012	8h	Water	1.16 µg	7	**5.1%**	-	*ex vivo* human skin	OECD TG 428
		24h				**8.6%**	35.5%		
Mørck et al.	2009	48h	Ethanol	423 µg	11	**13%**	24.6%	*ex vivo* human skin	Adapted OECD TG 428
Zalko et al.	2011	72h	Ethanol/ Phosphate buffer	11.4 µg	3	**45.4%**	41.5%	*ex vivo* human skin	Organ culture in static diffusion cells
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Negligible exposure by contact ?

- In the EU risk assessment of 2008, 10% skin penetration was taken as no data were available. In this RA, dermal exposure is considered as negligible.
- Combined with worst-case concentration estimated by Biedermann et al (2010), assuming that up to 1.13 µg/day transferred to each finger, i.e. ~100 µg/day in total, considering the 10 fingers and that larger parts of the hand enter in contact with receipts.
  - 8.6% * 100 µg = 8.6 µg/day passes through the skin
  - TDI : 50 µg/kg bw/day, i.e. 3000 µg/day for a 60 kg person

⇨ Confirmation that dermal exposure can be considered as marginal in relation to total exposure

Thanks for your attention !

Reference:

Demierre A.-L., Peter R., Oberli A., Bourqui-Pittet M. (2012). Dermal penetration of bisphenol A in human skin contributes marginally to total exposure. Toxicology Letters 213:305-308.