Effect of Post-harvest Treatments On The Occurrence of Polycyclic Aromatic Hydrocarbon (PAHs) In Cocoa Beans Sourced From Côte d’Ivoire

Material and Methods

Raw cocoa sampling

Ivorian first generation of hybrids (Amelonado × West African Trinitario) variety cocoa pods harvested at Akoupé (Côte d’Ivoire) from traditional plantation in 2014 and 2015 (Figure 1) were used to constitute 370 cocoa samples in controlled conditions: health state of pods, fermentation methods, drying supports, storage conditions and time (Figure 2).

PAHs contents measurement

PAHs contents of cocoa were determined using an optimized and validated method based on stirred saponification of 1 g of cocoa butter for 1 hour in 6 mL of KOH, 1 M at 80°C. Benzo (a) anthracene (BaA); Chrysene (Chr), Benzo (a) Pyrene (BaP), Benzo (b) Fluoranthene (BbF) were then identified and quantified by HPLC-Fluorescence and content of sum of the four PAHs (PAH4).

Results

• PAH4 content of raw cocoa resulted from good post-harvest treatments and drying practices is about 5 – 6 μg.kg⁻¹ of cocoa butter (Figure 3).
• PAH4 content of raw cocoa stored for 28 days (Figure 3):
  • Traditional warehouse is ranged 5.6 – 8 μg.kg⁻¹ of cocoa butter.
  • Traditional kitchen (with wood smoke) reaches 35-39 μg.kg⁻¹ of cocoa butter slightly up EU standard 835/2011.
• Artificial dried cocoa in the presence of wood smoke recorded the highest PAH4 content reaching 142.05 μg.kg⁻¹ of cocoa butter while natural dried cocoa presented the lowest content (Figure 4).
• Sun or natural drying cocoa method is appropriated to limit PAH occurrence, however artificial drying method specifically in the presence of wood smoke promotes contamination 3 to 4 times higher than the European standard (30μg.Kg⁻¹ of cocoa butter) (Figure 4).

Conclusion and recommendations

Controlled cocoa post-harvest treatments and sun drying method induce low PAHs content in raw cocoa. Artificial drying method and storage of cocoa in the presence of wood smoke provoke alarming levels of PAHs very higher than international standards. They must be avoided. Occurrence of PAHs in raw cocoa could be greatly reduced by using smokeless drying and storage methods.