

Explorative study of oxygen barrier materials for the dairy-based products

The study has revealed a strong potential of thin barrier coatings, namely silicon oxide and aluminum oxide coated PET (polyethylene terephthalate) film as high oxygen barrier material comparable to aluminum foil, applicable for use in flexible packaging (pouch). For rigid packaging (bottles), the study have demonstrated how the modification of EVOH (ethylene vinyl alcohol) thickness in packaging structure influences the oxygen barrier performance. Among the active packaging materials, polyethylene terephthalate (PET) with oxygen scavenging mechanism was shown to perform competitively with conventional packaging materials.

In a nutshell, the packaging material barrier property is the physical resistance against the permeation of any molecule or compound such as oxygen, carbon dioxide, water and so on. Oxygen is considered among the most affecting factors for the product shelf-life; higher amount of permeant results in a shorter shelf-life of food. Different foodstuffs require various degrees of protection against oxygen; therefore there isn't "one-for-all" barrier solution but instead a great variety of options to choose from. The most widely used materials are plastic polymers that has been gradually replacing both metal and glass packaging over the last decades. While offering the benefits of lighter weight, easier formability and reduced costs, the drawback of plastics is their higher permeability to oxygen. In order to enhance the barrier properties, commonly multilayered structures of several polymers are used, with each layer contributing to the resulting performance. Despite that, for extremely oxygen-sensitive foods, aluminum foil is often used as one of the packaging layers, due to its almost perfect barrier characteristics. Last decades have seen an explosive development of plastics, particularly in the field of oxygen barrier materials. Mostly, the efforts are tunneled towards creating a barrier material with potential to replace the aluminum foil, as well as deliver the superior performance comparing to existing solutions.

The master thesis work described in this abstract has pursued as its primary goal to deliver a thorough investigation and classification of the recent developments and trends in field of high barrier materials for oxygen-sensitive dairy-based foods. The necessity of this study lies in the fact that despite the number of advances in plastic packaging, many food companies are still using the conventional multilayered packaging with aluminum foil. The reason for that is a lack of a thorough comparative research of a general scope of packaging materials currently being present on the market. Only with this knowledge, the company is equipped to undertake a study to consider the alternatives to currently used packaging solutions. Author has employed the method of "technology scouting", that combined secondary research over a wide range of publicly available sources (such as suppliers' websites) and primary research where the suppliers have been reached directly for personal discussion. The results of the study has identified two major groups on the market of plastic barrier materials: passive and active barrier materials. The names imply their mechanisms of protection; passive materials are simply serving as an "armor" against permeating oxygen, while active barriers have so-called oxygen-scavengers, presented by substances in material structure that can absorb permeating oxygen.

The study discussed here was conducted by Anna Kim and can be found on <http://www.plog.lth.se/education/fipdes/>.