

Evaluation of volatile compounds in cocoa beans (Theobroma cacao L.1753) from new fermentation media in Côte d'Ivoire



KONAN Kouakou Ahossi^{1,2}, COULIBALY Ibourahema¹, Manon Genva², Marie-Laure Fauconnier²

1. Jean Lorougnon GUEDE University, Biochemistry-Microbiology Departement, Agro valorisation Laboratory, BP 150 Daloa, Côte d'Ivoire

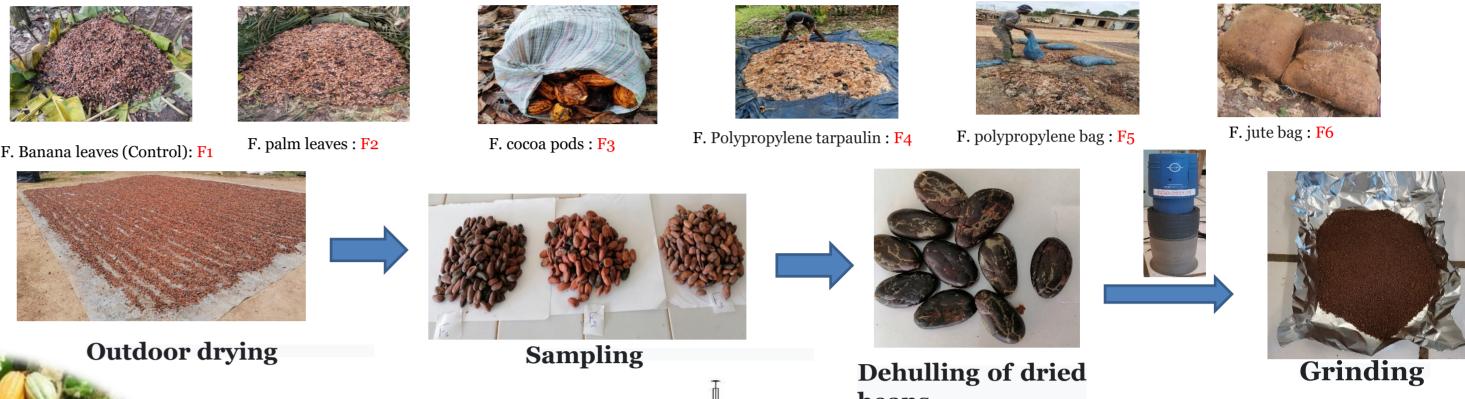
2.Laboratory of Chemistry of Natural Molecules, Gembloux Agro-Bio Tech, Passages des Déportés 2, 5030 Gembloux, Belgium

1 Introduction

- □ Recognized under the scientific name of *Theobroma cacao*, this name means << the food of the gods >> [1]
- ☐ The quality of chocolate products proven by consumer acceptability mostly depends on cocoa volatile compounds
- ☐ However, post-harvest practices (fermentation and drying) can change the chemical composition of cocoa beans. Considered as a key step, it is during fermentation that aroma precursors mainly sugars and amino acids are generated[2].
- □So, fermentation is an essential step in the cocoa post-harvest transformation process which determines the marketability and organoleptic quality of the derived products [3]
- ☐ Today in Ivory Coast (the world's leading producer and exporter of cocoa beans), fermentation is applied in a variety of ways by Ivorian producers. This is due to climatic variations and soil impoverishment, leading to the gradual disappearance of banana trees, whose leaves considered since then the best medium for fermentation.
- ☐ According to the literature, the aroma of cocoa is largely dependent on post-harvest treatments such as fermentation and roasting[4].
- ☐ The objective of this study was to determine the volatile compounds of the beans from the new fermentation media.

2 Method

- ☐ The industrial protocol of fermentation was applied to all the tests, namely: fermentation time of 144 hours (6 days) with the following mixing rates: 48 hours, 96 hours, and 120 hours.
- ☐ In order to better appreciate the variation of the parameters during the fermentation, all the beans from the different fermentation media were dried on the same drying medium (polypropylene tarpaulins).



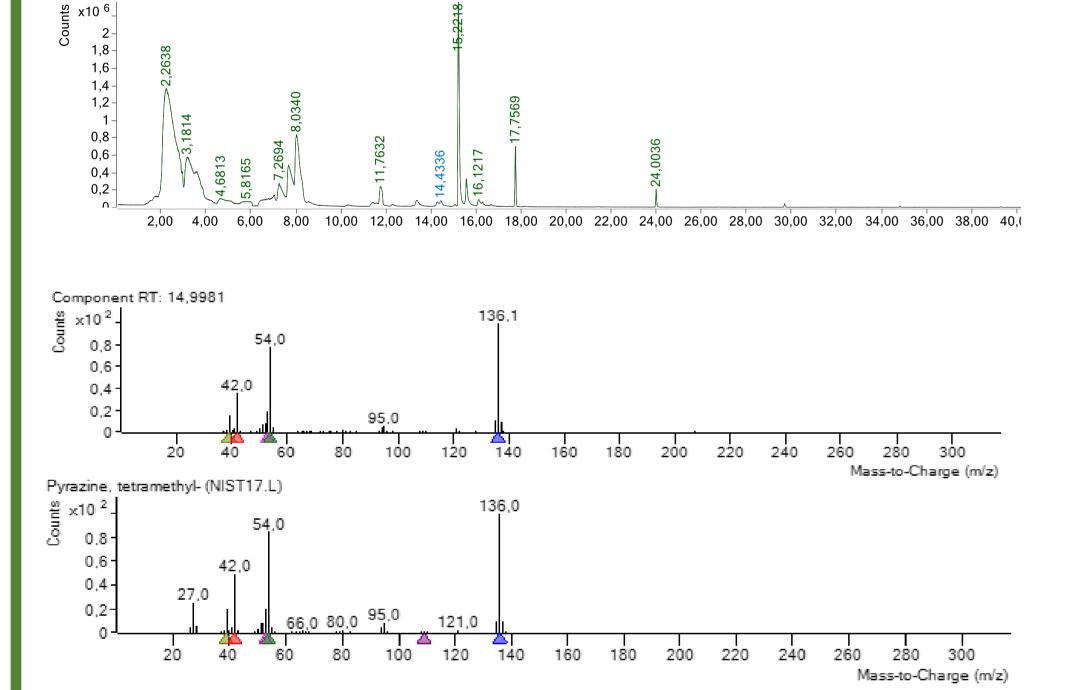
beans

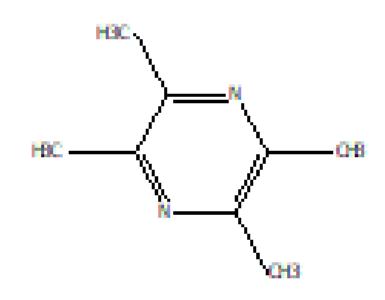
Vials containing the cocoa powder to be injected into the **Analysis of volatile compounds by GC-MS GC-MS**

acetic acid

3 Results

❖ Volatile compounds were identified using mass spectrometry, detection was done in SCAN mode, allowing to identify and quantify selected compounds of interest.





Tetra méthyl- Pyrazine

- - F1: Banana leaves; F2:palm leaves; F3: cocoa pods; F4: Polypropylene tarpaulin; F5: polypropylene bag; F6: jute bag

☐ Table of compounds to all new fermentation media

- ☐ Three compounds Acetic acid, Acetoin and 1-Butanol, 2-methyl-, acetate were found in common with all fermentation media.
- ☐ Acetic acid is produced from ethanol during the fermentation and is the main indicator of microbial activity
- ☐ This acid penetrates the beans and initiates biochemicals changes in the beans, leading to the formation of a diversity of molecules, including those responsible for the cocoa aroma
- ☐ The roasting has the essential roles of reducing the acetic acid content, the origin of the bitter, acid, and astringent flavour.
- ☐ The presence of pyrazines (Pyrazine, 2,5-dimethyl-; Pyrazine, tetramethyl-) in dried cocoa beans fermented in (palm leaves, polypropylene tarpaulin, polypropylene bag, and jute bag) without prior roasting is considered an indicator of good fermentation and predicts bean quality[5]
- ☐ However, the uneven distribution of the different volatile compounds in the samples is a function of the constitution of each fermentation medium, the mass of beans stored in each medium, but also the optimal temperature reached during the six fermentation periods.
- ☐ Palm leaves, polypropene sheets have a higher fermentation temperature, better aeration by stirring and an easier flow of juice. While the bags have an average temperature of fermentation and less aeration although they are perforated before use.
- ☐ The cocoa pods had the lowest temperature and a high rate of germinated beans.

- ☐ In total, 25 compounds were identified in unroasted cocoa powders (Match factor > 80%)
- ➤ **Alcohol** (1-Pentanol; 2,3-Butanediol; 2-Butanol, 3-methyl-;2-Heptanol, Phenylethyl Alcohol)
- **≻Aldehyde** (Benzaldehyde)
- **≻Ketone**(Acetophenone; 2-Nonanone; 2-Heptanone; Acetoin)
- >Acid(Acetic acid; Butanoic acid, 3-methyl-; Butanoic acid, 2-methyl-; Pentatonic acid, Propanoic acid, 2-methyl-)
- **Ester**(1-Butanol, 2-methyl-, acetate, 1-Butanol, 3-methyl-, acetate)
- >**Pyrazine** (Pyrazine, tetramethyl-, Pyrazine, 2,5-dimethyl-);
- **≻Alkane** (Propane, 2-ethoxy-);
- **≻Terpene** (Linalool)
- > Overs compounds (1-Pentene; Bicyclo[3.1.0]hex-2-ene, 4-methyl-1-(1-methylethyl-).

Conclusion

- The analyzes made it possible to identify the volatile compounds of the beans from each fermentation medium. Only three of them were common to all experimental fermentation media. The results revealed that the pyrazines generally described with a sweet chocolate flavor and thus positively influencing the aroma, were only detected in the beans fermented on palm leaves, bags, polypropylene sheets, and bags of jute. These supports are therefore likely to produce better flavored chocolates than the banana leaves usually recommended.
- * In perspective, chocolate based on beans from each fermentation medium will be transformed and a sensory analysis will be carried out to characterize the organoleptic parameters and assess the level of appreciation of the beans according to the fermentation medium used.

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