



A Comparison of ENSO Bottles, Oxo-degradables and PLA

ENSO Bottles™, in partnership with Resilux America, is bringing Eco-Pure™ technology to the PET bottle industry through specially formulated additive, preforms and blown bottles. ENSO bottles are the first truly biodegradable and recyclable PET bottles on the market today.

ENSO bottles with EcoPure adds nutrients and other organic compounds into the bottle which allow microbial action to colonize in and around the plastic and completely metabolize the bottles, turning them into inert humus (biomass) and biogas (anaerobic) or Co2 (aerobic).

The development of our bottles marks a turning point from traditional PET bottles and provides a turn-key stable solution over starch-based (PLA) and oxo-degradable products currently on the market.

Biodegradability

From an environmental perspective there are a number of issues which arise from using oxo-degradables and PLA (plastics made from plant starch) products. Both oxo-degradable and PLA products require an environment with oxygen, UV, and heat in order to begin breaking down, these conditions are NOT often found in landfills.

Oxo-degradables have been on the market for a number of years and as such there are a number of different oxo-degradable additives used which will affect the biodegradability of the products. Some oxo-degradable products do not completely degrade leaving behind harmful heavy metals and chemicals (plastic polymers, Cobalt, Cadmium and other toxic residue) in the ground and oceans. Other oxo-degradables will break down by microbial digestion but still leave behind a biomass and polymer residue. As a requirement, ALL oxo-degradable additives require oxygen, heat and UV in order to break down. These conditions are NOT found in landfills and will result in the products existing for many, many years.

From an environmental perspective, PLA products require the utilization of valuable food resources (land, food products, etc). Many reports indicate that fossil fuels used in processing of plant starch for plastics is harder on the environment than the fossil fuels used in making traditional plastics. Another issue with PLA product biodegradation is that it requires an even more stringent environment to break down. These products must be placed in professional composting environments and will not break down in landfills or on road sides or oceans. The process for professional composting requires the products to be placed in a compost facility which controls the specific heat, oxygen and moisture levels.

ENSO bottles are biodegradable in anaerobic (no oxygen, no light), and aerobic (with oxygen) environments. When our bottles are placed in a microbial environment the additive attracts specific microbes which digest the entire bottle, thus leaving behind inert humus (soil) and CO2 or Biogas.

Recycling

The ability to recycle is an important aspect when choosing an earth-friendly PET packaging solution. There are billions and billions of PET bottles being dumped in landfills through-out the world, and recycling is one way to postpone the pollution problem.

It is unclear and not much available data to verify if oxo-degradable products can and should be recycled along with existing PET recycle streams.



A Comparison of ENSO Bottles, Oxo-degradables and PLA

PLA is recyclable but not within the current recycling infrastructure; most recyclers have a trouble with PLA due to PLA visually looking like PET. With PLA's low melting temperature compared to PET, PLA is considered a contaminant and is causing some batches of recycled PET plastic to be unusable.

ENSO bottles are recyclable and can be comingled with existing PET recycling streams. Our scientific data supports that ENSO bottles will not contaminate PET recycle streams as the material used does not impact the PET polymer in any way.

Physical Properties and Shelf-life

Both oxo-degradables and PLA products have limited shelf life and other handling issues. These are important facts to consider when using either oxo-degradable or PLA packaging for your product.

The product shelf-life for oxo-degradables is between 2 to 6 months. Some of the 2nd generation oxo-degradable products claim the shelf-life has been increased to 6 months to 2 years (if the environment is right). The process of degradation of oxo-biodegradable begins immediately after manufacturing and will accelerate when exposed to heat, light or stress. Anti-oxidants and UV inhibitors are placed in the product to help counteract this degradation and short shelf-life. It is important to note that other manufacturing issues may arise from the use of oxo-degradables.

PLA or starch based products currently have a shelf-life of approximately 2 to 4 months. These products have serious issues with being able to handle heat and moisture and require the product to remain in a temperature controlled environment. It is important to note that other manufacturing and product issues may arise from the use of PLA. For example, PLA has a lower oxygen barrier and is less impact resistant than PET, traditional colorants cannot be used.

ENSO bottles maintain the same physical properties as standard PET bottles. Specific shelf-life with ENSO bottles will depend on the product and bottle application and are the same as that found in standard PET.

Table 1.0 – Comparison between ENSO bottles, and other technologies in the market.

Product	ENSO Bottles	PET Resins	Starch Based Resins	Photo-degradables	Oxo-Degradables	Wood Based Resins
Shelf Life	Indefinite	Indefinite	1 - 4 mo	2 - 4 mo	6 mo – 2 yrs	3 - 6 mo
Affected by Light	No	No	Yes	Yes	Yes	No
Affected by Heat	No	No	Yes	Yes	Yes	Yes
Affected by Moisture	No	No	Yes	Yes	Yes	Yes
Affected by Stress	No	No	Yes	Yes	Yes	No
Landfill Biodegradation	<1 - 5 years*	Never	Never	Never	Never	Never
Compost Biodegradation	<1 - 5 years*	Never	30 - 180 days*	3 months - 5 years*	3 months - 5 years*	Almost impossible*
Remnants	Biomass, Co2, Biogas	Plastic resin	Co2, Biogas	Heavy metals, Plastic resin	Cobalt, Cadmium, and salts	Co2, Biogas

*Time requirement for degradation depends on the environment in which the materials are disposed, as types, quantity and quality of micro-organisms.