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Physical Properties of Orange Peel Flour from Navel, Sunkist, and Valencia Oranges

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Structured Abstract

Background: Orange peel flour (OPF) produced from citrus fruit processing by-products has shown promise as a sustainable material and application. Some of the most important physical properties include pH value, bulk density, and color profile. These factors are greatly determined by the nature or source of the material itself. For instance, different types of oranges, such as Navel, Sunkist, and Valencia, have different characteristics in terms of peel thickness and distribution of pigment composition. Such differences may lead to a unique physical characteristic in OPF as a means of support for its application as a food ingredient.

Methods: Orange peels of Navel, Sunkist, and Valencia were cleaned, soaked in 0.5% citric acid, blanched, dried at 50°C, ground, and then sieved to a consistent particle size of 0.18 mm. OPF measurements were made for the powder, which entailed analysis of pH, bulk density and color profile (L*, a*, b*); to determine compactability. The color parameters were analyzed using a colorimeter. All measurements were performed in triplicate, and Duncan's Multiple Range Test was used to determine the statistical differences for all the OPF data at a significance level of $p<0.05$.

Results: Significant differences ($p<0.05$) were determined among OPF samples for most of the physical properties. All samples had acidic pH levels, indicating the presence of natural organic acids. Bulk density values varied from 0.452 to 0.493 g/mL. Navel OPF had the higher bulk density, indicating a denser particle packing; while Valencia OPF had the lowest value, indicating greater porosity. Valencia OPF had the highest L* value, producing a whiter color appearance for its flour. Sunkist OPF had higher values of a* and b*, indicating a deeper shade of red and yellow; it produced a relatively darker appearance compared to Navel OPF.

Conclusion: In conclusion, orange's varietal differences strongly affected the functional suitability of its OPF. Differences in density and color profile draw great importance to the selection of the cultivar since it clearly impacts both powder behaviour and visual quality. Sunkist OPF showed superior color characteristics while Navel had more desirable packing properties. Overall, the physical properties of OPF support its potential usage in food systems.

Keywords: Orange peel flour, Physical properties, Citrus by-products, Bulk density, Valorization

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