

Oxidation and World Hunger

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Abstract

The cost of food is the main cause of 828 million people sleeping hungry daily, and it is necessary to reduce food losses which will contribute to the reduction of its final price, allowing the access of a greater number of people to the nutrients necessary for their sustenance, requiring technological solutions such as the reduction of gaseous permeability in polymeric packaging to increase the shelf life of fresh foods and processed products that require precise information on the gas transport coefficients of homogeneous semipermeable materials, such as semicrystalline polymers under different pressures, temperatures and air humidity contents. Thus, there is a need to bring together initiatives such as those suggested in this work to allow the global reduction of food losses.

Keywords: Oxidation; Gaseous permeability; Polymer packaging; World hunger

Introduction

The cost of food is the main cause of 828 million people sleeping hungry every night according to the World Food Program [1] and about US\$ 40 billion a year is needed to end hunger in the world by 2030. Oxidative rancidity is the main cause of the deterioration of foods rich in lipids, such as meats and vegetable oils and can occur during processing and storage, causing undesirable changes in its color, flavor and aroma that make the food unfit for human consumption, due to a series of chemical reactions between oxygen and the unsaturated fatty acids of lipids [2]. Auto-oxidation that is the chemical reaction of oxygen with lipids represents the main mechanism of oxidation of fatty foods, leading to the formation of free radicals that are highly reactive and can cause a reduction in the nutritional quality of foods by reacting with proteins and vitamins, degrading them.

Gas Permeability and Oxidation

As vegetable oils are a combination of glycerol and fatty acids, the main cause of deterioration is oxidation that reduces the quality of the sensory, functional and nutritional attributes of the product, generating financial and environmental losses due to its premature disposal. As oxidative rancidity is the most important reaction regarding the quality of vegetable oil, the packaging must present an oxygen barrier that depends on the type of polymer used, the manufacturing process and its thickness throughout the package. For example, the packaging of polyethylene terephthalate offers sufficient barrier to oxygen and water vapor to meet the protection requirements of edible oil and it is necessary to know the characteristics of gaseous permeability of the polymer that determine the quality of food until it reaches the final consumer [3].

The study of gas transport phenomena needs to be deepened, as gas permeability limits the shelf life of food, especially Ready-to-Eat Meals (MRE), which must be stored for up to 3 (three) years for military use [4] and up to 5 (five) years for use in space missions [5]. The smaller the thickness of the polymer film, the greater the influence of the pores on the permeability of the gas, because in addition to the intrinsic voids arising from the molecular structure of the polymers, the films can also present pores originated during their production [6], forming channels that cross their thickness.

Conclusion

Although world food production will be sufficient to meet demand in the coming decades, there is a food crisis [7], as hunger tends to grow [8] due to the growth of poverty associated with population growth [9], the water crisis characterized by the decline of water available for irrigation [10] and the phosphate crisis, because the reserves of phosphorus used in fertilizers are being depleted [11,12].

As for food preservation, gaseous permeability limits the shelf life of packaged products, requiring new technologies to increase their shelf life, contributing to the reduction of food losses and negative environmental impacts, because in addition to the waste that promotes hunger, it causes financial losses and the depletion of agricultural and environmental resources that are limited.

As world hunger is a problem of multiple causes, it requires solutions on a case-by-case basis, but the sum of initiatives to solve specific issues results in great savings by avoiding the waste of fresh or processed food, contributing to the conservation of natural resources and reducing the accumulation of garbage in large urban centers.

Therefore, gaseous permeability enables the oxidation of food, making it unfit for consumption, causing unnecessary losses of valuable resources from harvest to the final consumer, increasing the accumulation of urban waste and the final price of food, which hinders the access of a greater number of people to the nutrients necessary for their sustenance.

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