

Utilization of cupuaçu-seeds as raw material for chocolate-like products: Variability of morphological traits and biochemistry of aroma potential

Reisdorff, Christoph ⁽¹⁾, Rohsius, Christina ⁽¹⁾, Müller, Silke ⁽¹⁾
and Claret de Souza, Aparecida das Graças ⁽²⁾

⁽¹⁾ Universität Hamburg, Hamburg, Germany. ⁽²⁾ EMBRAPA Amazônia Ocidental, Manaus, Brazil.

The cupuaçu-tree (*Theobroma grandiflorum*), a close relative of the cocoa-tree, is cultivated throughout the Amazon region for the production of its aromatic pulp. The seeds, which amount to 15 - 20 % of the fruit fresh weight, are not yet used. Attempts to commercialize a type of chocolate-wares made from cupuaçu-seeds failed so far, probably due to the unsatisfactory quality of the product. The objective of our studies was to evaluate whether seeds of *T. grandiflorum* meet the requirements to form a chocolate-like aroma.

The chocolate aroma of cocoa seeds is formed in two steps of processing: fermentation and roasting. In the fermentation process the sugars of the fruit pulp are degraded to alcohol and afterwards to acetic acid. Acetic acid then permeates the seed shell and penetrates the cotyledons. In the cotyledon tissue acetic acid affects a disintegration of the compartments of the cells leading to the fusion of liposomes and to the generation of a continuous aqueous reaction phase. If the pH of this aqueous phase is lowered by acetic acid to a certain value, two types of proteases are activated. In a cooperative manner these proteases digest the major storage protein of the cocoa-seeds, a globulin of the vicilin type. The result of this degradation is a mixture of amino-acids and oligo-peptides, which represents the precursors of cocoa-aroma. In the course of drying and roasting these precursors react with reducing sugars to Maillard-products, forming the proper cocoa-aroma.

We investigated cupuaçu-seeds concerning the following seed inherent factors, which are pre-requisites for the formation of chocolate-like aroma-precursors in the course of fermentation:

- The quantities and the biochemical characteristics of seed storage proteins and proteases: Both are basic for the generation of aroma-precursors.
- The morphology of the seed shell: This is decisive for its permeability for acetic acid.
- The seed size and shape: It determines the diffusion distance for acetic acid, which must penetrate the entire tissue of the cotyledons within a short time.
- The heterogeneity of seed size and shape: Extremely different seed forms would result in the presence of unfermented or over-fermented seeds within a fermentation load, which lowers the quality of the whole.
- The presence of high quantities of phenolic compounds: Phenolics are considered to prevent microorganisms from colonizing the cotyledons during fermentation and drying. Additionally, phenolics seem to contribute to the final flavor of chocolate products.
- The ultra-structure of storage cells: Under the influence of acetic acid the decompartmentation of storage cells must generate continuous aqueous reaction phases for the sound proteolysis of the storage globulins.

Concerning these seed inherent factors our results reveal, that cupuaçu-seeds possess the biochemical potential to be used as raw material for chocolate-like products. However, simple application of the fermentation practices known from cocoa will not lead to a satisfactory yield of aroma precursors. There are some particular characteristics of cupuaçu-seeds, which must be met by appropriate fermentation procedures.