17th International Cereal and Bread Congress Abstract

(A)鄭光成

Oral

Enhancing the nutritional value of fermented *Chenopodium formosanum* through environmentally friendly bioreactors

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Abstract:

Bioreactor offers a sustainable approach to fermentation, allowing for efficient and controlled scaling up of production while optimizing traditional methods. In this study, fresh fourth-day *Chenopodium formosanum* (Djulis) sprouts served as the substrate for *Rhizopus oligosporus* fermentation. The resulting products exhibited superior antioxidant capacity compared to those derived from Djulis grains. Fermentation in a bioreactor led to higher free peptide content (99.56 ± 7.77 mg casein tryptone/g) and enzyme activity (2.21 ± 0.01 U/g for amylase, 54.57 ± 10.88 U/g for glucosidase, and 40.81 ± 6.52 U/g for proteinase) compared to traditional methods. Mass spectrometry analysis identified two peptides with predicted high bioactive properties as DPP IV and ACE inhibitors. Moreover, the bioreactor system revealed over twenty novel metabolites compared to traditional fermentation. These findings suggest that utilizing a bioreactor for Djulis sprout fermentation is a suitable approach to upscale production and enhance both nutritional value and bioactivity. The current bioreactor system can also secure the goal for sustainable agriculture and food chain systems.

Keywords: Bioactive compound, *Chenopodium formosanum*, Fermentation, Food sustainable

(B)姚銘輝

Poster

Building a resilient, sustainable cropping and production system for rice cultivation in Taiwan

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Global warming has increased the frequency of extreme weather events and directly affected crop production and food supply. Primarily influenced by the East Asian Monsoon, the climate of Taiwan exhibits distinct seasonal variations in precipitation patterns and topographic features. Thus, a crucial challenge for achieving resilient agriculture in Taiwan is improving the resistance of its agricultural production systems to climate change. Paddy rice is a staple food in Taiwan, and therefore, small fluctuations in rice yield can severely affect Taiwan's food security. Taiwan must establish a resilient, sustainable cropping system for rice production that can adapt to disaster events in the short term and climate change in the long term. In recent years, rice production in Taiwan was affected by severe droughts that occurred during the vegetative and ripening phases, as well as frequent lodging due to heavy rain. According to a hazard–vulnerability map for rice yield under various climate scenarios, total rice production could decrease by approximately 5%–15% under the SSP5-8.5 and 2℃ scenario of the Sixth Assessment Report (i.e., AR6). This trend is similar to those of other Asian countries, indicating that current planting areas must be replanned in response to the threats of future climate change and extreme weather events. For an adjustment strategy to be effective, it must involve aligning the seeding date with anticipated future climate conditions to avoid heavy rains, which usually occur in June. Also, delaying the planting date or directly seeding on dry fields are adaptable options that can increase the likelihood of water shortages during the growth season for rice. The resilient, sustainable cropping and production system for rice cultivation proposed in this study incorporates the use of weather risk maps and historical disaster probability diagrams. By considering disaster risk and water supply capacity, enabling relevant individuals to identify and exclude high-risk planting areas, assess the suitability of current planting areas, and develop appropriate food security adaptation strategies.

(C)夏詩閔

Oral

Gastroprotective Capacity of Dehulled Adlay Extrudate and the Changes on Active Ingredients during Storage

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Adlay (*Coix lachryma-jobi* L. var. *ma-yuen* Stapf.) seeds have been reported to possess gastroprotective activity. Phenolic compounds,dietary fibers, phytosterols, and coixenolide are proven to be active ingredients for suppressing peptic ulceration. In the present study,dehulled adlay extrudate (DAE) was prepared. Total polyphenol content (TPC), total dietary fibers (DF), main phytosterols, and coixenolide were quantified. Continuously, the changes of contents in the above items were elucidated by storage and accelerated stability studies.

Further, the capacity of DAE against water immersion restraint stress (WIRS)-induced and alcohol-stimulated gastric ulcers was investigated in vivo. The ulcer index (UI) of Wistar rats administered with 20% of DAE-substituted AIN-93 diet was significantly inhibited when treated with WIRS or tube feeding of 95% ethanol. According to validated analysis, DAE contains 942 ± 65 μg gallic acid equivalent (GAE)/g of TPC, 14.0 ± 0.6% of DF, 409 ± 94 μg/g of β-sitosterol, and 136 ± 35 μg/g of total coixenolide; among them, the contents decreased significantly during storage periods except for DF. The results suggested that DF in DAE might be the main active ingredient to inhibit gastric ulcers and could be regarded as a quality control indicator.

Keywords: Coix lachryma-jobi L. var. ma-yuen Stapf. Dehulled adlay extrudat Dietary fiber Stability study Quality control

(D)蘇靖峰

Oral

Effective pH-controlled-releasing and antioxidant properties of ellagic acid encapsulated with oxidized-crosslinked dual-modified starch microgel

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Abstract:

A pH-controlled-releasing ellagic acid (EA) system for effective antioxidant properties was proposed by encapsulating EA with oxidized-crosslinked dual-modified (OC-DM) starch microgels. The dual modifications were carried out by 2,2,6,6-tetramethyl-1-piperidinyloxy (TEMPO)-mediated oxidation followed by sodium trimetaphosphate (STMP) crosslinking. Two oxidized starches with a reaction time of 20 and 45 min (OS20 and OS45) and two OC-DM (OCS20 and OCS45) were chosen for materials of encapsulation, because these two oxidized starches provided a good pH-responsive swelling behavior at pH 7, and combined with the followed crosslinking modification provided a great slowly releasing behavior. The highest encapsulation efficiency (EE) and inner content (IC) of EA could be obtained in OC-DM microgels prepared at pH 4. The pH-responsive and slow-releasing of OC-DM starch microgels encapsulated EA were attributed to the formation of clathrate compounds, amylose-EA complex, evidenced by FTIR and XRD. The EA encapsulated with OCS20 microgel had the highest EE (59%) and IC (59.7 mg, based on microgel (g)). Based on the *in-vitro* digestibility releasing test, the EA encapsulated with either single- or dual-modified starch microgels demonstrated a great pH-controlled releasing capability, preventing the degradation of excess free EA exposed in the intestinal environment at one time, just like the case of EA encapsulated with native starch. In the case of OCS20 microgel encapsulated EA, two slow-releasing phases were observed in 120-180 and 240-360 min, respectively. Two steps of releasing indicated that EA could be gradually released for intestinal absorption, in addition, the late release of EA may be used as prebiotics. All EA-encapsulated microgels prepared in this study showed excellent DPPH radical scavenging activities, proportional to the amount of EA encapsulated. Overall, an effective pH-controlled releasing OC-DM starch microgel encapsulated EA with high EE and IC was developed in this study. This technique could be widely

applied for preparing the encapsulated bioactive compounds with pH-responsive and slowing-releasing properties both for food and cosmetic fields.

Keywords: TEMPO-mediated oxidized starch, STMP-crosslinked starch, microgel, pH-controlled releasing, ellagic acid.