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# RECYCLING OF FOOD INDUSTRY BY-PRODUCTS: PRODUCTION OF COCOA BEAN SHELL POWDER USING SPRAY DRYING TECHNIQUE

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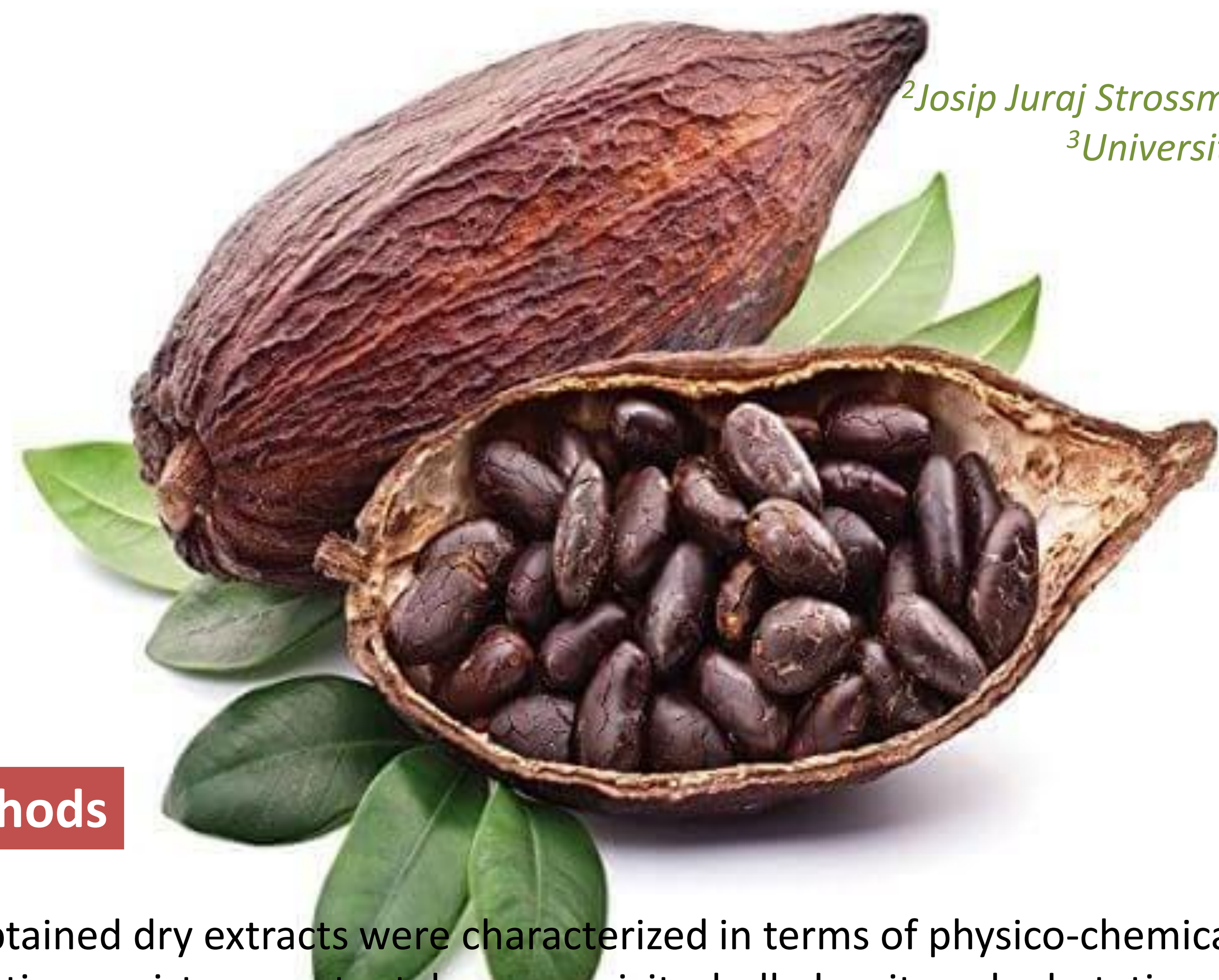

## Introduction

Cocoa bean shell, which represents waste generated in the production of cocoa and its products, is proven to contain numerous bioactive components that can be applied in food, cosmetic, and pharmaceutical industry. To valorize this material, it is necessary to develop an adequate method that can provide quality and stabile products of cocoa bean shell that contains bioactive components. With that goal in mind, the spray drying technique with two carriers – maltodextrin and whey protein was applied.

## Methods

The obtained dry extracts were characterized in terms of physico-chemical properties: moisture content, hygroscopicity, bulk density, rehydratation, water absorption index and water solubility index, content of total phenols and total flavonoids. Furthermore, the content of bioactive components (theobromine, caffeine, gallic acid, caffeic acid, p-coumaric acid, (+)-catechin, (-)-epicatechin and (-)-epicatechin gallate) was performed by HPLC method.

## Results and discussion

By using maltodextrin, an approximately 74% efficacy of the process was achieved, while with whey protein it was 59%. The powders obtained with both carriers had a moisture content below 6%, which secures the extended stability of the extract if it is stored in an adequate manner. Similar results were achieved in the case of hygroscopicity which is the capacity of the material to absorb moisture. This capacity was monitored after 2, 5, 7, 10, and 14 days and it ranged from 12.40 to 16.68% for both powders.

The value of the bulk density of the obtained powders were higher in the case where maltodextrin was used, while whey protein was more efficient and adequate carrier for the preservation of polyphenols. As a result, a higher content of total phenols and flavonoids in dry powders dried with whey protein was determined. Higher content of methylxanthines and phenolic acids, except caffeic acid, was obtained when whey protein was used as a carrier while the content of other analyzed active components was the same regardless of carrier type.

Table 1. Powder characterization

| Carrier | Efficiency (%) | Moisture content (%) | Rehidratation (s) | Bulk density (mg/mL) | WSI (%) | WAI (%) |
|---|---|---|---|---|---|---|
| Maltodextrin | 73.52 | 5.54 | 5.3 | 421.58 | 62.4 | 29.6 |
| Whey protein | 58.61 | 5.83 | 4.3 | 302.43 | 72.8 | 12.8 |

Table 1. HPLC analyses of phenols

| Carrier | Maltodextrin | Whey protein |
|---|---|---|
| Gallic acid | 0.37 | 0.48 |
| Catechin | 1.48 | 1.47 |
| Epicatechin | 0.15 | 0.11 |
| Caffeic acid | 0.04 | 0.03 |
| Epicatechin gallate | 0.07 | 0.06 |
| *p*-coumaric acid | 0.02 | 0.03 |

Table 2. HPLC analyses of methylxanthines

| Carrier | Maltodextrin | Whey protein |
|---|---|---|
| Teobromine | 5.95 | 7.34 |
| Caffeine | 1.10 | 1.34 |

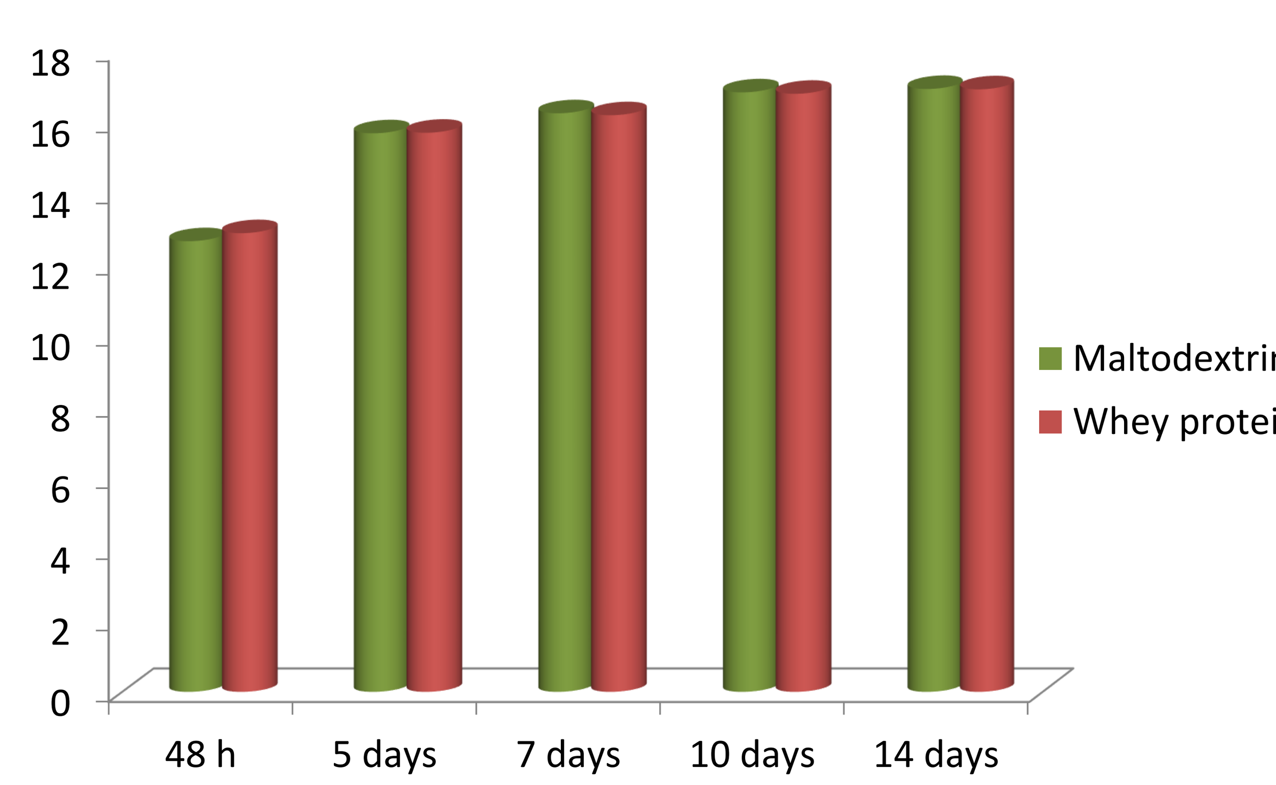


Figure 1. Hygroscopicity (%)