Chapter 1

Introductory Chapter: Starch Modifications

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Additional information is available at the end of the chapter

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1. Overview of modifications

Starch is the main polysaccharide used as food and ingredient or additive in the food industry. The main advantages over other polysaccharides are the low cost and renewable raw material, but even starch can be obtained from several natural sources or modified by engineering genetic, as the waxy starch of corn. It also has drawbacks such as: lower solubility usually in water, lower shear stress resistance, lower capacity to support thermal decomposition, and high retrogradation, and these issues limit the use on several temperatures and pH usually found on food system and industrial applications.

The native starch can be improved by means of physical, chemical, and ionic treatments. The physical treatments are cost-effective, are less labor intensive, and only have initial investment of equipment than the chemical treatments (**Figure 1**). The aim of physical treatment is to produce changes in the granular structure, and the common processes involved are heat moisture, annealing, and extrusion. However, today, there are novel processes like sonication and high hydraulic pressure. **Figure 2** shows the main characteristics of these processes. This plot is an easy way to view and compare process conditions like moisture, temperature (glass and gelatinization), and the effect of treatment on granule structure and molecular weight. For example, after annealing process, the granular structure and molecular weight remains without change, and the moisture percent is similar that heat moisture processes employ, but the temperature of process is set between glass and gelatinization temperature.

The chemical modified starch has lot of reports in the literature compared with the other treatments; on this spectrum of chemical modifications, the starch molecules can reduce the molecular weight of chains, add functional groups like acetyl, or even oxidize OH groups present in the monomer of the starch polymers. The chemical treatments also can associate chains of starch like in cross-linked reaction or even make a web around the starch granule. Another step forward in the reactions, complexity of starch is graft copolymerization, which means adding synthetic monomers or polymers or semisynthetic polymers to the biopolymers of starch. Another interesting

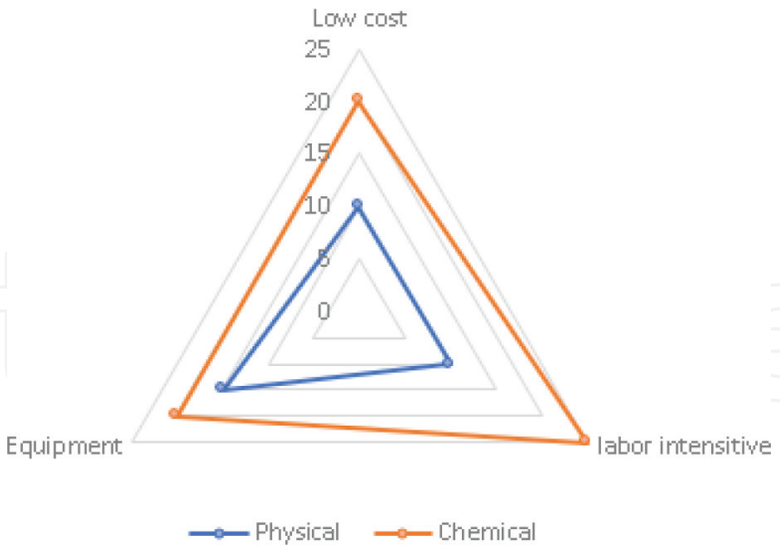

Figure 1. Relative comparison of the physical and chemical treatments of starch.

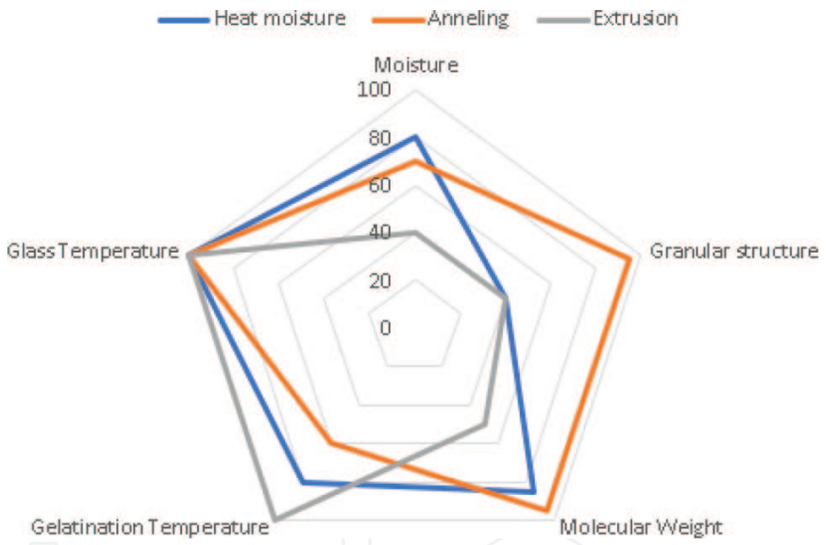

Figure 2. Relative comparison of process conditions and its effect on granular structure for physical treatments of starch.

process to modify the starch is the ionizing radiation process. The radiation ionizing can come from UV, gamma, or accelerated electrons; at first instance, this process was used with synthetic polymers, but today it is used with starch. The radiation produces free radicals that react with starch polymers to produce different properties on the ionized polymers.

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