



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Federal Department of Home Affairs FDAH
Federal Office of Public Health FOPH
Consumer Protection Directorate

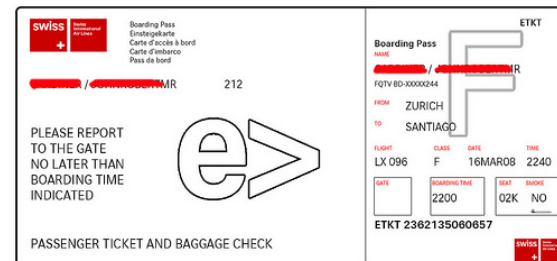
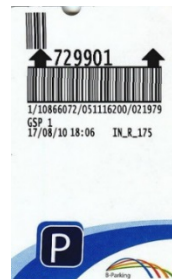
Bisphenol A: An endocrine disruptor present in sales receipts

ISSA/INRS International Symposium

Paris, 2nd June 2016



Bisphenol A exposure



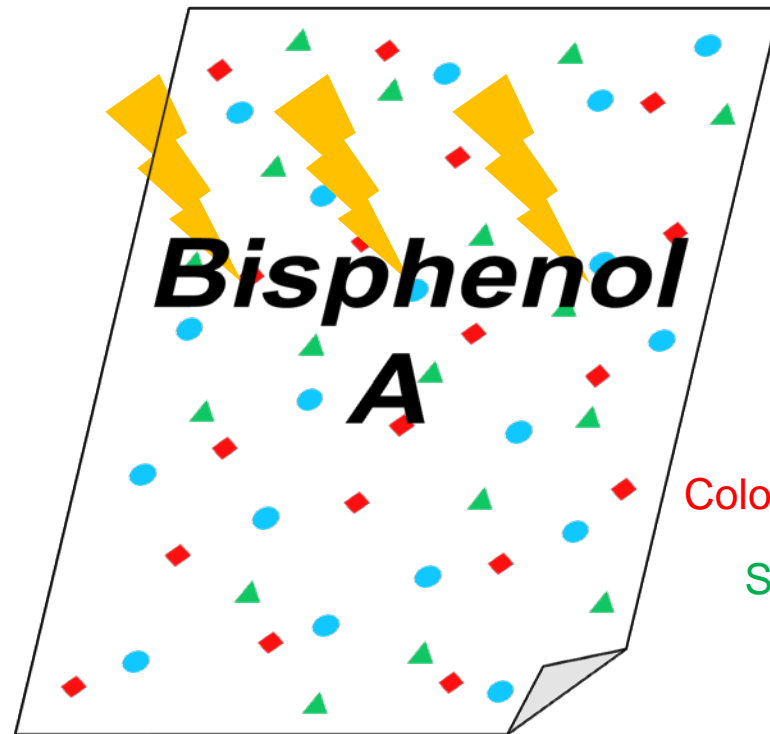
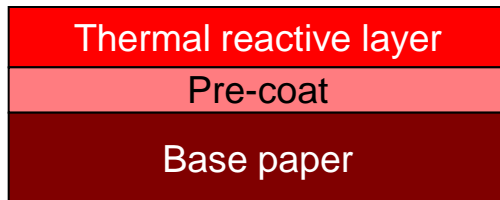
Plastic polycarbonate

Epoxy resin

Thermal paper



Thermal paper



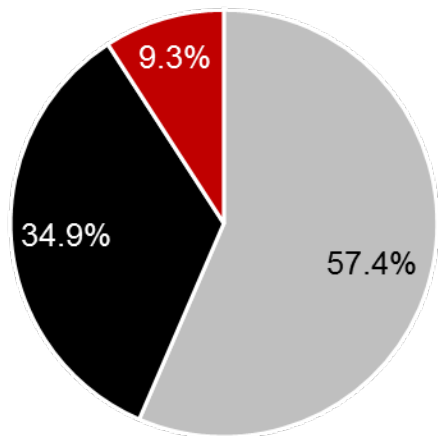
Dye
Color developer
Sensitizer



How much BPA is absorbed by the skin?

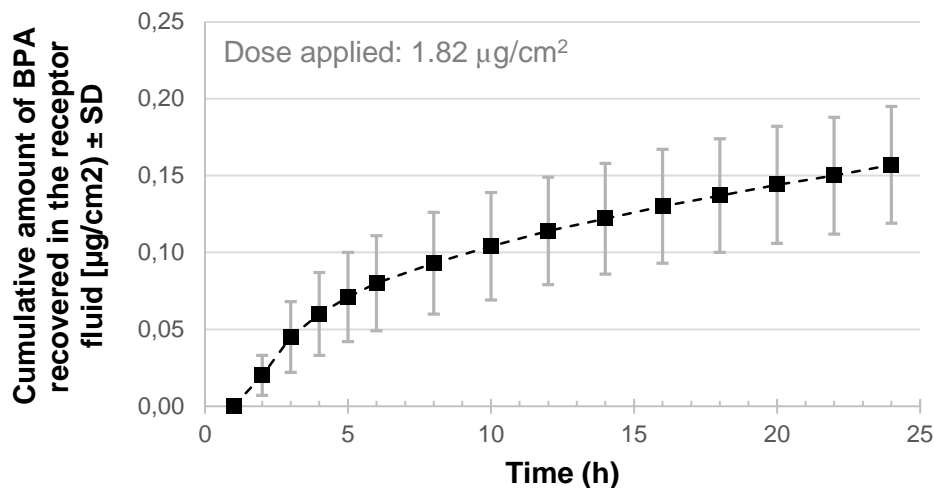
Analysis performed according to OECD TG428 (*in vitro*)
with frozen skin (200 μM thickness)

BPA distribution



■ Not absorbed ■ Skin ■ Receptor fluid

Absorption kinetics



Permeation rate_(1-4h) (J) 0.022 (\pm 0.011) $\mu\text{g}/\text{cm}^2/\text{h}$
Permeation constant (K_p) 1.14 (\pm 0.57) $\times 10^{-4}$ cm/h
Lag time (T_{lag}) 1h

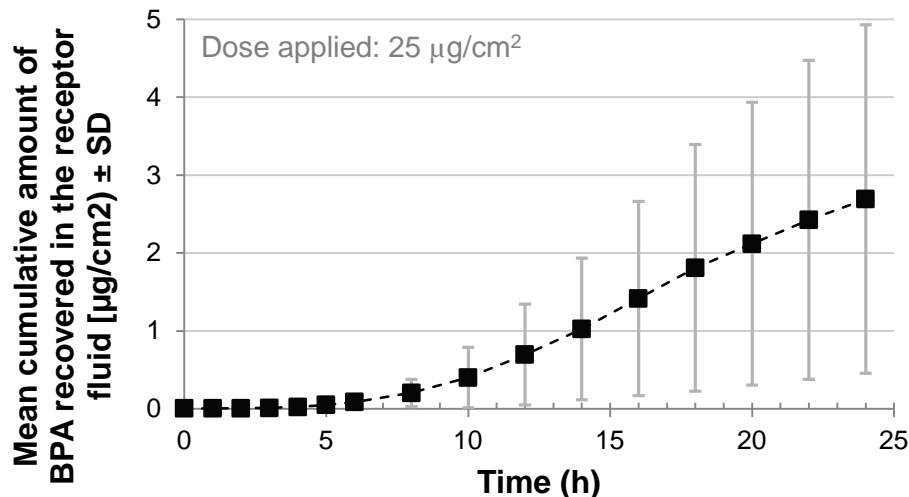
Demierre et al (2012) Toxicol Letters



BPA absorption into viable skin (*Preliminary results*)

Similar analysis performed with viable skin (800 μM thickness) from plastic surgery

Absorption kinetics



Permeation rate (J) 0.23 (± 0.12) $\mu\text{g}/\text{cm}^2/\text{h}$
Permeation constant (K_p) 9.2 (± 4.95) $\times 10^{-4}$ cm/h
Lag time (T_{lag}) 8.5 (± 0.2) h

- Results in similar range
- Variation due to different skin (frozen vs viable), skin thickness, dose and volume applied



First conclusions

- Thermal papers are a BPA source of exposure
- Sales workers are particularly exposed
- Dermal absorption rate is around 10%
- Ban on BPA in thermal paper in Japan (2001), Taiwan (2011), Connecticut USA (2015)...
- Process currently ongoing in EU

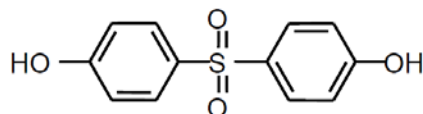


Another color developer is still needed

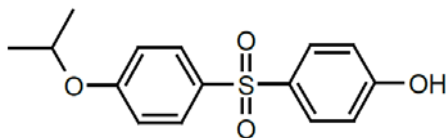


Market analysis in Switzerland

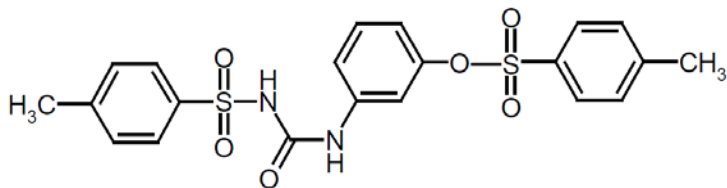
Analysis of 124 thermal papers (cashier receipts, ATM receipts, parking tickets, bus tickets...) between Sep 2013 and Jan 2014



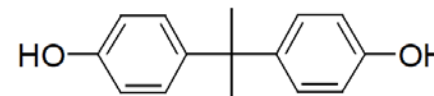
Bisphenol S



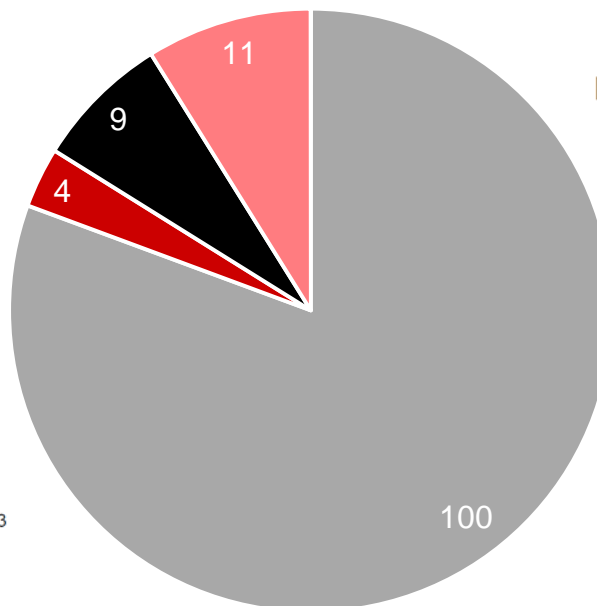
D-8



Pergafast® 201



Bisphenol A



Goldinger et al (2015) Regul Toxicol Pharmacol

Bisphenol A: An endocrine disruptor present in sales receipts

Anne-Laure Demierre – ISSA/INRS International Symposium – 2nd June 2016



What are these alternatives?

Bisphenol S

- Endocrine disruptor (weak estrogenic)
- More persistent than BPA in the environment

D-8 (also known as Wincon-8 or BPSIP)

- Few data available
- Limited information on endocrine disruption
- Highly toxic for the environment

Pergafast® 201

- Few data available
- Limited information on endocrine disruption
- Very persistent and highly toxic for the environment

US EPA DfE Report: Bisphenol A alternatives in thermal paper (2014)



ED activity of BPA and its alternatives

Steroidogenesis Assay (OECD TG456):

In vitro evaluation of impact on production of estradiol (female hormone) and testosterone (male hormone)

Goldinger et al (2015)
Regul Toxicol Pharmacol

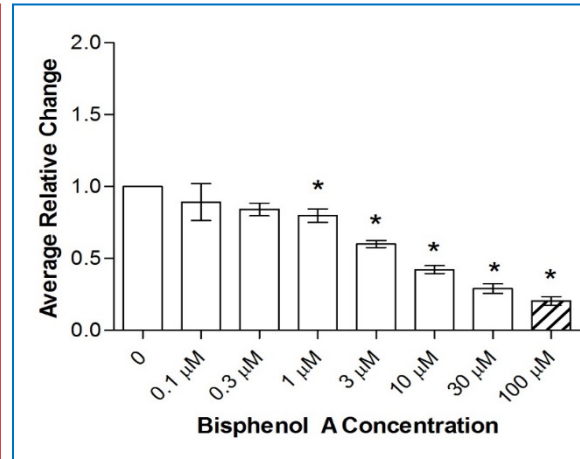
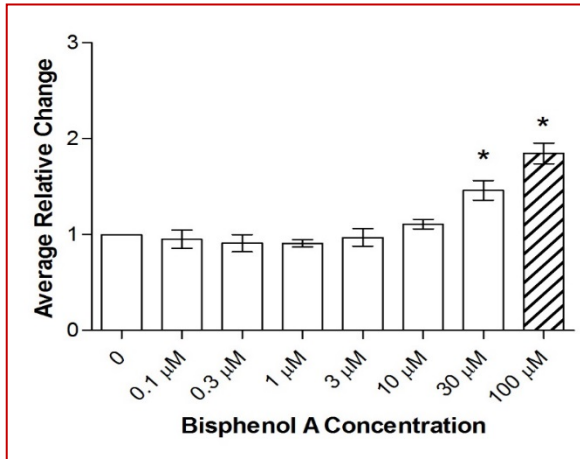


ED activity of BPA and its alternatives

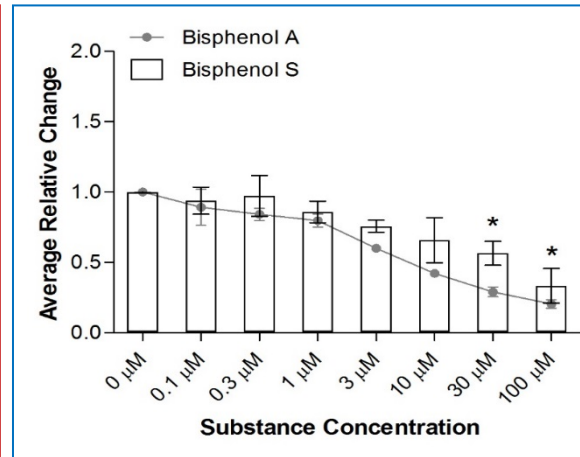
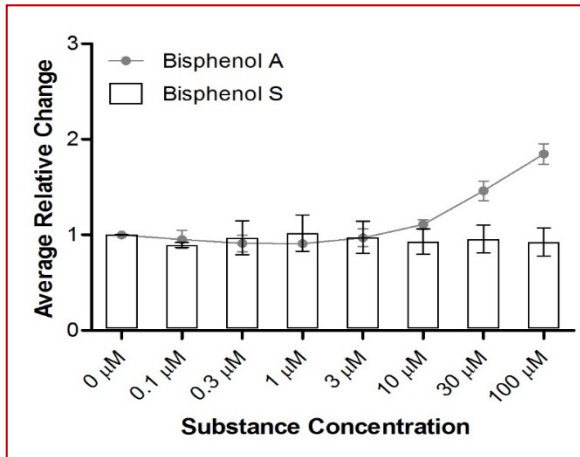
Estradiol

Testosterone

Bisphenol A



Bisphenol S



- Inducer of **estradiol** production
- Inhibitor of **testosterone** production

- No effect on **estradiol** production
- Inhibitor of **testosterone** production

*Goldinger et al (2015)
Regul Toxicol Pharmacol*

Bisphenol A: An endocrine disruptor present in sales receipts

Anne-Laure Demierre – ISSA/INRS International Symposium – 2nd June 2016

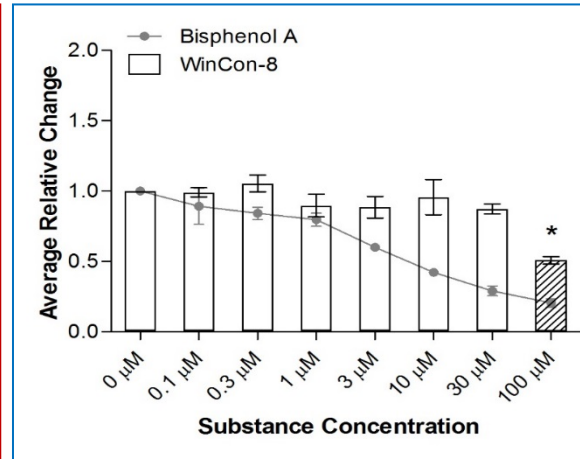
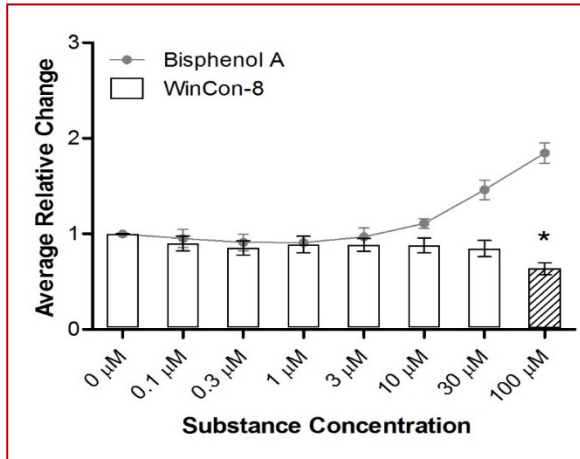


ED activity of BPA and its alternatives

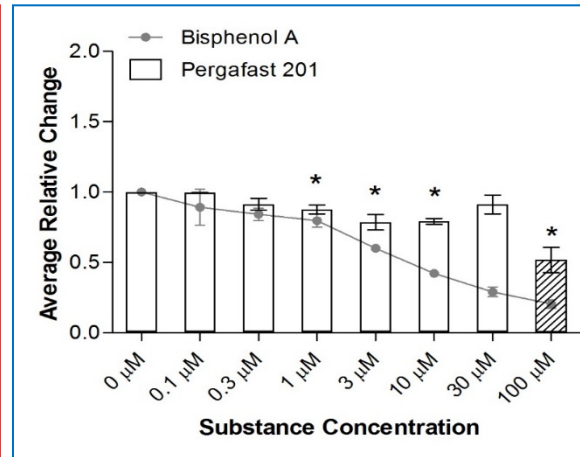
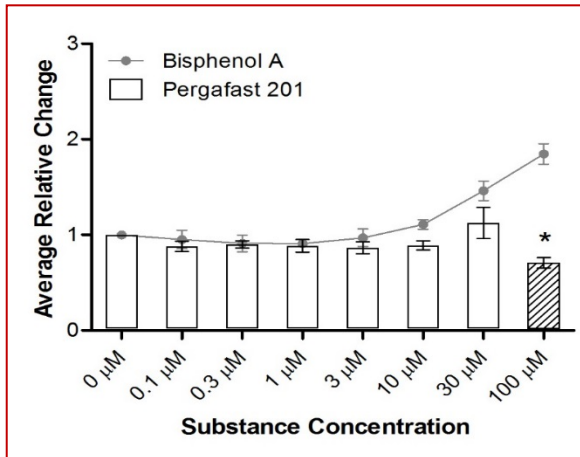
Estradiol

Testosterone

D-8 (WinCon-8)



Pergafast® 201



➤ No effect on **estradiol** nor **testosterone** production

Goldinger et al (2015)
Regul Toxicol Pharmacol

Bisphenol A: An endocrine disruptor present in sales receipts

Anne-Laure Demierre – ISSA/INRS International Symposium – 2nd June 2016



Conclusions

- Replacement of BPA already ongoing
- Confirmation of endocrine activity of BPA and BPS
- No significant effect on estradiol or testosterone production has been shown for Pergafast[®] 201 and D-8
- Non-Bisphenol alternatives look safer than BPA
- But further studies required to affirm that they are really safe



Endlich! Bald sind
alle Kassenzettel
ungiftig

Blick, 24.9.2013

Finally! Soon will
be all receipts
nontoxic

Blick, 24.9.2013



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Federal Department of Home Affairs FDAH
Federal Office of Public Health FOPH
Consumer Protection Directorate

Thanks to

IST

Institut universitaire romand de Santé au Travail

Elena Reale

Nancy Hopf

Aurélie Berthet

Federal Food Safety and Veterinary Office

Otmar Zoller

Heinz Rupp

Hans Reinhard

Roxane Magnin



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Federal Office of Public Health

Daniela Goldinger

Martine Bourqui-Pittet