

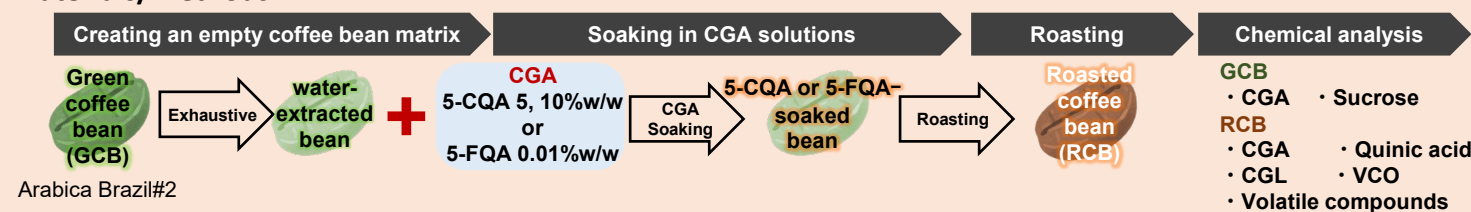
Elucidating the Reaction Pathways of Chlorogenic Acid Isomers Induced by Roasting

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Introduction

Chlorogenic acids (CGA) in green coffee beans undergo multiple pathways during roasting and are known to contribute to the formation of non-volatile compounds such as chlorogenic acid lactones (CGL) and vinyl catechol oligomers (VCO) [1], volatile compounds such as phenol and guaiacol [2]. However, no systematic and comprehensive study on the contribution of different CGA isomers to the formation of these compounds has yet been reported. Thus, this study aimed to investigate the reaction pathways of 2 CGA isomers (5-caffeoylquinic acid (5-CQA), 5-feruloylquinic acid (5-FQA)) during the roasting of coffee beans. This was done by creating an empty "coffee bean matrix" by exhaustive extraction, then adding 5-CQA or 5-FQA, and analyzing the compounds formed by roasting.

Materials/Methods



Results/Discussion

Green Coffee Bean (GCB)

- Sucrose was reduced to 10% through water extraction treatment.
- It was confirmed that the concentrations of 5-CQA and 5-FQA increased to levels equivalent to the amounts added during the soaking process.

Roasted Coffee Bean (RCB)

Note: CGA soaking decreased the pH of the GCB. Since pH was shown to dramatically affect chemical reaction during roasting, the following results are shown for samples adjusted to match the pH of the untreated GCB.

- In 5-CQA-soaked beans, the levels of quinide, CQL, phenol, and VCO increased.
- In 5-FQA-soaked beans, the level of FQL increased. However, the increase of guaiacols was not observed.
- It has been reported that lactone formation is predominant over quinic acid formation during the decomposition of CGA [4]. Similar results were obtained in this study.
- In the 5-CQA-soaked beans, the conversion rate from CQA to the quantifiable compounds was approximately 40%, indicating the presence of numerous unknown compounds.

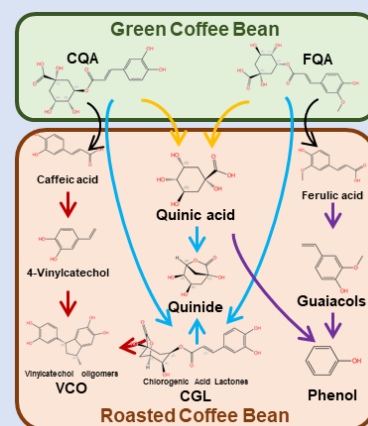


Figure 1: Overview of the reaction pathway of CGA during roasting

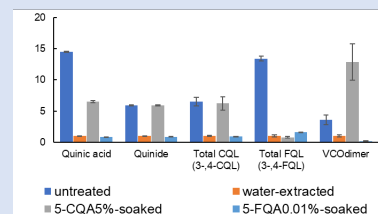


Figure 2: Each compounds levels (relative content when water-extracted=1)

Conclusion/Perspectives

The experimental method of creating an empty coffee bean matrix and adding specific compounds to observe their changes during roasting was shown to be effective for quantitatively understanding specific chemical reactions occurring through the roasting process. In future studies, we will investigate unidentified compounds while verifying the behavior of CGA at varying roasting degrees, thereby elucidating the reactions of CGA in greater detail during the roasting process.

References:

- [1] Blumberg, S. et al., J. Agri. Food Chem., 2010, 58(6), 3720-3728.
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