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# Study on cold plasma treatment with different feed gases on physical and textural characteristics of Black bean (*Phaseolus vulgaris* L.)

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**Abstract**

Black beans (*Phaseolus vulgaris* L.) are among the most widely consumed legumes worldwide, prized for their high nutritional value including protein, dietary fiber, and bioactive compounds[1, 2]. However, conventional thermal processing often compromises their textural and functional properties. Non-thermal cold plasma technology has emerged as a promising, environmentally sustainable alternative capable of modifying the physical and functional characteristics of food commodities without thermal degradation[3, 4]. Thus, this study aimed to investigate the effect of cold plasma treatment using two different feed gases, helium (He) and argon (Ar), on the physical properties of black beans. Samples of black beans (15 g each) were subjected to cold plasma treatment at 12 kV for 10 min using either helium (He) or argon (Ar) as the feed gas. Three treatment groups were established : untreated control (B), plasma-treated with He (B-He), and plasma-treated with Ar (B-Ar). Results showed that cold plasma treatment did not significantly affect moisture content ($p > 0.05$) across all treatment groups, with values ranging from $11.28 \pm 0.12\%$ to $11.59 \pm 0.23\%$. In contrast, significant differences ($p < 0.05$) were observed in pasting properties; argon-treated samples exhibited the lowest peak, trough, and final viscosity values, suggesting structural modifications to starch granules induced by plasma exposure[5]. Solid loss during cooking was significantly higher in plasma-treated samples compared to the control at cooking intervals of 20, 30, 45, and 60 mins, indicating increased cell wall permeability[6]. Texture Profile Analysis (TPA) revealed that plasma treatment significantly reduced hardness, with argon-treated samples showing the lowest values (56.08 N at 0 min; 28.31 N at 30 min). Overall, cold plasma treatment with both helium and argon feed gases effectively modifies the physical and textural properties of black beans.

**References**

[1] C. D. Ferreira, V. Ziegler, R. T. Paraginski, N. L. Vanier, and M. de Oliveira, "Physicochemical, antioxidant and cooking quality properties of long-termstored black beans: effects of moisture content and storage temperature," International Food Research Journal, vol. 24(6):, pp. 2490–2499, 2017. [Online]. Available: http://www.ifrj.upm.edu.my/24%20(06)%202017/(30).pdf.

[2] M. Meenu, P. Chen, M. Mradula, S. K. C. Chang, and B. Xu, "New insights into chemical compositions and health-promoting effects of black beans (*Phaseolus vulgaris* L.)," Food Frontiers, vol. 4, no. 3, pp. 1019–1038, 2023, doi: 10.1002/fft2.246.

[3] J. A. Bezerra et al., "Cold plasma as a pre-treatment for processing improvement in food: A review," Food Res Int, vol. 167, p. 112663, May 2023, doi: 10.1016/j.foodres.2023.112663.

[4] M. Dharini, S. Jaspin, and R. Mahendran, "Cold plasma reactive species: Generation, properties, and interaction with food biomolecules," Food Chem, vol. 405, no. Pt A, p. 134746, Mar 30 2023, doi: 10.1016/j.foodchem.2022.134746.

[5] C. Kyomugasho, I. Wainaina, T. Grauwet, A. Van Loey, and M. E. Hendrickx, "Bean softening during hydrothermal processing is greatly limited by pectin solubilization rather than protein denaturation or starch gelatinization," Food Research International, vol. 165, p. 112471, Mar 2023, doi: 10.1016/j.foodres.2023.112471.

[6] A. Bassett, S. Hooper, and K. Cichy, "Genetic variability of cooking time in dry beans (*Phaseolus vulgaris* L.) related to seed coat thickness and the cotyledon cell wall," Food Res Int, vol. 141, p. 109886, Mar 2021, doi: 10.1016/j.foodres.2020.109886.

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