

Factsheet



Protein-enrichment from African crops for value-added food ingredients

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How to enhance utilization of African food crops by increasing the nutritive value via dry fractionation?

Dry fractionation of cowpea, Bambara groundnut and amaranth for protein enrichment

Dry fractionation technologies, including milling, sieving and air classification, are sustainable processing methods that enable separation of food components (such as protein, starch and dietary fibre) without using extraction solvents or other chemicals, water or high temperatures. Thus, those methods are gentler and use less energy compared to wet extraction processes that are often used in manufacturing of plant protein ingredients. Cowpea, Bambara groundnut and amaranth are gluten-free crops with excellent-quality proteins, a balanced composition of essential amino acids and other key compounds. Dry fractionation of cowpea, Bambara groundnut and amaranth enables production of ingredients rich in protein and dietary fibre, while starch content is reduced. Currently, there are no or little value-added products from cowpea, Bambara groundnut and amaranth on the market. The protein-rich ingredients from cowpea, Bambara and amaranth can be applied to reach “high in protein” nutritional claims for various food products such as savory crackers and meat analogues.

PRODUCTION OF PROTEIN-RICH INGREDIENTS FOR THE GROWING MARKET BY DRY FRACTIONATION

> Global plant-based market is expected to grow from **USD 10.3 billion in 2020** to **USD 15.6 billion by 2026**

> Using air classification, protein-rich ingredients can be produced:

- ✓ Cowpea with **56% protein**
- ✓ Bambara groundnut with **53% protein**
- ✓ Amaranth with **31% protein**

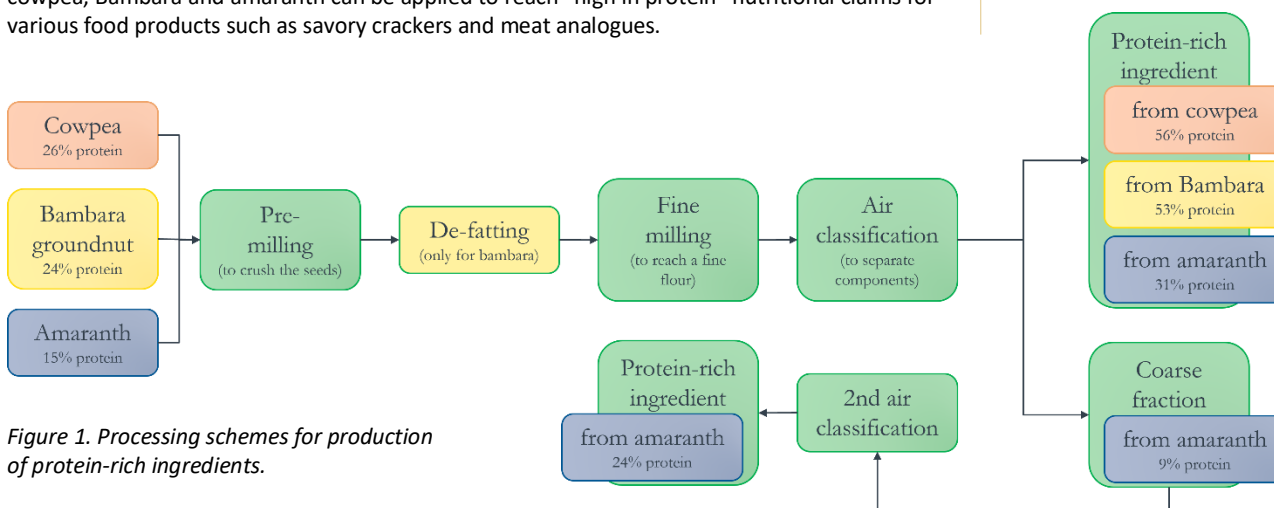


Figure 1. Processing schemes for production of protein-rich ingredients.

MAIN RESULTS AND OUTCOMES OF THE ACTIVITY

Dry fractionation enriches protein from local African crops and allows preparation of food products with improved nutritional and sensorial quality

- Protein content of cowpea was increased from 26 to 56% with a mass yield of 23% by fine milling and air classification (Figure 1).
- For Bambara groundnut, defatting before fine milling and air classification improved protein separation and allowed to reach protein content of 53% compared to 24% in the raw material with a mass yield of 34% (Figure 1).
- Fine milling and air classification of amaranth increased protein content from 15 to 31% with a mass yield of 36% (Figure 1).
- For amaranth, second air classification step increased protein content of the low protein fraction of the first step from 9 to 24% (Figure 1).
- Using the protein-rich cowpea fraction in manufacturing of savory crackers gave a better appearance, colour and structure to crackers when compared to those prepared using the cowpea flour only. Additionally, the crackers baked with protein-rich cowpea had less intensity of beany flavour, less grainy mouthfeel and better roasted cereal flavour (Figure 2).
- Application of the protein-rich fraction from Bambara in high-moisture extrusion enabled production of meat-like structures (Figure 2).

MAIN PRACTICAL RECOMMENDATIONS

Main practical recommendations for improving the food use of cowpea, Bambara groundnut and amaranth are:

- Using dry fractionation, including milling, air classification and sieving, for protein enrichment. The equipment needed for adopting dry fractionation technology (e.g., mills, sieves and air classifiers; Figure 3) are in common use in companies that process cereal ingredients.
- Aiming at a good balance between protein content and mass yield in dry fractionation in order to recover as much protein as possible to the protein fraction, which makes the process the most feasible
- Applying the protein-enriched dry-fractionated ingredients in food applications that benefit from high protein content, for example in meat analogues produced by high-moisture extrusion for producing foods with high nutritional quality in terms of protein content and amino acid composition

CONCLUSIONS

Protein-enrichment from indigenous African crops by dry fractionation can provide more high-quality plant proteins for the growing market

- Cowpea, Bambara groundnut and amaranth are some of the commonly produced and consumed indigenous crops on the African continent but currently there are no or little value-added products from those raw materials on the market
- Protein contents of approximately 55% can be obtained by dry fractionation of cowpea and Bambara groundnut
- Protein content of amaranth can be doubled by dry fractionation
- High-protein ingredients are suitable for example for savory crackers and meat analogues

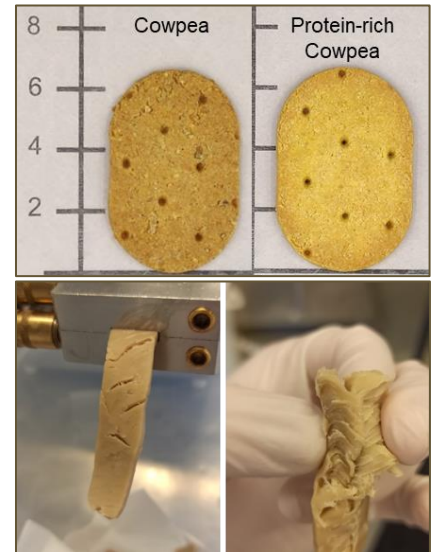


Figure 2. Crackers (above) and meat analogues (below) prepared with protein-rich ingredient of cowpeas and Bambara groundnut, respectively.



Figure 3. Air classifier used in protein enrichment.



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