

Effects of standard humic materials on relative bioavailibility of NDL-PCBs in juvenile swine

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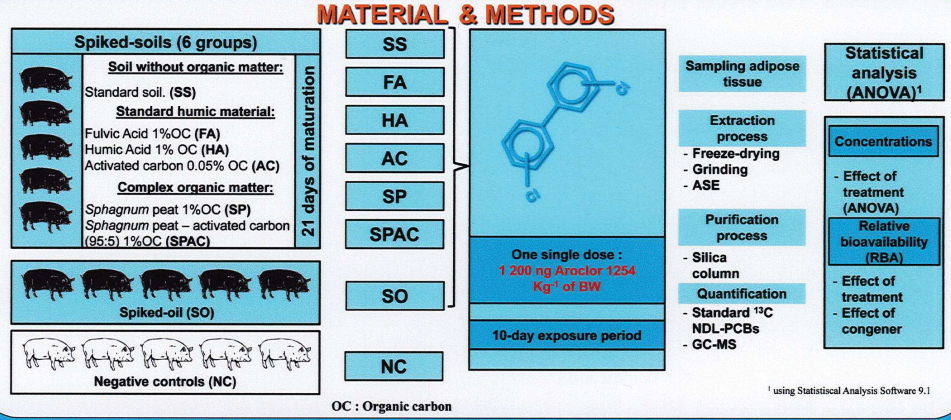
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INTRODUCTION

Exposure assessment to polychlorinated biphenyls (PCBs) from contaminated soils is a critical issue in terms of human health, especially since little reliable information on transfer of PCBs to humans via involuntary soil ingestion is available. Indeed, young children (1-30 months) with their hand-to-mouth activity may be exposed to contaminated soils. The relative bioavailability (RBA) approach is chosen in order to compare **the bioavailability of organic pollutants from different soils** (USEPA 2006).

The current study addresses the impact of soil organic matter (OM) quality on bioavailability of sequestrated NDL-PCBs

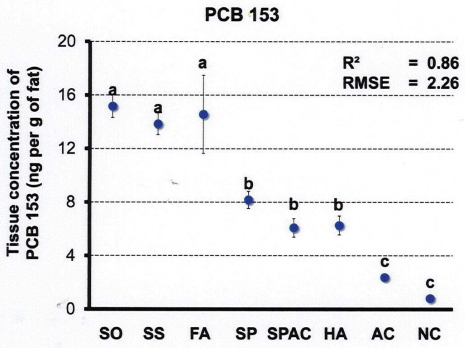
MATERIAL & METHODS



OC : Organic carbon

[1] using Statistical Analysis Software 9.1

RESULTS AND DISCUSSION



Concentrations (ng g^{-1} of fat) of PCB 153 in adipose tissue.
Errors bars correspond to standard error (n=5). Values presenting a common letter do not significantly differ (*P*<0.05).

	PCB 138		PCB 153		PCB 180	
	RBA	95% CI	RBA	95% CI	RBA	95% CI
SO	100.0 ^{a}	[88.4 - 111.6]	100.0 ^{a}	[88.4 - 111.6]	100.0 ^{a}	[88.4 - 111.6]
SS	86.3 $^{a.b}$	[73.3 - 99.3]	91.3 ^{a}	[78.3 - 104.3]	112.8 $^{a.b}$	[99.8 - 125.9]
FA	78.3 $^{a.b}$	[65.3 - 91.3]	96.1 ^{a}	[83.0 - 109.1]	95.5 $^{a.b.c}$	[82.5 - 108.5]
SP	62.8 $^{b.c}$	[51.1 - 74.4]	53.9 ^{b}	[42.3 - 65.5]	74.5 $^{b.c.d}$	[62.9 - 86.2]
HA	43.7 $^{c.d}$	[32.0 - 55.3]	40.2 $^{b.c}$	[28.5 - 51.8]	68.0 $^{c.d}$	[56.4 - 79.7]
SPAC	43.8 $^{c.d}$	[32.2 - 55.5]	41.4 $^{b.c}$	[29.7 - 53.0]	54.4 $^{d.e}$	[42.7 - 66.0]
AC	14.3 $^{d.e}$	[2.7 - 26.0]	15.7 $^{c.d}$	[4.1 - 27.4]	32.6 $^{e.f}$	[21.0 - 44.3]
NC	4.5 ^{de}	[-7.1 - 16.2]	5.4 ^{d}	[-6.3 - 17.0]	11.4 ^{f}	[-0.3 - 23.0]
LSMEANS	54.2 $^{C.B}$	[50.2 - 58.3]	55.5 ^{B}	[51.4 - 59.5]	68.7 ^{A}	[64.6 - 72.7]

Residual p<0.001 OM effect : p<0.001 PCB*OM : p=0.050
RMSE p<0.001 PCB effect : p<0.001

Relative Bioavailability factors of NDL-PCBs.
RBA factors were calculated from adjused means of concentrations (ng g^{-1} of fat). Values in brackets indicates 95% confidence interval (2xSE). Values presenting a common letter do not significantly differ (*P*<0.05). RMSE : Root means square error. RBA : relative bioavailability. 95% CI : 95% confidence interval.

Three different sets of NDL-PCB concentrations in adipose tissue can be distinguished (p<0.05):
- **AC :** close to background level **(NC)**
- **SP, SPAC and HA :** intermediate levels indicating a medium sequestration by organic matter
- **SO, SS and FA:** high concentrations and no significant reduction

- **Highly condensed material (AC) strongly reduces relative bioavailability**
- **AH, SP** present significantly reduced relative bioavailability
- **SPAC** also, but competition between AC and SPAC may occur explaining that reduction is not as strong as those of AC
- **Along chloration** RBA increases which may reveal increase in deposit in adipose tissue.

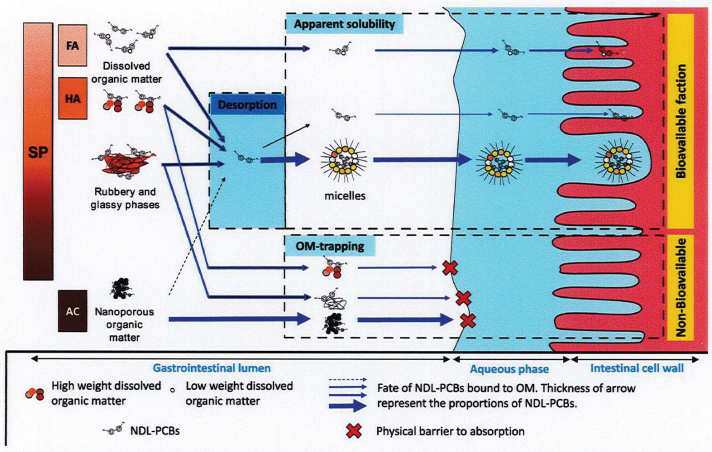
1 Desorption of NDL-PCBs from OM

Desorption occurs in the digestive lumen which is an aqueous environment.
Desorption could be very low for condensed material as AC.

2 Solubilisation

Solubilisation of lipophilic compounds as NDL-PCBs is rather low.

Apparent solubilisation can be induced by transport vehicle like micelles or soluble organic matter



Proposal of mechanistic retention and bioavailability of NDL-PCBs bound to Organic Matter

3 Transportation to epithelium wall

Before the uptake, NDL-PCB have to migrate to intestinal wall crossing a particuliar aqueous phase : the unstirred water layer.
This could be a physical limitation for NDL-PCB physically bound to organic matter.

4 Biological uptake

Uptake of NDL-PCBs in micelles, solubilised or bound to digestible soluble organic matter could, then, occur.

CONCLUSION

- Organic matter plays **a major role in the retention of NDL-PCBs during the digestive process in piglets**.
- It appears also that characteristics of the organic matter dramatically pilot the retention of NDL-PCBs.
- Condensed organic matter (activated carbon) strongly reduces bioavailability whereas the less condensed one (fulvic acid) has not significant effect.

U.S. EPA 2006. Estimation of Relative Bioavailability of Lead in Soil and Soil-like Materials Using *in Vivo* and *in Vitro* Methods, Environmental Protection Agency, Office of Solid Waste and Emergency Response.

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