

Virgin Cocoa Butter from Modified Cocoa Bean Processing

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Food



**Cocoa
butter**

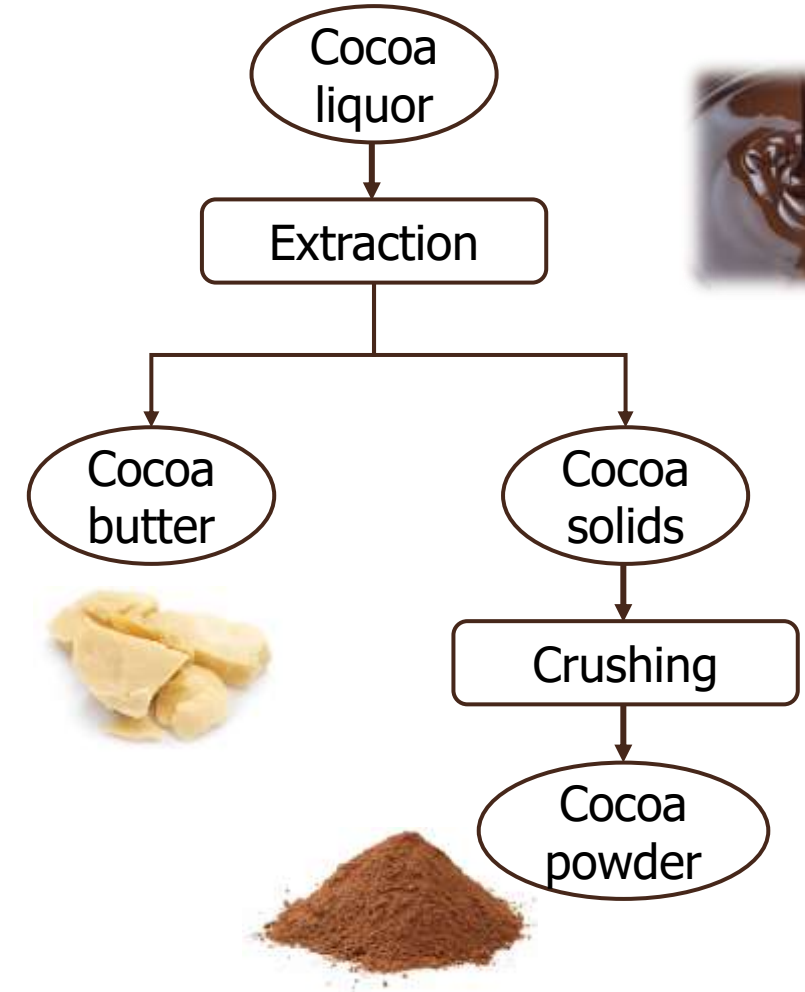
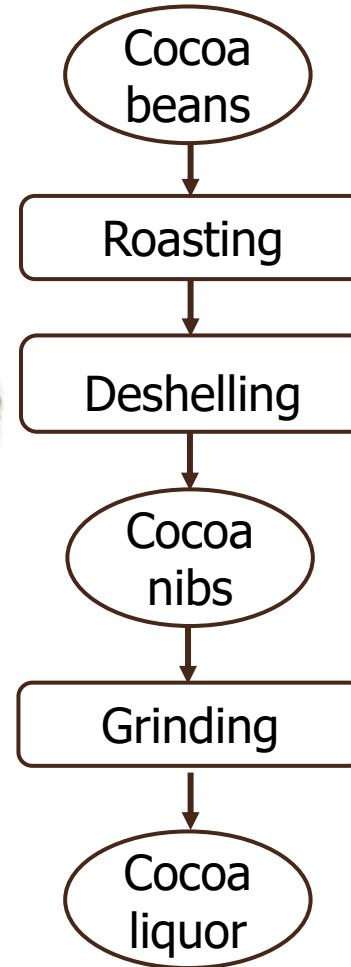
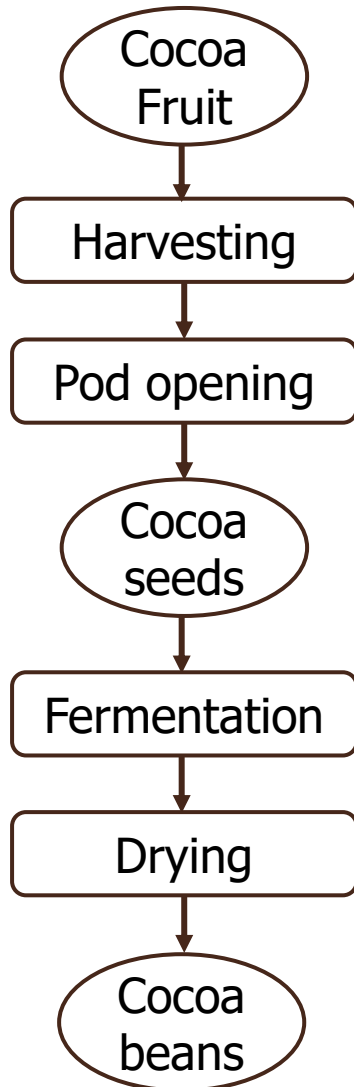


Pharmaceutical



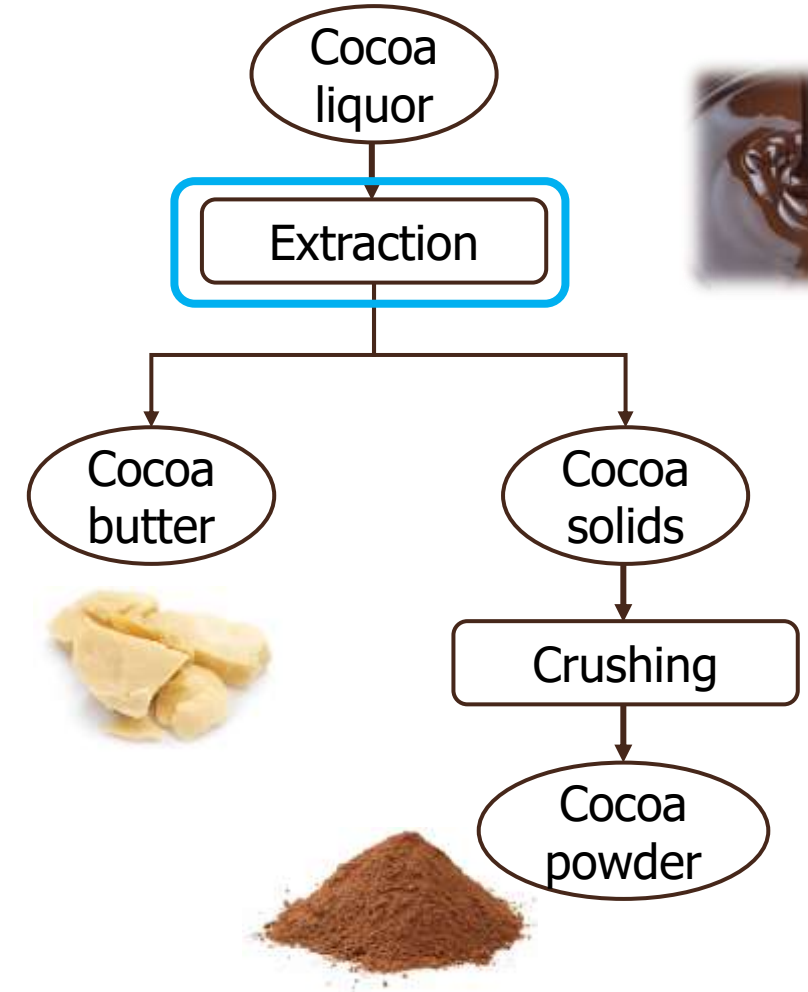
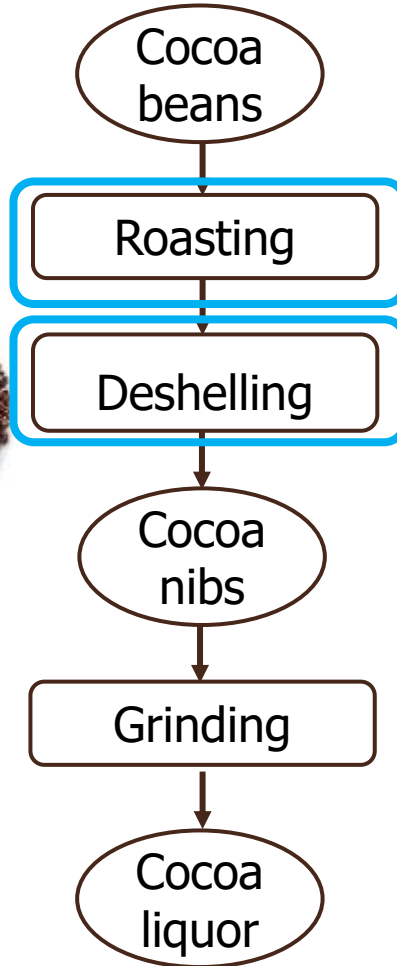
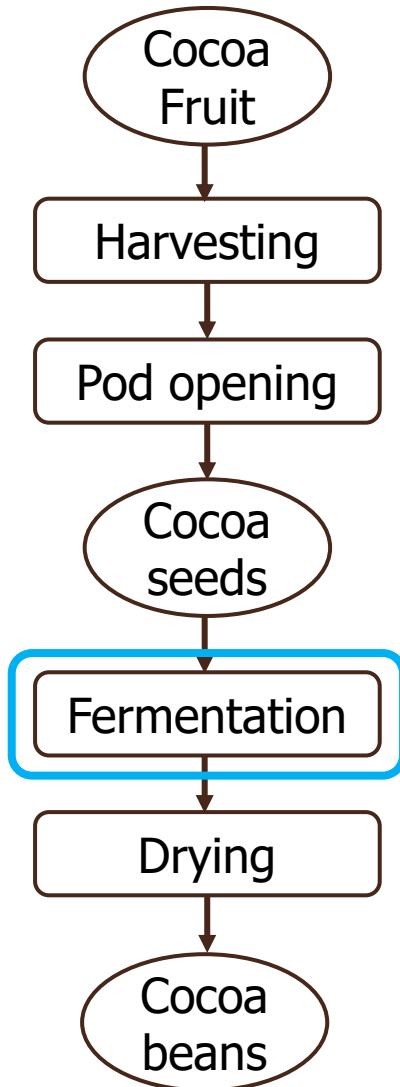
Cosmetics

Cocoa butter production method



(Okiyama et al., 2017)

Possible modifications:



(Okiyama et al., 2017)

Cocoa butter extraction

- Mechanical pressing

Expeller



Hydraulic pressing



- Solvent extraction with hexane
- Supercritical fluid extraction

Treatments

| Code | Fermentation | Deshelling | Roasting | Pressing |
|------|--------------|------------|----------|--------------------|
| U | No | Yes | No | Hydraulic/expeller |
| US | No | No | No | Expeller |
| UR | No | Yes | Yes | Hydraulic/expeller |
| USR | No | No | Yes | Expeller |
| F | Yes | Yes | No | Hydraulic/expeller |
| FS | Yes | No | No | Expeller |
| FR | Yes | Yes | Yes | Hydraulic/expeller |
| FSR | Yes | No | Yes | Expeller |

| Evaluations |
|---|
| <u>Cocoa butter</u> |
| <ul style="list-style-type: none"> • Yield of extraction • Free fatty acid content • Solid fat content • Triacylglycerol content • Oxidation stability |
| <u>Cocoa solids</u> |
| <ul style="list-style-type: none"> • Total phenolic content • Phenolic compounds |

Conventional processing

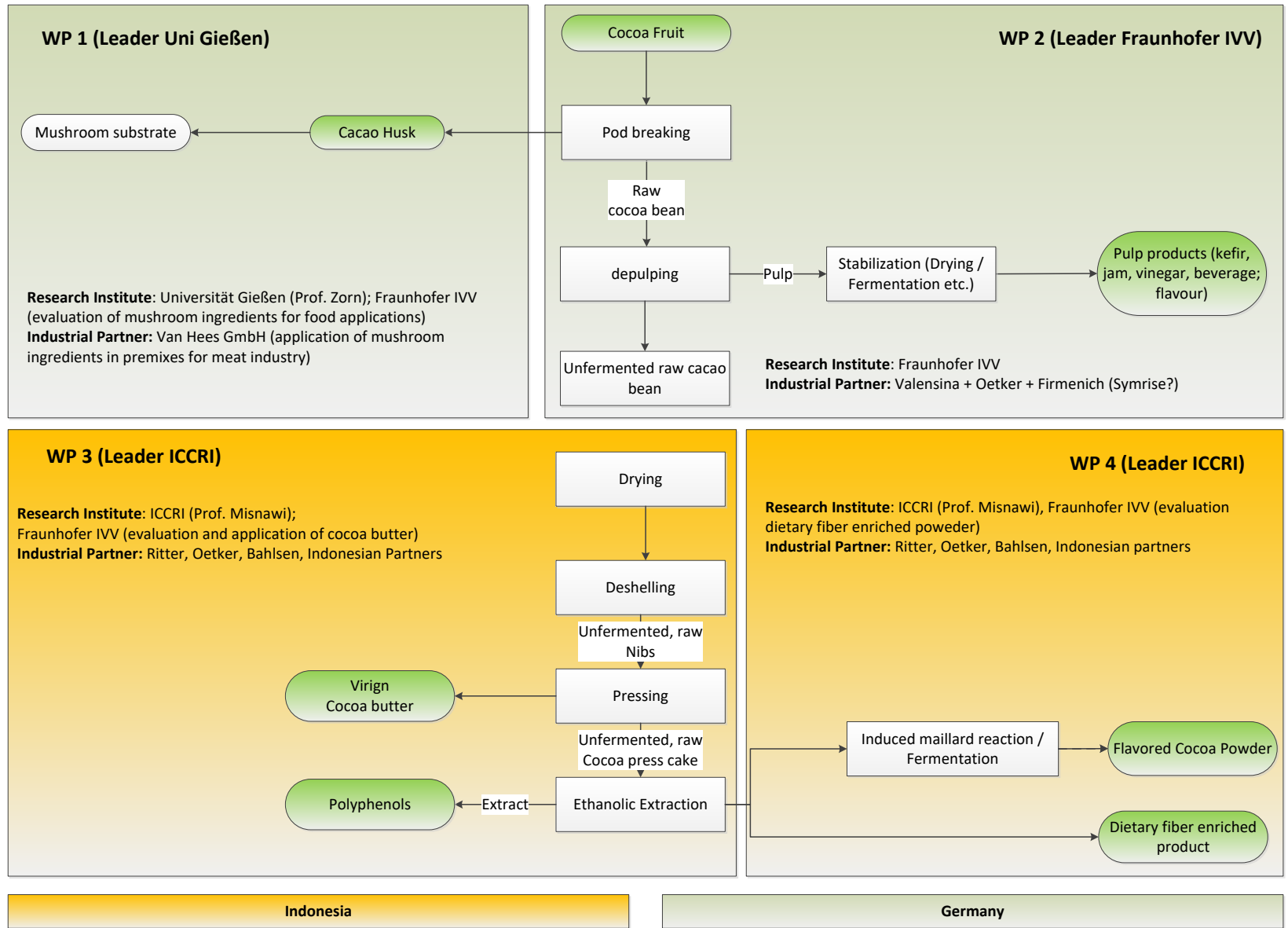
Analyses

Cocoa butter

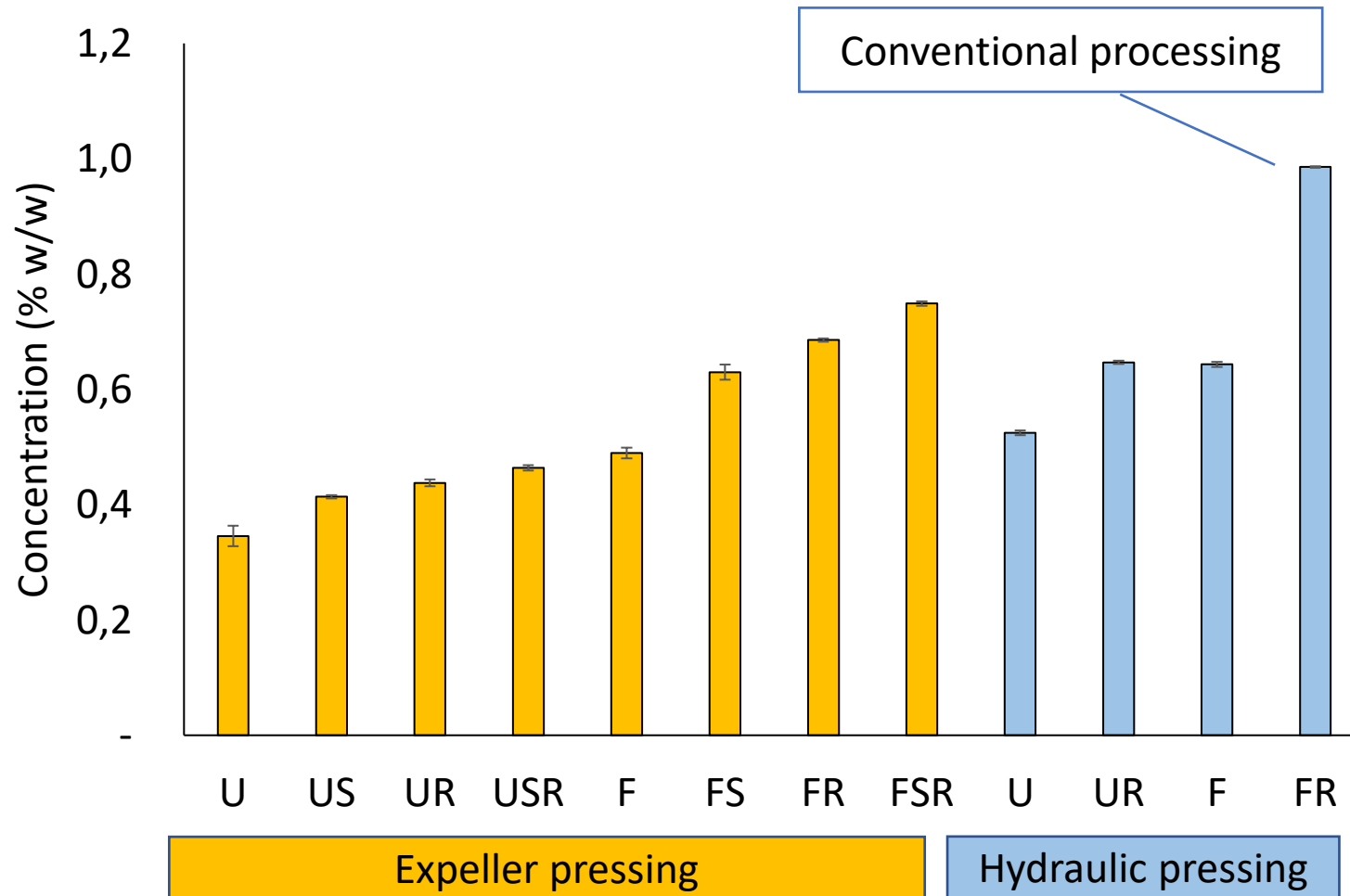
- Free fatty acids (FFA) content: titration based on AOCS Cd 3d-63 official method
- Solid fat content (SFC): nuclear magnetic resonance (NMR) (Rothkopf & Danzl, 2015)
- Fatty acids composition: Gas chromatography (GC)
- Oxidation stability (Rancimat analysis)

Cocoa solids

- Total polyphenol content (TPC): Folin-Ciocalteu method (Rodríguez et al., 2014)



Free fatty acid (FFA) content

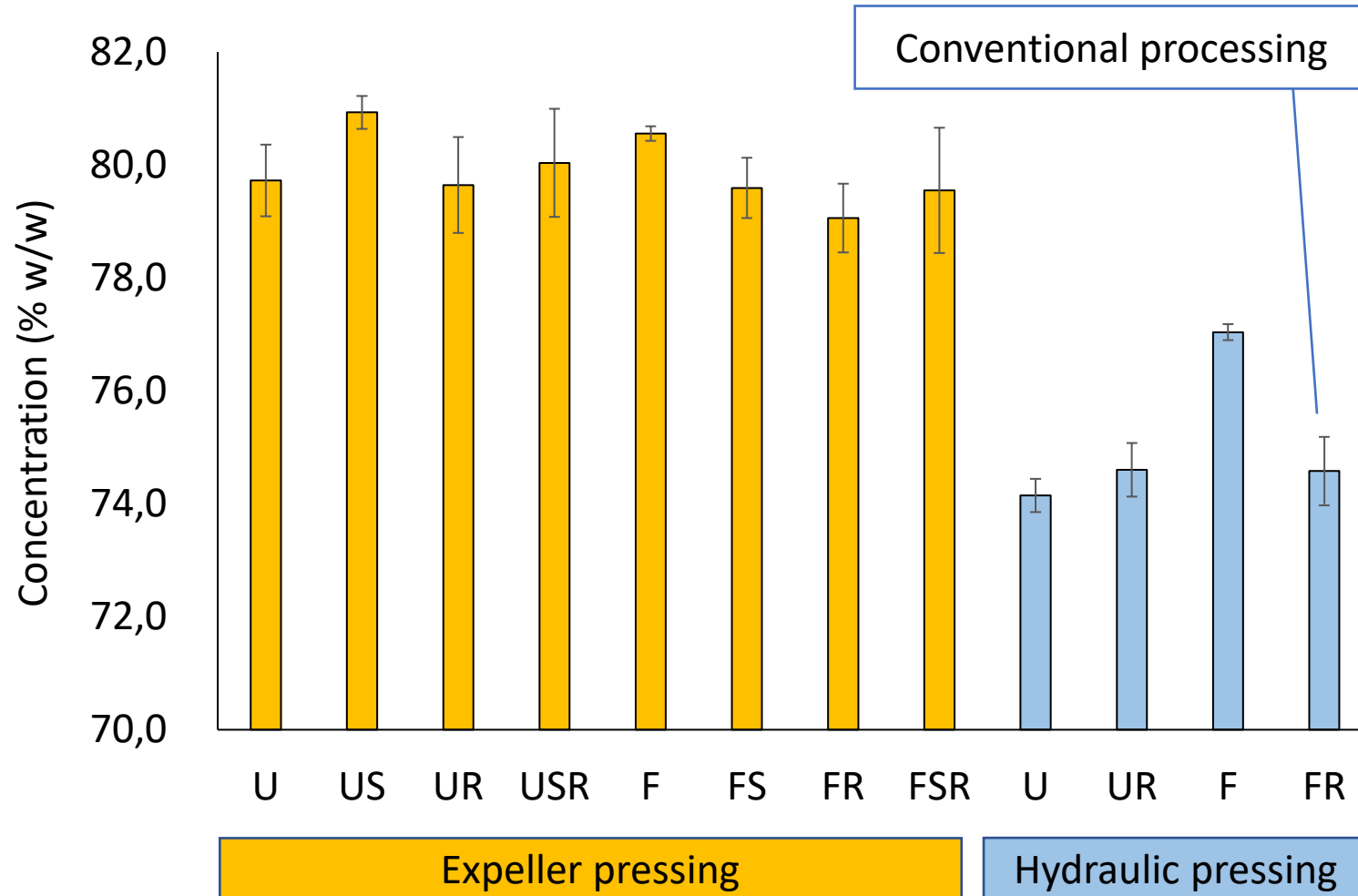


- FFA contents were lower in the cocoa butter from treatments without fermentation and with expeller pressing

Cocoa butter

- U unfermented, no shell
- US unfermented, shell
- UR unfermented, no shell, roasted
- USR unfermented, shell, roasted
- F fermented, no shell
- FS fermented, shell
- FR fermented, no shell, roasted
- FSR fermented, shell, roasted

Solid fat content (SFC)

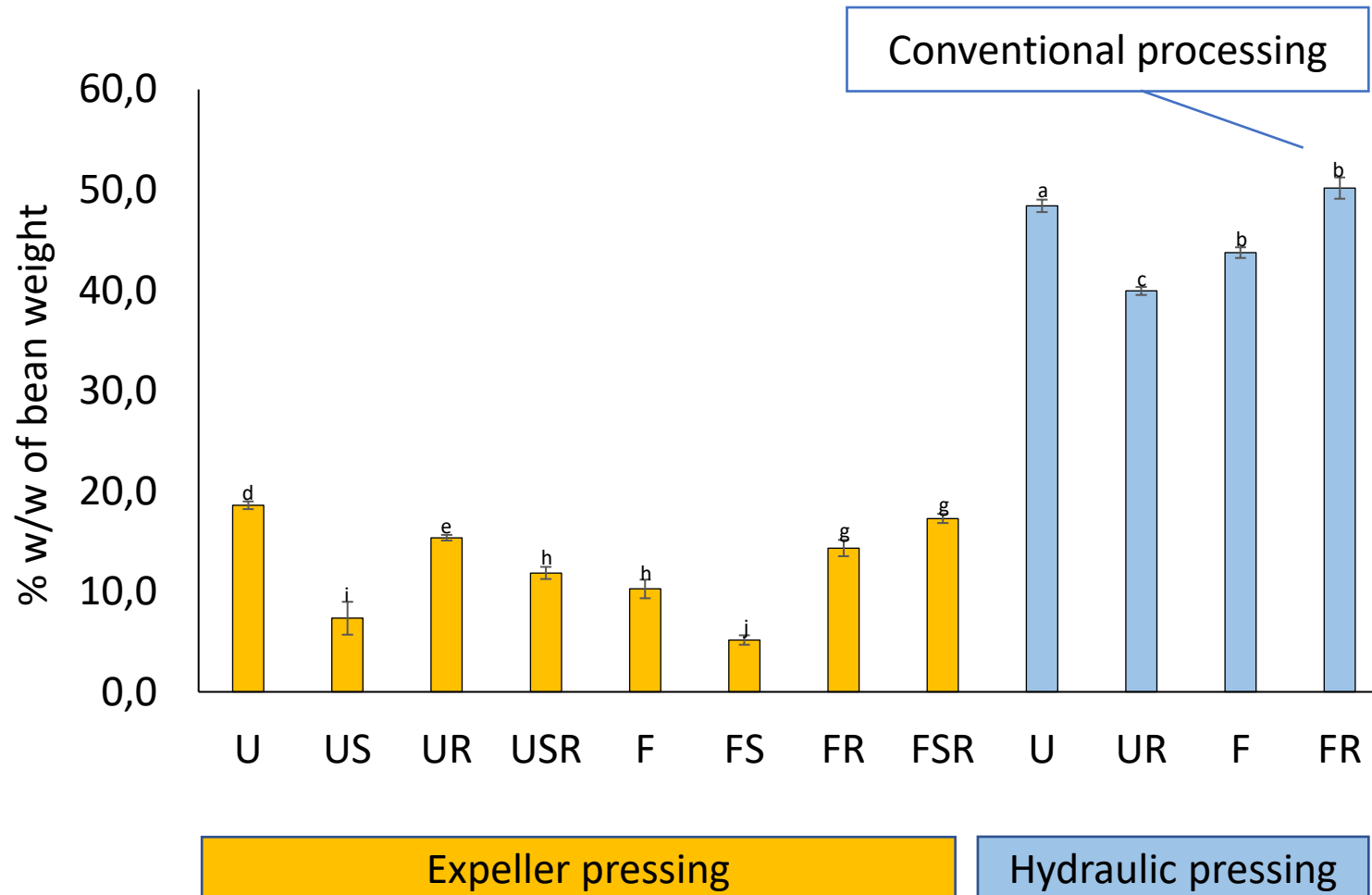


- SFC values were higher in the cocoa butter from treatments with expeller pressing

Cocoa butter

U unfermented, no shell
US unfermented, shell
UR unfermented, no shell, roasted
USR unfermented, shell, roasted
F fermented, no shell
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Yield of extraction



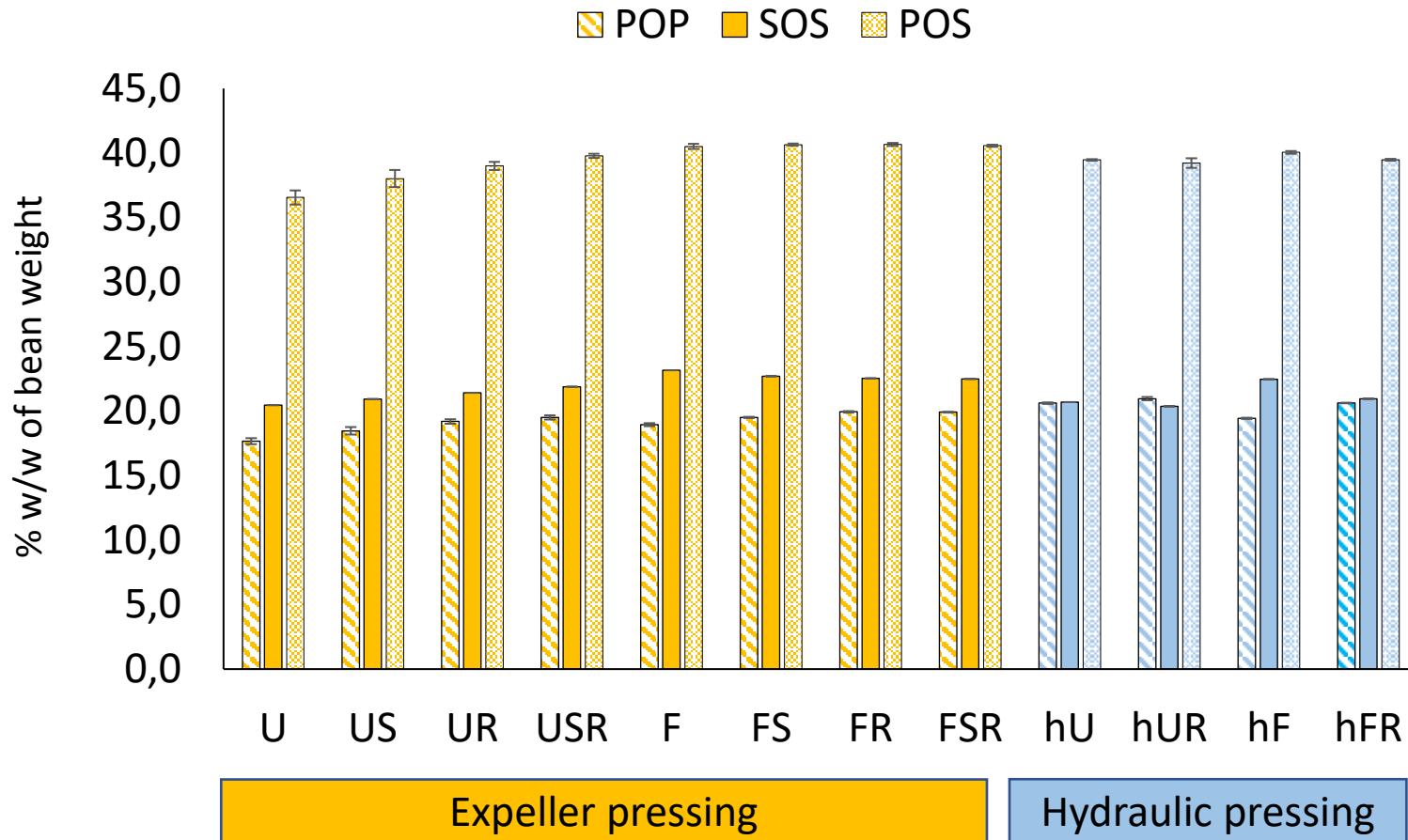
- Yields of extraction were higher in the cocoa butter from treatments with hydraulic pressing

Cocoa butter

- U unfermented, no shell
- US unfermented, shell
- UR unfermented, no shell, roasted
- USR unfermented, shell, roasted
- F fermented, no shell
- FS fermented, shell
- FR fermented, no shell, roasted
- FSR fermented, shell, roasted

Triacylglycerols

- Triacylglycerol contents were varied across different treatments

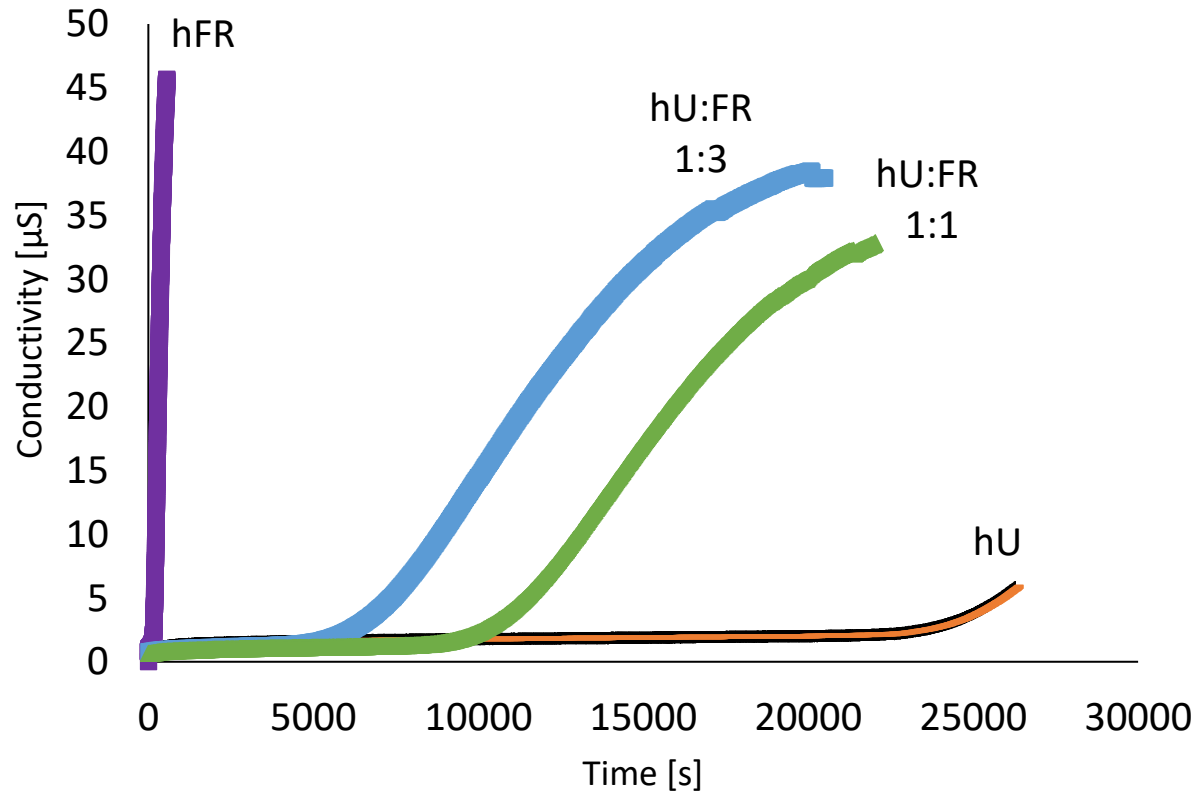


Cocoa butter

- U unfermented, no shell
- US unfermented, shell
- UR unfermented, no shell, roasted
- USR unfermented, shell, roasted
- F fermented, no shell
- FS fermented, shell
- FR fermented, no shell, roasted
- FSR fermented, shell, roasted

- POP = Palmitic – Oleic – Palmitic
- SOS = Stearic – Oleic – Stearic
- POS = Palmitic – Oleic – Stearic

Oxidation stability



| hU | hFR | Onset (min) |
|----|-----|----------------------------|
| 0 | 1 | 5.3 ± 0.5 ^a |
| 1 | 3 | 200.6 ± 19.3 ^b |
| 1 | 1 | 203.7 ± 64.2 ^b |
| 1 | 0 | 370.4 ± 160.4 ^b |

- The onset of oxidation was delayed in the cocoa butter from treatment without fermentation.
- The mixing of unfermented cocoa butter with a regular cocoa butter has resulted in the delay in the onset of oxidation.

Cocoa butter

U unfermented, no shell

FR fermented, no shell, roasted

Extraction method:
hydraulic pressing

Proposed modifications on the cocoa bean processing

- Cocoa bean processing without fermentation
- Expeller pressing at a higher quantity to increase the yield of cocoa butter extraction

Potential outputs

- Cocoa butter with minimal induction of enzymatic and thermal damage → Virgin Cocoa Butter
- Cocoa solids with higher phenolic content

Significance of study

- Product diversification:
 - virgin cocoa butter,
 - phenolic-rich cocoa powder
- Utilization of smallholder farmer's product
 - Some farmers in Indonesia operate small land (<1ha) at low productivity (<500 kg/year).
 - Conducting proper fermentation is very challenging at a low amount of cocoa beans
 - It is suggested that these farmers produce unfermented cocoa beans as the raw material of virgin cocoa butter

Thank you very much for your attention

We are looking forward to your comments and inputs

For further communication, please kindly contact me at
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