

Accumulation of an emergent contaminant, α -hexabromocyclododecane (α -HBCDD), in tissues of pigs

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Hexabromocyclododecane (HBCDD) is a brominated flame retardant present in thermal insulation materials such as polystyrenes that are used in livestock buildings. Its presence in some food samples from animal origin may contribute to human exposure to this endocrine disruptor.

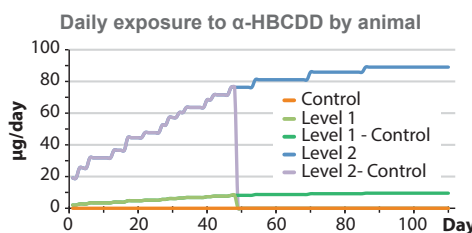
Materials and methods

Experiment

- 56 fattening barrows (LWxLd) × Piétrain (27.7 kg, 68 days of age)
- Diets containing 0, 3.2 or 29.7 μ g α -HBCDD / kg
- Exposition during : - total growing-finishing period (49 + 63 days).
 - growing period of 49 days followed by 63 days of depuration.

Tissue sampling and analysis

- Serial slaughtering of 3 pigs per exposed or decontaminated group at days 20, 50, 71, 92 and 112 to collect liver, dorsal fat and *semimembranosus* muscle samples
- Chemical analyses of Total lipids (Folch) and HBCDD isomers (LC-MS/MS) after lipid extraction



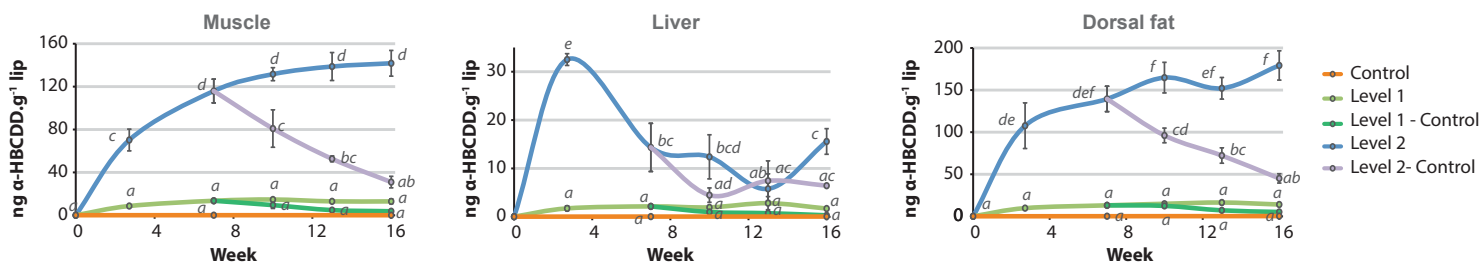
Group	Exposition α -HBCD μ g/g	Growth		Finishing		Total of pigs
		Start	End	Start	End	
Control	0	2	3	3	3	8
Level 1	3	3	3	3	3	15
Level 2	30	3	3	3	3	15
Level 1-Control	3 / 0			3	3	9
Level 2-Control	30 / 0			3	3	9

Slaughtering day: 1 20 50 71 92 113

Results

α -HBCDD concentrations in pig tissues

- Performance is not affected by α -HBCDD exposure. No isomerization of α - to β - or γ -HBCDD forms was detected, while OH-HBCDD was identified as a minor product of α -HBCDD metabolism.
- α -HBCDD concentration on a lipid weight basis was higher in adipose tissue than in muscle and lower in liver.
- With the 29.7 μ g/kg diet, α -HBCDD concentration in the muscle quickly increased up to 116 ng/g lipid at day 49. It decreased down to 31 ng/g after 63 d of depuration, partly because of the body weight gain.



Accumulation ratio (AR) in tissues

$$AR = \frac{[\alpha\text{-HBCD}]_{\text{tissue}} \text{ ng.g}^{-1} \text{ lip}}{[\alpha\text{-HBCD}]_{\text{feed}} \text{ ng.g}^{-1}}$$

Ratios in fat and leg muscle for pig are similar to ratios for broiler obtained in a study of the same research program.

AR	Pork	Broiler	Salmon
Back /abdominal fat	6,6	8,4	-
Ham/Leg muscle	5,3	5,2	-
Breast muscle / fillet	-	2,2	2,7

Jondreville et al., 2017 Bertssen et al., 2011

Depuration (half-life, $t_{1/2}$)

Overall elimination half-lives (*) were 27 and 32 d in *semimembranosus* muscle and backfat but these half-lives were increased by a factor 2 and 5 (**) without the dilution due to growth and associated lipid deposition.

$t_{1/2}$, days	Overall*	Without growth**	Effect of growth
Back fat	32	165	81%
Ham	27	67	60%

Conclusion

- HBCDD is an emergent contaminant listed in Annex A of Stockholm Convention on Persistent Organic Pollutants in November 2014, which results in a ban on its manufacture and use. However, the release of HBCDD into the environment is expected to continue as a result of the long lifespan of polystyrenes.
- Concentrations in pig tissues are proportional to the exposure and elimination half-lives are long.
- It is concluded that HBCDD accumulation in pig tissues is possible, justifying a monitoring of exposure sources

