



HAL
open science

Exposure assessment of sequestered organic compounds in polluted sites and soils: use of a juvenile animal model to estimate their relative bioavailability

Matthieu Delannoy, Agnès Fournier, Guido Rychen, Cyril Feidt

► To cite this version:

Matthieu Delannoy, Agnès Fournier, Guido Rychen, Cyril Feidt. Exposure assessment of sequestered organic compounds in polluted sites and soils: use of a juvenile animal model to estimate their relative bioavailability. Laboratoire Ecologie Fonctionnelle et Environnement (EcoLab). 29th International Conference on environmental Geochemistry and Health, Jul 2013, Toulouse, France. ABSTRACT BOOK - 29th International Conference on environmental Geochemistry and Health, pp.158, 2013. hal-03945345

HAL Id: hal-03945345

<https://hal.univ-lorraine.fr/hal-03945345>

Submitted on 18 Jan 2023

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution - NonCommercial - NoDerivatives 4.0
International License



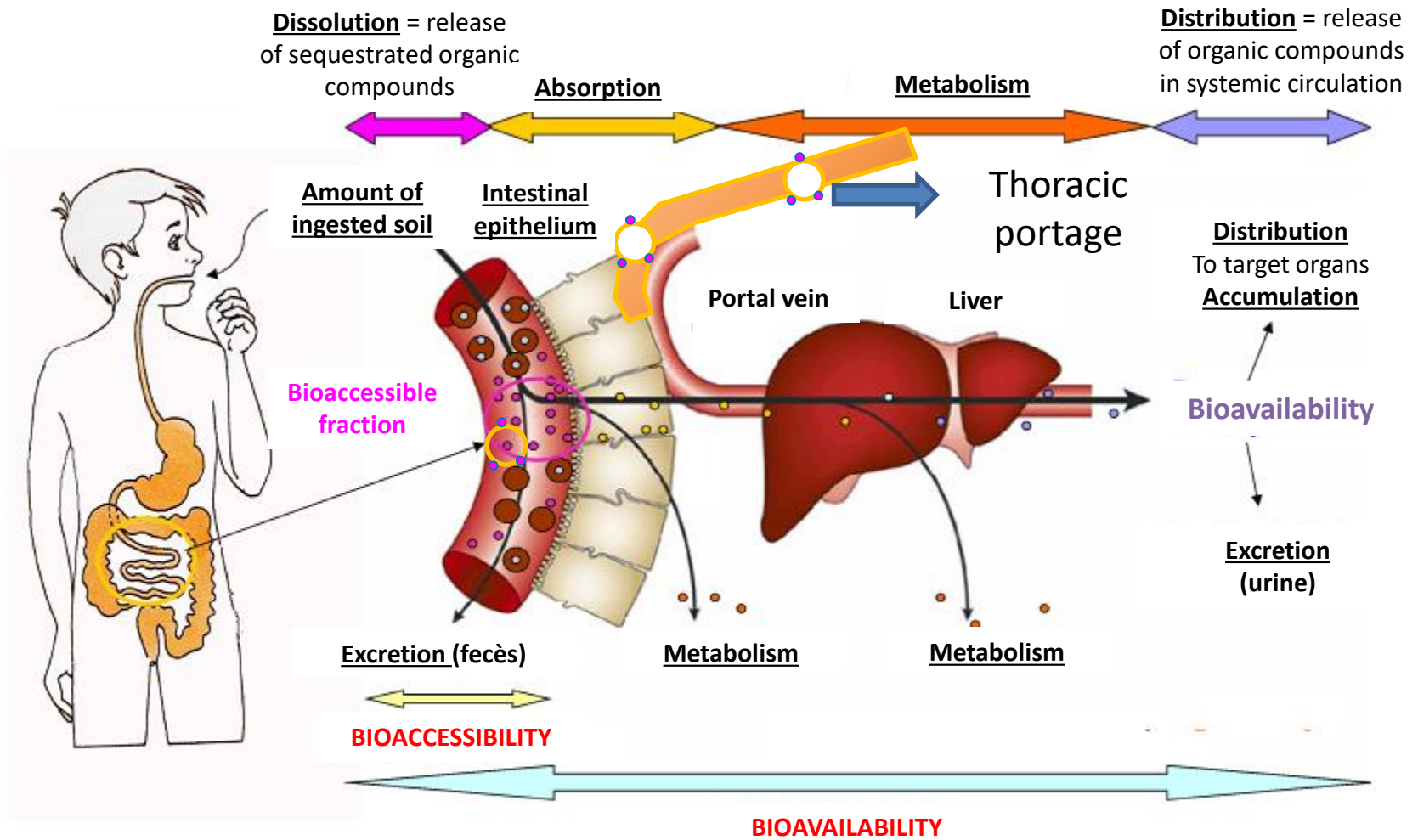
**EXPOSURE ASSESSMENT OF SEQUESTERED ORGANIC COMPOUNDS IN
POLLUTED SITES AND SOILS: USE OF A JUVENILE ANIMAL MODEL TO
ESTIMATE THEIR RELATIVE BIOAVAILABILITY.**

MATTHIEU DELANNOY, AGNÈS FOURNIER, GUIDO RYCHEN, CYRIL FEIDT.

11TH JULY 2013 – SEGh LECTURE - TOULOUSE

I- EXPOSURE ASSESSMENT AND RELATIVE BIOAVAILABILITY

I.1- Place of bioavailability in exposure assessment



● Ingested soil particles

○ Ingested toxic substance

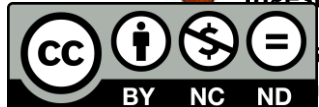
● Dissolved toxic substance

○ Fraction of substance

● Metabolized fraction of substance

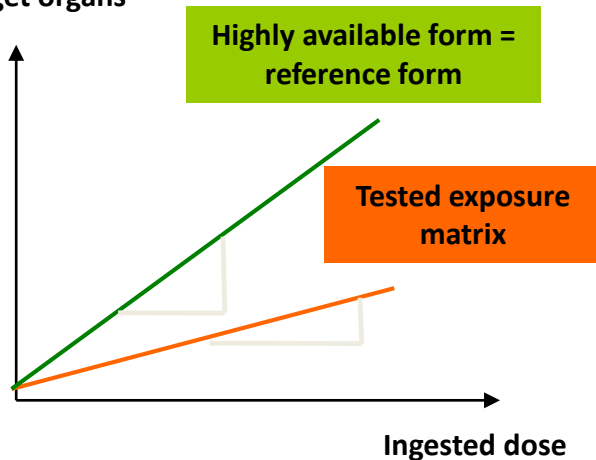
○ toxic

● Bioavailable fraction of toxic substance



I.2- Relative bioavailability and comparison of exposure media

Concentrations in target organs



$BR = \text{slope ratio}$

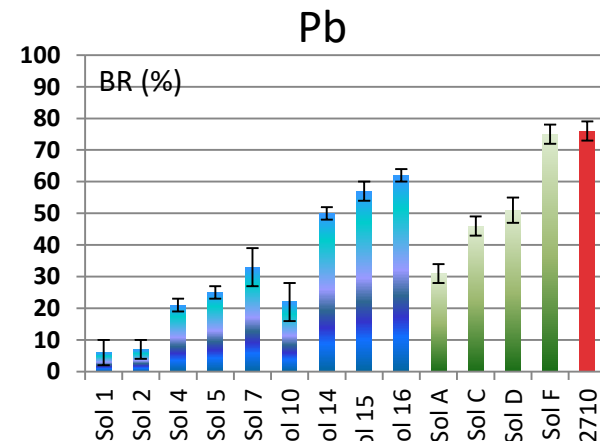
Use in order to validate bioaccessibility methodology.

Validity criteria

- same dose-response pattern between exposure and reference media
- Assessment of relative bioavailability inside linearity domain of the dose response pattern

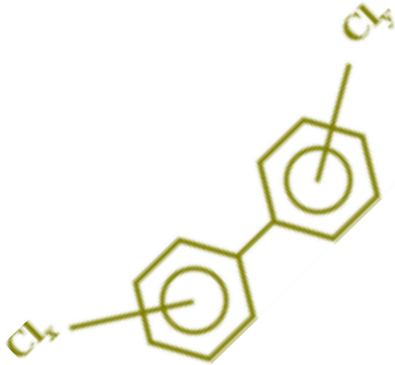
Interests

- Based upon biological effects, target organs specialized in accumulation, metabolism, excretion of compounds
- Used by sanitary agencies



II- SOIL INGESTION AND ASSESSMENT OF ORAL-EXPOSURE TO NDL-PCBs

1.2- Population at risk and NDL-PCBs hazard



- **Family of 209 congeners**
- **Bioaccumulative and ubiquitous (POPs)**
- **7 PCBs frequently retrieved in environmental matrices and foodstuff are basis of regulatory approaches**
 - PCB 28; PCB 52; PCB 101; PCB 118; PCB 136; PCB 153; PCB 180
- **2 different toxicity profiles: Dioxin like and non-dioxin-like**

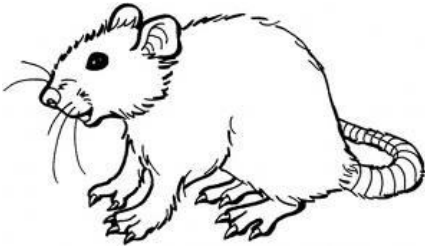
Children (1-3 years) = population at risk



- **Children behavior: *hand to mouth***
 - **Vulnerability**
 - Immature metabolism
 - Development phase
- ⇒ **Increased exposure and sensitivity to toxicity impairments.**

US-EPA (2011) : 200 mg/j of soil and/or dusts for children (0 à 6 years).

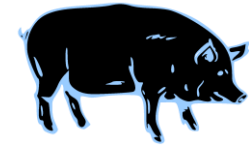
II.2- Animal model for children animal exposure.



- Manipulation advantage
- Absorption mechanisms differs than those of human
- Coprophagia and intestinal and gastric pH differs to.



- Ethical consideration concerning manipulations of primates. Closest model to human.



- Adequate model of digestive tract of children.
- Slow development .
- Few coprophagia.
- Appropriate model according to environmental agencies. (USEPA, 2007)

II.3- Soil and retention of NDL-PCBs.



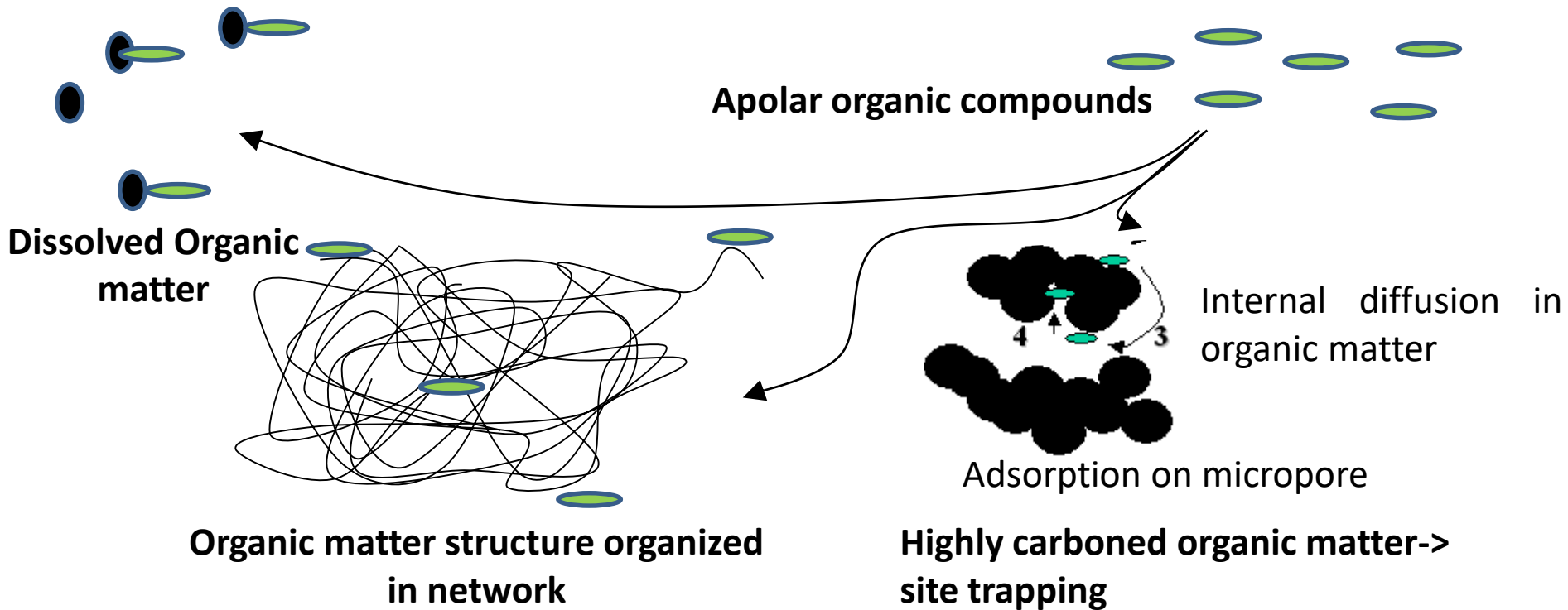
Characteristics of soil ↔ retention of NDL-PCBs through digestive process

-Determine **variation factors of bioavailability of NDL-PCBs contaminated soils.**

-Impact of these variation factors on NDL-PCBs relative bioavailability
-Usefulness of these variation factors in risk assessment

III- HYPOTHESIS AND OBJECTIVES OF THE STUDY

III.1- Importance of organic matter – *schematic retention of organic compounds.*



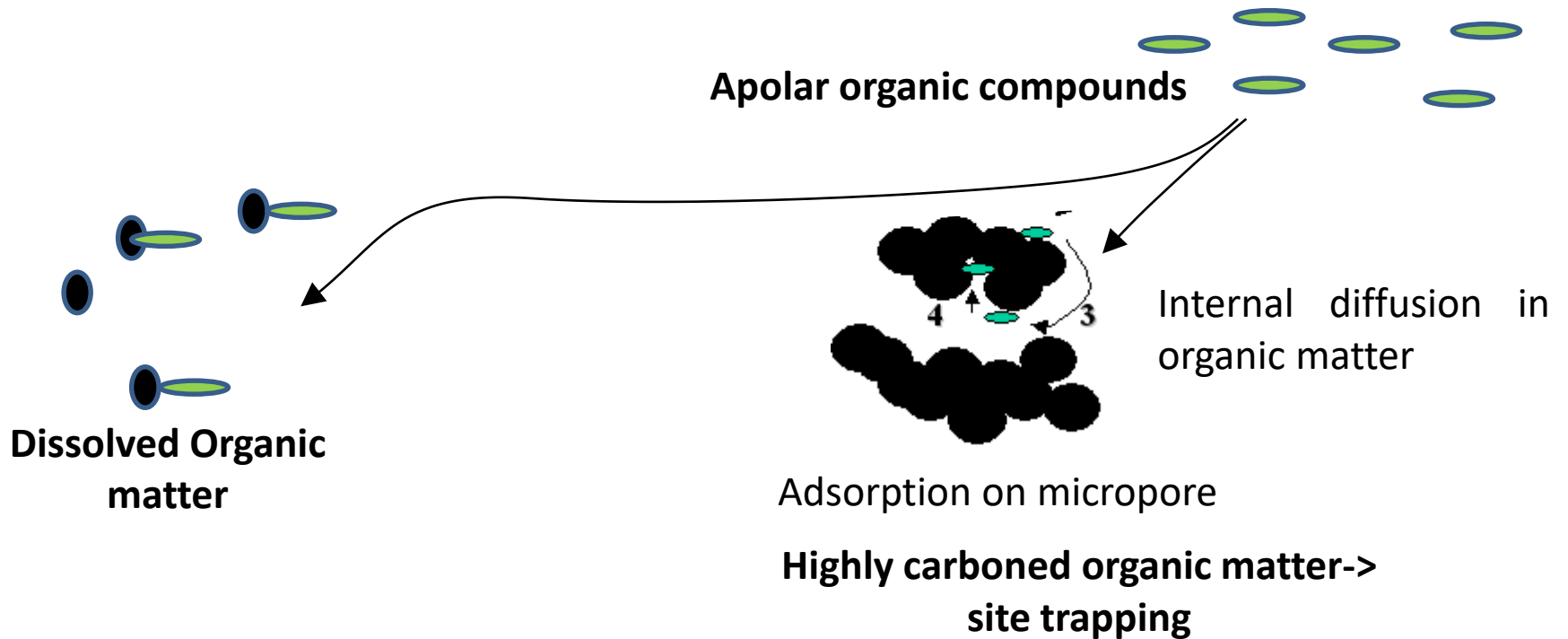
condensation

Condensation of organic matter and behavior models of organic matter retention



Lack of *in vivo* data to perform an exposure assessment

III.2- Importance of organic matter – *schematic retention of organic compounds.*



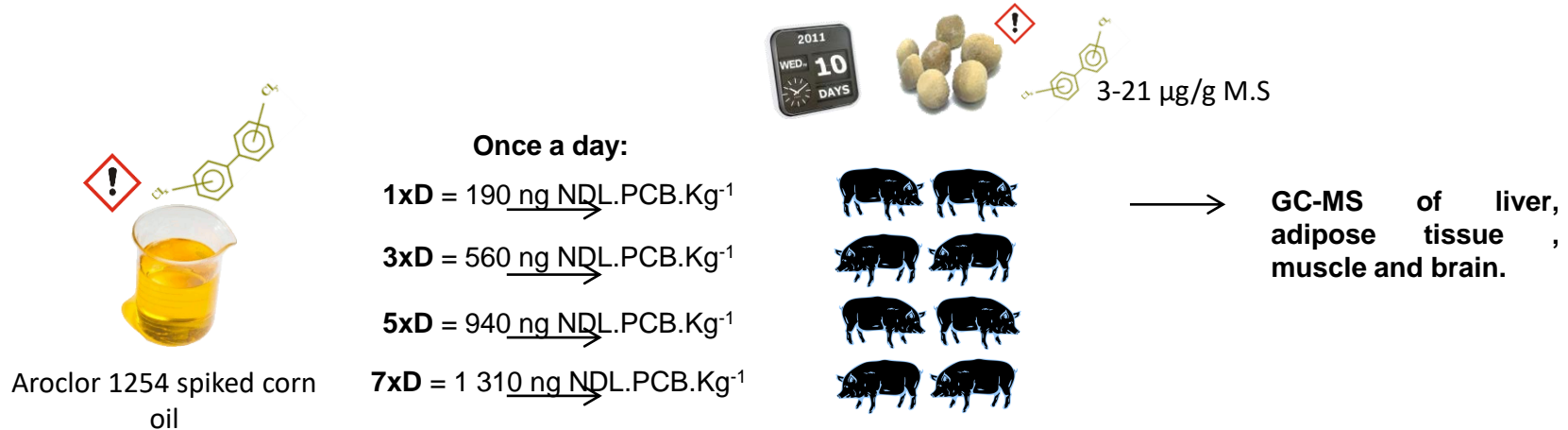
Weak retention of NDL-PCBs

Important retention of NDL-PCBs

IV- ASSESSMENT OF LINEARITY

IV.1- Assessment of linearity of dose-reponse pattern

MATERIAL AND METHODS



4 groups (n=2) of castrated weaned piglets were exposed during 10 days;

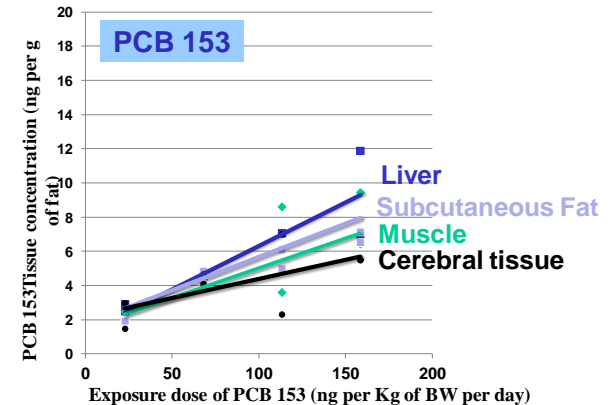
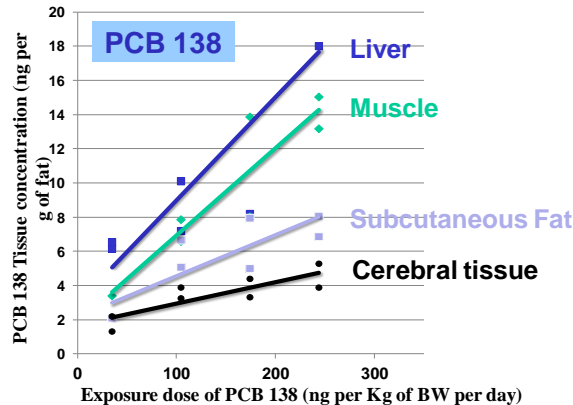
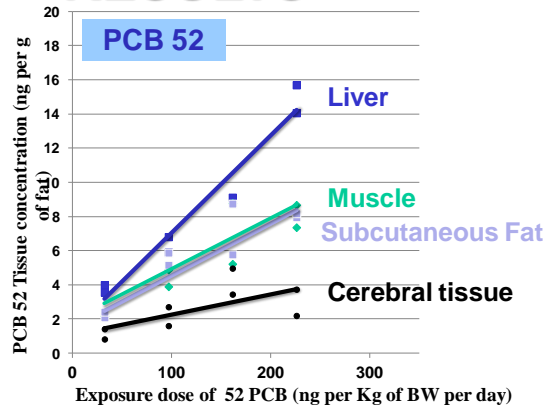
Biological matrices were selected :

- Adipose tissue** : lipophilic and bioaccumulative characteristics of NDL-PCBs.
- Liver** : metabolism.
- Brain** : neurological toxicity of NDL-PCBs

Sample : Highly perfused and importance in body weight

IV.2- Assessment of linearity of dose-reponse pattern

RESULTS



		PCB 52	PCB 138	PCB 153
Liver	slope (y/x .10 ²)	57,0	51,0	60,3
	R ²	0,96	0,78	0,80
	p	0,001	0,001	0,009
Subcutaneous fat	slope(y/x .10 ²)	29,7	24,0	34,9
	R ²	0,83	0,83	0,91
	p	0,002	0,001	0,000
Muscle	slope(y/x .10 ²)	30,5	39,1	51,1
	R ²	0,76	0,71	0,92
	p	0,010	0,005	0,049
Cerebral Tissue	slope(y/x .10 ²)	1,18	1,26	51,1
	R ²	0,43	0,71	0,43
	p	N.S.	0,009	N.S.

- Similar responses were obtained from all studied congener
- **Linear regression is significant for liver, muscle and adipose tissue.**
- Higher concentrations were obtained in liver.
- Cerebral tissue doesn't provide a significantly relationship

→ **La linéarité de la relation dose-réponse semble significative pour le tissu adipeux, musculaire et hépatique.** Le niveau de concentration faible dans le tissu cérébral n'a pas permis de montrer la linéarité de la relation dans ce tissu.

V- IMPACT OF ORGANIC MATTER CONDENSATION ON RELATIVE BIOAVAILABILITY OF NDL-PCBS CONTAMINATED SOILS.

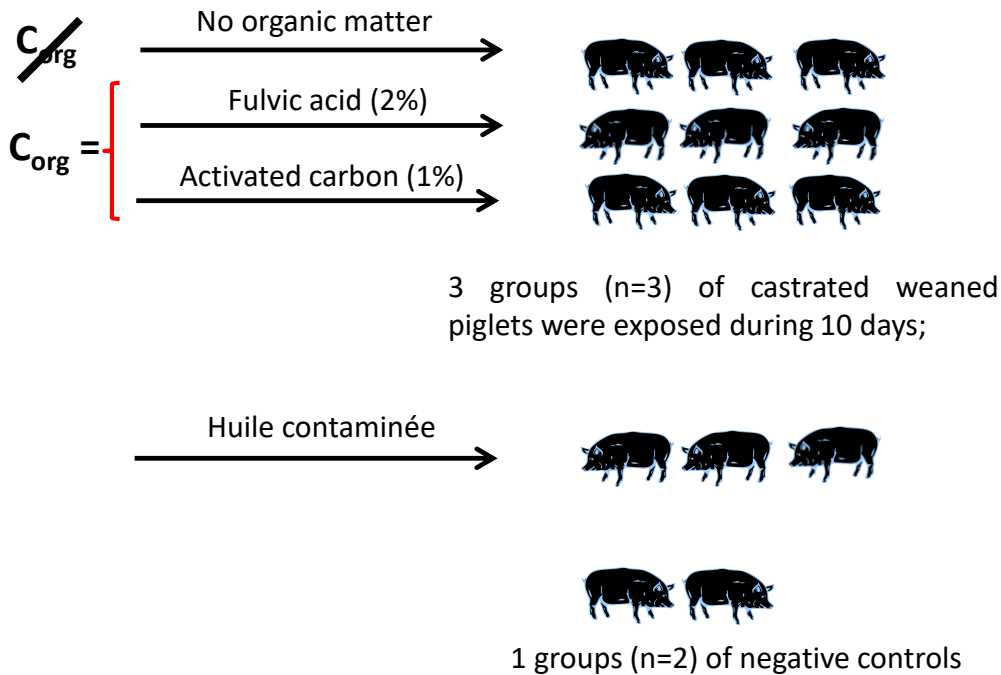
MATERIAL ET METHODS



Artificial soil: 19,2µg of Aroclor 1254/g of D.M.



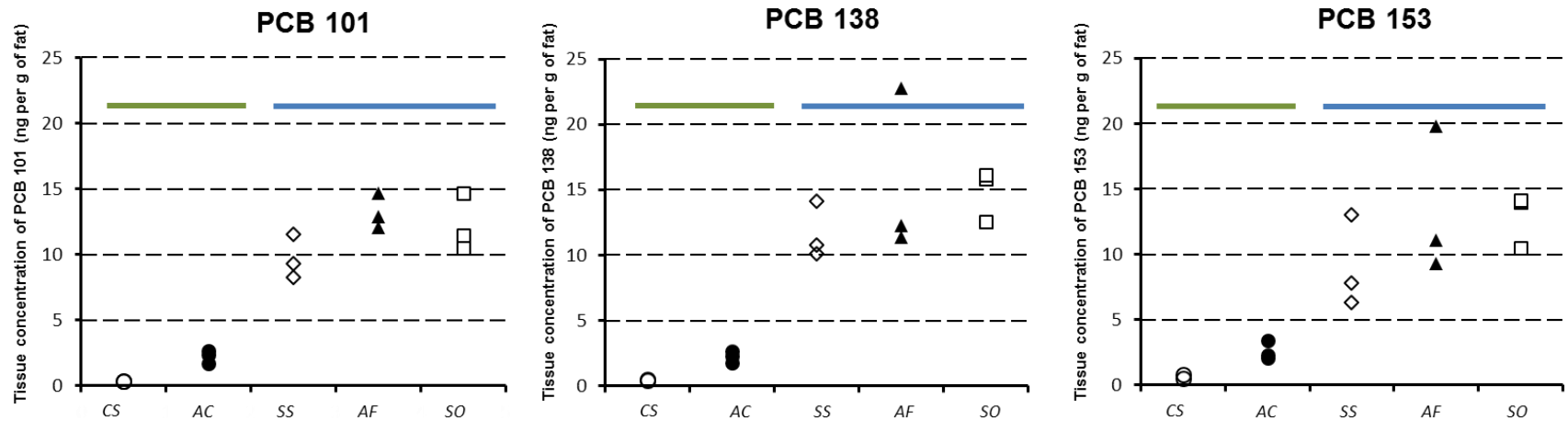
Spiked corn : 19,2µg of Aroclor 1254/g



GC-MS of liver, adipose tissue, muscle and brain.

V.2- IMPACT OF ORGANIC MATTER CONDENSATION ON RELATIVE BIOAVAILABILITY OF NDL-PCBs CONTAMINATED SOILS.

RESULTS



- Soil containing 1% of activated carbon presents a clear decrease of bioavailability Le sol contenant 1% de charbon actif **présente une nette diminution** de la biodisponibilité par rapport aux autres sols.
- Fulvic acid amendment doesn't seem to modify relative bioavailability of NDL-PCBs comparatively to standard soil

MERCI POUR VOTRE ATTENTION