

Active barrier packaging materials for fat and oils

Identification

Key words	polyethylene terephthalate (PET) bottle, oxygen scavenger, active barrier, shelf life, packaging material, mayonnaise, olive oil
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How does it work?

Primary objective	Reduction of oxygen flux through the packaging material (active barrier)
Working principle	<p>This technology is based on the enclosure of an oxygen scavenger in the packaging material. An oxygen scavenger is a material or combination of reactive compounds and reacts with oxygen to provide enhanced barrier protection for oxygen sensitive products. It is incorporated into layers of containers where it controls oxygen and CO₂ permeation and protects product integrity. For liquid foods, a polymeric oxygen scavenging system is suitable. This active barrier reduces, e.g. for extra virgin olive oil, the decline in antioxidant activity during storage in PET bottles. Oxidation of products is lower than in simple PET bottles stored under the same conditions [1, 4]. Materials having high oxygen barrier properties, for example PET with oxygen scavenger slow down the quality decay kinetics to larger extent, as compared to PET alone [2]. The performance of active barrier PET containers may move towards that of glass bottles (which have high oxygen barrier properties). E.g. mayonnaise stored in PET containers with an oxygen scavenger incorporated during extrusion has comparable oxidative stability as stored in glass [5]. Passive barriers (simply blocking the passage of oxygen through the packaging walls) partially lose their capability as the temperature rises. Active barriers, however, are oxygen-scavenging materials that re-balance their rate of reaction to follow changes in temperature.</p>
Images	
Additional effects	Quality preservation of the packed product. Improved oxygen protection inhibits the growth of mold and aerobic microorganisms improving the microbial quality of the product, it helps to preserve product color and flavor.
Important process parameters	<p>Packaging material conditions: Barrier properties persist for only a finite time, which is a function of two primary variables: scavenging capacity and rate of consumption. Scavenging capacity depends on the composition of the blend and the container wall thickness.</p>
Important product parameters	<p>Product conditions: initial oil oxygen concentration Oxidative stability of packaged mayonnaise, storage 6 month, 20°C : glass = PET with oxygen scavenger > PET coated with an oxygen barrier > PET. No distinction in sensory properties between glass and PET with oxygen scavenger or PET coated with an oxygen barrier; no significant difference in the linear viscoelastic properties for storage in glass or plastic materials [5].</p> <p>Environmental conditions: The main factor affecting the sensory quality loss upon storage is also light [3].</p>

What can it be used for?

Products	PETs with polymer oxygen scavenger are suitable for liquid or semiliquid oil (fatty) foods. It is also suitable for some other liquid foods (e.g. beer).
Operations	Packaging of products
Solutions for short comings	Prolonged shelf life and improved quality of oil and fat products compared to ordinary PET packaging, comparable barrier properties with glass packaging (depend on type of scavenger).

What can it NOT be used for?

Products	
Operations	
Other limitations	Multilayered scavengers can separate or delaminate under temperature or pressure stress, leaving an unattractive looking container.
Risks or hazards	There is no risk of polymeric type scavenger migration into the product.

Implementation

Maturity	This technology of packaging is used in industry. Many kinds of active polymeric scavenger are available under different trademarks (Oxbar® , MonOxbar® , DiamondClear®, Amosorb® etc.). Differences are mainly in structure of layer (multi-layer, monolayer) and materials.
Modularity /Implementation	For multi-layer oxygen scavenger a multilayer injection equipment is required
Consumer aspects	Some types of scavengers (monolayer barrier material) are not accepted well due to the pearlescence and haze, which drastically reduces its attraction on the shelf.
Legal aspects	Regulation (EC) 1935/2004 on materials and articles intended to come into contact with food Regulation (EC/Nr. 450/2009) on active and intelligent materials and articles intended to come into contact with food Regulation (EC) 72/2002: "Positive list"
Environmental aspects	Improved recyclability (Compatible with PETE-1 recycling streams), PET containers with monolayer barrier material also deliver freight savings and reduced greenhouse emission.

Facilities that might be interesting for you

Further Information

Institutes	Clemson University, Advanced Plastics Technologies, Institute of Plastics Processing. Aachen
Companies	Constar, BP, Colormatrix, Invista, Honeywell, Amcor Flexibles

References

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