

Potential Cold Plasma Treatment Improvements on Food Product Development Properties of Cricket Protein

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Keywords: Cold Plasma, Cricket Protein, Development Properties

Introduction

By the year 2050 the earth's growing population is expected to reach approximately 9 billion people (Cunha et al., 2025). This growth means there will be a demand for accessible and viable nutrition such as reliable protein sources. Our current global emphasis on animal proteins creates a market that is not energy efficient with many negative environmental impacts (Alexander et al., 2017). The animal protein market cannot feed the earth's population alone. It has now become critical to capitalize on the wave of acceptance from the population to find a new source of reliable and clean protein.

Research has already been conducted on finding efficient methods of cricket protein extraction for high protein yields (Cunha et al, 2025). These methods allow for efficient cricket protein extraction. We can then further test the effects of cold plasma (CP) technologies on functional and biological characteristics of the extracted cricket protein. Studies have shown variable results and applications of CP (Pina-Pérez et al., 2021). Using these works, we can compare how cricket protein functional and biological characteristics vary when applied with CP technology.

Purpose

The objective of the research conducted was to compare the biological and physical food properties of extracted cricket proteins before and after CP treatments.

Methods

The cricket proteins were first subjected to defatting due to the damaging results oxidizing lipids could have. The cricket flour was then placed in a 1:10 Cricket flour slurry and adjusted to 10 pH for an hour. The solution was then centrifuged, and the supernatant was collected. The supernatant's pH was adjusted to 4.5 for an hour before it was centrifuged and the residue was collected and freeze dried. The freeze-dried products would make up the cricket protein isolates for the experimentation.

The cricket protein was divided into a control sample that would undergo immediate analysis and a CP treatment group that would have three 15-minute 220 V treatments applied. These proteins would then be ready to be analyzed. The characteristics that were analyzed were protein yield and purity, solubility, foaming and emulsification, water and oil holding capabilities, digestibility, and radical scavenging activities.

Results

The original cricket protein extracts had a mass yield of 7.00% with a standard deviation of 0.50%. The purity of the proteins extracted had a value of 79.90%. This gave an extractability value of 43.04% with a 3.39% standard deviation.

The STIR spectroscopy of the cricket protein sample and control showed subtle differences in the wavelengths signifying a change in amide II and α -helix regions predominantly. This was reflected in the solubility testing, which showed a significant decrease after plasma exposure in highly acidic and alkaline pH ranges. The foaming properties also showed a significant increase throughout the incubation period after plasma exposure. Despite these changes, both the control and plasma-treated proteins shared similar water and oil holding capacities with no significant difference.

Digestibility testing found that plasma-treated cricket proteins had higher breakdown in the gastric phase. As for radical scavenging activity, the CP treated digestates consistently reduced with each phase of digestion. Plasma-treated cricket proteins showed significantly higher scavenging activity at the end of digestion.

Discussion and Implications

Cold plasma exposure has modified the protein structure, improving foamability, digestibility, and antioxidant properties. However, the functional properties like solubility and emulsification do not show significant improvement. With the beneficial effects of CP, cricket proteins can be used as an alternative protein source that has improved qualities for digestion and intestinal health. Increased foaming also means that the protein will be better in food stuff like cakes, muffins, and breads that can be widely manufactured and distributed. I believe that with further test and optimization of the parameters, new results can be found that may lead to differing benefits of CP treatments.

References

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