MedCrave
Step into the World of Research

MOJ Food Processing & Technology

Opinion Article

Open Access

CrossMark

Foods and their characteristics: physical aspects

Abstract

Physical properties are important food characteristics that may be very important and transcendent depending of the specific food and particular processing. These properties should be considered and controlled, no matter of the industrial transformation, some of them are color, density, flow nature, form, heat capacity, size, texture, and viscoelasticity, among others. Color and texture are more general and notably affected by processing (formulation, drying, thermal treatment), whereas flow nature, density and viscoelasticity are less known and their changes throughout pumping, evaporation and high pressure applications require deeper knowledge.

Keywords: food properties, food coloring, fluids, viscosity

Volume 12 Issue 1 - 2024

Jorge F. Vélez-Ruiz
Department of Chemical and Food Engineering, Universidad de las Américas Puebla, Mexico

Correspondence: Jorge F Vélez-Ruiz, Food Engineering Independent Consultor, Biochemical Engineer, Ph. D. in Food Engineering, Department of Chemical and Food Engineering, Universidad de las Américas Puebla, Mexico, Tel +222.2370117, Email jorgef.velez@udlap.mx

Received: May 30, 2024 | **Published:** July 09, 2024

Introduction

In this opportunity, I would like to talk about physical properties inside the Food Science, Food Processing, and Food Engineering.

Physical properties are characteristics related with physical aspects and phenomena of foods, they impact the degree of acceptability by consumers and are modified during the processing, such as color, density, flow properties, heat transfer properties, mass transfer coefficients, and viscosity, among others.

Color of foods, such in baked breads, is a quality parameter of great importance, color parameters may be related to the formulation of the specific bread and it is importantly related to those physicochemical reactions developed through the cooking. The color of foods may be expressed by different recognized and accepted scales, for instance the CIELAB (International Commission of Illumination´s/Commission Internationale de l´Eclairage), in which three parameters are utilized to grade the color, L^* for luminosity, a^* for the green-red range, and b^* for yellow-blue range.

Density may be also used to follow the changes during the processing, such in the case of solid foods in which the relation mass to volume change through the drying process of meats or fish. Another example is how the density augment with the evaporation process of juices or milk concentration, in relation to the water elimination presented through this process.

Flow properties are meanly related to liquid foods, although some of them may be used in powder foods. These properties, such consistency coefficient, flow index and yield stress, may be utilized to classify foods as Newtonian fluids, such clarified juices, beer, and honey; or as non-Newtonians fluids, such is the case of cajeta, catsup, and yogurt. The yield stress is "more visible" in foods, such mayonnaise, and dressings. Other example, is liquid milk that changes from Newtonian in fresh form, to non-Newtonian (pseudo plastic type) in concentrated milk. Also, flow parameters of concentrated milk have been related to the degree of solids concentration, among other factors, such origin and thermal processing.

Flow behavior, flow properties and their modeling are very important aspects of engineering, that are determined and analyzed during the characterization of foods, either for new foods, for changes in formulation, and to know the effect of the processing on a specific food, such is the case of yogurt for instance. Yogurt is a milk product in which its formulation and manufacturing affects importantly its flow nature; this food item may include only the milk components and microorganisms, but also may include modifications in composition, such lower fat content, inclusion of calcium and a diversity of ingredients (other proteins, gums, minerals, and carbohydrates, among others), settled yogurt is normally manufactured without agitation, and thus the formed gel maintains its structure; or well gel structure is altered by agitation and shear stresses, in the case of drinkable yogurt.

Heat transfer properties, such thermal conductivity and diffusivity of solid foods are involved in heat transfer processes, such heating down (refrigeration and freeze drying for instance) or heating up (pasteurization and sterilization for instance), whereas the convective coefficient is involved through the heat transfer phenomena of food liquids. The knowledge of these properties and processing parameters, are needed to compute the freezing time or the overall heat transfer coefficient for evaporators design, just to cite a couple of examples. There are proposed equations to predict and compute the convective coefficients during evaporation and drying, for instance.

Similarly, but hard of understanding, diffusion and mass transfer properties/coefficients in food transformation and engineering, are properties involved in processes, such as dehydration, distillation, extraction, in which two phenomena may occur; one of them is developed at molecular level, then the determination of the diffusion coefficient is an important evaluation. And the other one, convection, at macromolecular level, in which this mass transfer coefficient determination, is an important engineering parameter.

The viscosity as other useable and important physical property is a flow parameter applicable for Newtonian fluids; gases have very low viscosities, but syrups of different concentrated fruit juices have very high viscosities. In the case of non-Newtonian liquid foods, an apparent viscosity may be measured and expressed at a range of deformations or shear rates, in order, to carry out a comparison between food liquids with different flow behavior. This property or those related flow parameters, are indispensable for the calculation of friction energies and pump power, needed for transportation of liquid foods through pipelines, as part of an engineering design.

With these brief comments, should be clear to understand the great importance, wide variety, and needs for the knowledge of physical properties, not just for students, also for technicians, process engineers, and researching people.[1–9]

Conclusion

Physical properties of foods are very important, they should be considered not matter of the food item and particular processing. They are modified and will have more or less importance depending on the food and transformation. Color is a determinant factor in food selection; form and size are of great significance in packaging, particle size is very important to control the drying degree, viscosity as Newtonian parameter of liquid foods change to non-Newtonian behavior with evaporation process. Then, these properties should be known by processor and scientist for food items design and transformations.

Acknowledgments

None.

Conflicts of interest

Authors declare that there is no conflict of interest.

Funding

None.

References

1. Aportela-Palacios A, Sosa-Morales ME, Vélez-Ruiz JF. Rheological and physicochemical behavior of fortified yogurt, with fiber and calcium. Journal of Texture Studies. 2005;36(3):333–349.
2. Peleg M, Bagley E. Physical properties of foods. AVI Publishing Company Inc; 1983.
3. Rahman S. Food properties handbook. CRC Press Inc; 2006.
4. Rao MA, Rizvi SSH, Datta AK. Engineering properties of foods. CRC Press Inc; 1986.
5. Stroshine R, Hamann D. Physical properties of agricultural materials and food products. Richard Stroshine, West Lafayette, Indiana. 1994.
6. Vélez-Ruiz JF. Introduction to physical properties of foods. Editorial Académica Española. 2013.
7. Vélez-Ruiz JF, Barbosa-Cánovas GV. Rheological properties of concentrated milk as a function of concentration, temperature and storage time. Journal of Food Engineering. 1998;35(2):177–190.
8. Vélez-Ruiz JF. Evaluation of convective heat transfer coefficient for food process operations. In: Food Processing and Engineering Topics (Chapter 5). Sosa Morales ME, Vélez-Ruiz JF. (editors). Ed. Nova Science Publishers; Inc. 2009. p. 125–153.
9. Vélez-Ruiz JF. Concentrated, evaporated and condensed milk. In: Sweetened Condensed Milks: Science, Technology and Engineering. Chapter, 1, Editorial Elsevier; 2024. p. 21–54.