In situ contamination kinetic of Lolium perenne by Polycyclic Aromatic Hydrocarbons

Cécile Ducoulombier-Crépineau[1], Abdourahamane Tankari-Dan Badjo[1], Cyril Feidt[1], Guido Rychen[1]

[1]Unité de Recherche Animal-Produits Animaux ENSAIA-INPL-INRA

The ray-grass (*Lolium perenne*) is a commonly used fodder for the feeding of lactating ruminants. It is sewed on pastures in all European countries and the agricultural fields are, for many of them, located along roads, from rural remote roads to large highways. We know that vehicular emissions are one of the sources of PAHs because of the combustion of petroleum by the motors. We are also aware of the contamination of environmental matrices by atmospheric deposition from the verge of the road to a distance of 50m. These two points lead to a risk of contamination of fodder when it grows in such places. Previous studies have detected PAH concentrations in grass growing locally ranging from 120ng/g dry weight to 950 ng/g dry weight. As the grass is the first step for the food chain towards humans via the lactating animals, it is of great concern to assess the level of contamination of this matrix because the level of concentration in grass will lead to a level of concentration in milk measured by the transfer coefficient of the PAHs compounds. In this study our first purpose is to evaluate in how many time the ray-grass growing along the roads is contaminated by PAHs and to what level. Our second objective is to measure in how many time the concentration detected in an exposed grass can decrease, and towards what level, if located in a remote area.

To carry out this study we chose to use a bio-monitoring method to simulate a pasture of ray-grass and to avoid any in situ effect with grass grown locally. We seeded 96 pots of ray-grass, *Lolium perenne var.numan*, in standardized conditions (climate chamber). The ray-grass was exposed along a major highway (A33), with an average daily traffic of 70 000 vehicles. Each day, rainfall, temperature and traffic were measured. The pots stayed from June to the end of August to simulate a grazing period of lactating cows in the region. Every fifteen days, six pots of ray-grass were sampled and the analysis of 12 PAHs were proceeded. After the three months of exposure, the remaining 24 pots were located in a rural pasture away from any PAH sources for four weeks.

The main results showed that in the first fifteen days, the ray-grass is contaminated with the higher level. The total PAH concentration remained stable at an average of 138 ng/g dry weight during the whole period of three months. In two weeks the concentration increased from 14 ng/g dry weight (level measured in the pots stayed in the climate chamber) to 144 ng/g dw showing the rapid effect of the exposure. The saturation of the ray-grass to the level of 140ng/g dw is of great concern for the risk of exposure to the ruminants because it shows that even if the deposition is continuous, the grass concentration remains the same and at a relatively low level for a risk of transfer to the food chain. The concentrations of all the 12 PAHs increased during the first two weeks independently of the physico-chemical properties of the compounds. The variations of the environmental conditions remained low during this period of three months and didn't affect the level of concentration. The exposure in the remote area showed no significant decrease of the PAH concentrations suggesting that four weeks was a too short period. Nevertheless during this period, a difference between the high and low molecular weight compounds is detected : the concentration of the heaviest compounds seemed to remain stable while the lighter compounds began to decrease during the first week of non-exposure. Further studies will be carried out to measure the kinetics of contamination of other fodder (maize, dactylisglomerata, white clover…) to assess more precisely the risk of transfer towards milk and the role of the fodder in the mechanism of animal contamination.