Relaxation of the animal by-products feedban?
Analytical challenges and foreseen solutions to ensure high level of feed safety

Marie-Caroline Lecrenier [1], Pascal Veys [1], Olivier Fumière [1], Aline Marien [1], Julie Hulin [1], Gilbert Berben [1] & Vincent Baeten [1]
[1] Food and Feed Quality Unit of Agricultural Product Valorisation Department - CRA-W, Belgium;
m.lecrenier@cra.wallonie.be

Introduction

Since 2001, a positive trend in the BSE epidemic is observed and a gradual lifting of the ban has been put in place (Figure 1). However, occasional cases of classical BSE still occur in animals born after the reinforcement of the feed ban (BARB cases) and it is not clear whether these cases are due to an **incorrect implementation of the ban or to spontaneous incidents**.

One of the key points to consider when revising the current feed ban is the **availability of control tools** to ensure proper enforcement of the regulation. The persisting challenge in this context is the development of complementary methods or the adaptation of official methods in order to refine the identification of feed materials.

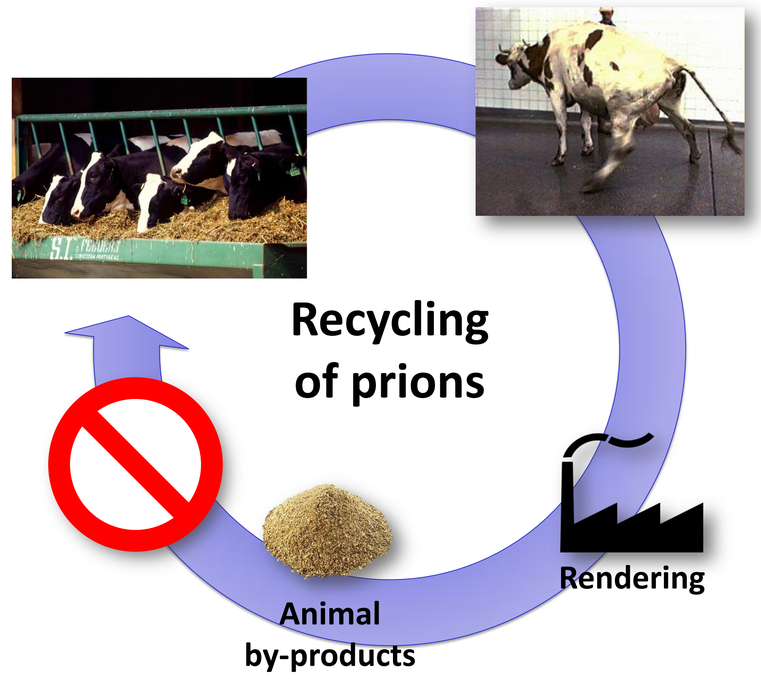

Figure 1: Schematic representation of the BSE origin and the cause of spreading

Practical overview of the current analytical situation and foreseen analytical gaps

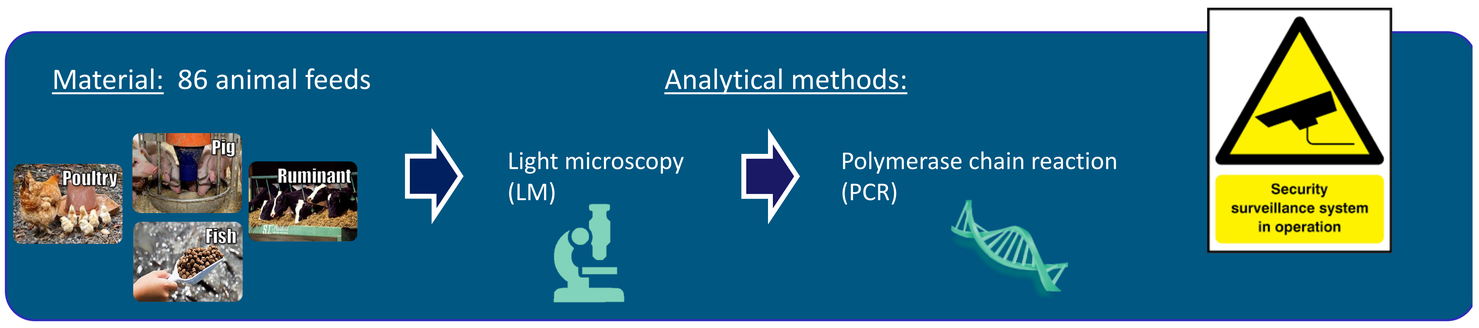

Figure 2: Experimental design of the study

Several compound feeds produced before the partial lifting of the feed ban in 2013 were collected and evaluated by the two current official methods of analysis for the determination of constituents of animal origin in feed (LM and PCR). Porcine, chicken and fish DNA targets were also checked (Figure 2).

Table 1: Summary of the results for the analyses of compound feeds by light microscopy and PCR

Description	#	Light Microscopy		Polymerase chain reaction (PCR)			
		Terrestrial	Fish	Ruminant	Porcine	Chicken	Fish
Feed with fish meal (FM)	30	-	+	-	-	-	+
	19	-	+	-	+	-	+
	4	-	+	-	+	+	+
	9	-	+	+	+	-	+
	3	-	+	+	-	-	+
	1	-	+	+	+	+	+
Feed with dairy products (DP)	17	-	-	+	-	-	-
	1	-	-	+	-	traces	-
	1	-	-	+	+	traces	-
Feed without FM and DP	1	-	-	-	-	-	-

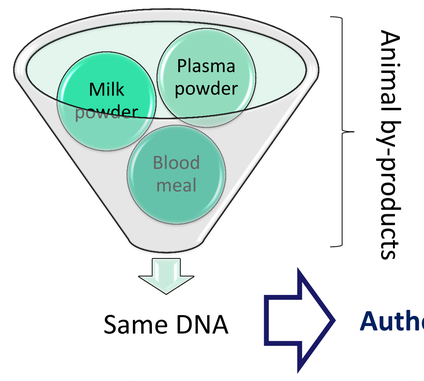

Figure 3: Schematic representation of the current analytical gap

By limiting the interpretation of the results to the LM analyses (as provided by the legislation in force before 2013), all samples are in accordance to the legal requirements = no particles from terrestrial animals (Table 1). Nevertheless, by adding the PCR results, the **presence of DNA of terrestrial animals is detected in nearly 65 % of the samples**. It demonstrates that, when analyses were limited to LM, some information is missing. In these cases, PCR analyses reveal the use of animal by-products of terrestrial origin [1].

However, as the prohibition of the use of animal by-products depends on their species origin and their type, DNA detection is insufficient to determine if prohibited feed materials are present or not (Figure 3).
This study clearly underlines the need for a direct method capable of **jointly determining both the species and the tissue of an animal by-product** included in feed.

Conclusion and perspectives

It is clear that, already now, some analytical gaps need to be fixed. But in the context of further relaxation of the ban, i.e. by reauthorisation of porcine PAPs in poultry feed or poultry PAPs in porcine feed, these limitations should be taken into account in regulatory provisions aiming at such a further lifting of the feed ban without increasing the risk of fraud that would have consequences for food and feed safety.

The most promising analytical solution is the detection of specific peptides by **UHPLC-MS/MS**. The peptide biomarkers used would be adapted taking into account each regulation modification.
Currently, several research teams conduct complementary studies on the subject [2-9]. The pooling of these works will probably provide a solution, at least partial if not total, to current and future needs.

Nevertheless, we already know that some gaps will persist due to the complexity of the regulation. The crucial point is still **the distinction between porcine blood meal and porcine blood products**. To date, no valid solution has been found to solve this issue. A potential solution could be an adaptation of the legislation. While maintaining the maximum security, but taking into account the analytical difficulties, it could avoid many frauds [10].

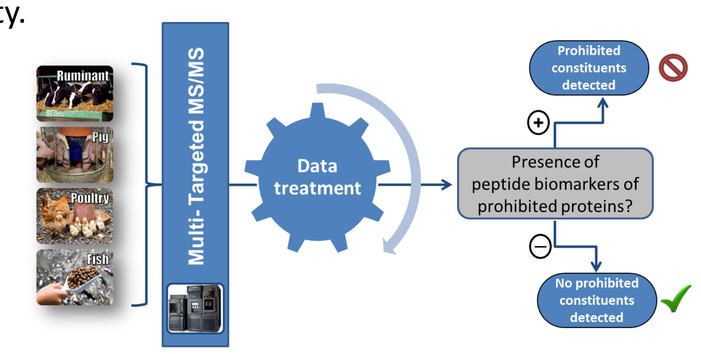

Figure 4: MS operational scheme for the analysis of feed in the context of a potential lifting of the ban

References

[1] Lecrenier, M. C. et al. (2019). *BASE*, 23 (4), 218-225; [2] Marbaix, H. et al. (2016). *J. Agric. Food Chem.*, 64 (11), 2405-2414; [3] Lecrenier, M. C. et al. (2016). *Food Chem.*, 213, 417-424; [4] Marchis, D. et al. (2017). J. *Agric. Food Chem.*, 65 (48), 10638-10650; [5] Lecrenier, M.C. et al. (2018). *Food Chem.*, 245, 981-988; [6] Niedzwiecka, A. et al. (2018). *Food Control.*; [7] Steinhilber, A. et al. (2018), *Anal. Chem.*, 90, 4135−4143; [8] Steinhilber, A. et al. (2018), *J. Agric. Food Chem.*, 66, 10327−10335; [9] Steinhilber, A. et al. (2019), *Anal. Chem.*, 91, 3902−3911; [10] Lecrenier, M.C. (2019). PhD thesis, https://orbi.uliege.be/handle/2268/235700.