

Glycolube[®] P

Multi-Functional Additive



Polycarbonate No Lubricant	0.5% Competitor A	0.5% Glycolube [®] P Additive	0.5% Glycolube [®] P Additive ETS
Yellowness Index			
17	13	4	7

Glycolube[®] P Additive is an effective lubricant for many polymer materials in both extrusion and molding processes. This product is recommended as a mold release for polycarbonate and is also compatible with many other thermoplastic polyesters and engineering thermoplastics.

Polycarbonate polymers are used to produce a variety of materials and are useful when impact resistance and/or transparency are a product requirement (e.g. in bullet-proof glass). Polycarbonate can be used for plastic lenses in eyewear, medical devices, automotive components, protective gear, greenhouses, digital discs (CDs, DVDs, and Blu-rays), and exterior lighting fixtures.

Polycarbonate performance, as measured by some critical properties like impact strength, tensile elongation, etc., is directly related to its molecular weight. Its longer-term performance (life expectancy) is related to retention of molecular weight that can be measured by size exclusion Gel Permeation Chromatography (GPC) techniques or indirectly by simple techniques like melt flow rate. Polycarbonate is susceptible to acidic, basic as well as metallic impurities. The degradation mechanisms are well studied for polycarbonate under each of those conditions. Product developers developing compounded polycarbonate blends strive to keep the total impurities at the lowest level. Therefore, Glycolube[®] P Additive is an ideal additive in this polycarbonate blends based on its extremely low impurity profile.

Glycolube[®] P Additive Delivers Processing Performance

This multifunctional lubricant's thermal stability allows for use in polycarbonate systems without degrading at processing temperatures. At a

processing temperature of 300°C, the addition of Glycolube[®] P Additive reduces processing torque as compared at the same metered rate of material addition to the extruder, as seen in Fig. 1.

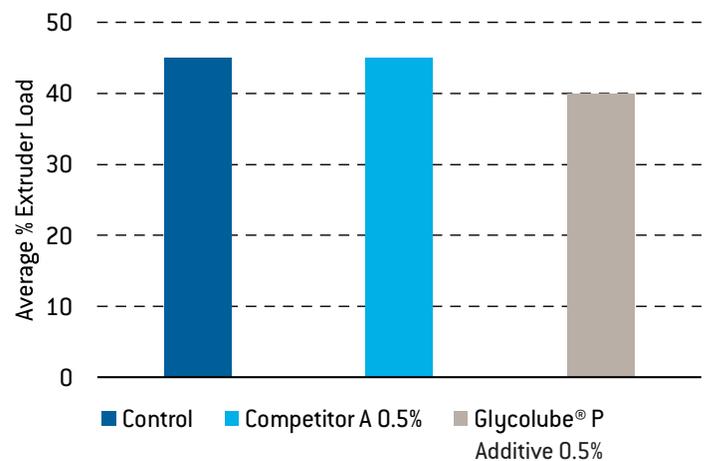


Figure 1: Glycolube[®] P Additive improves flow through the extruder, as seen in this reduction in torque during extrusion

Glycolube[®] P Additive also exhibits external lubricity while improving haze compared to competitive lubricants. Good external lubrication can come at the cost of increased haze in the final polycarbonate product, but Glycolube[®] P Additive maintains strong clarity of the final product.

The Risk of Thermal Degradation to Product Quality

Thermal degradation of polymer materials while undergoing the high heat and shear of the extrusion process will have a significant impact on the physical quality and appearance of the final product. A large-scale study of rheological behavior was performed to characterize the effect of lubricants on viscosity at various shear rates. Using the well-known Mark-Houwink relationship allows us to relate melt viscosity to molecular weight - Fig. 2 shows the result of these calculations. It is evident that Glycolube[®] P Additive not only protects the polymer from molecular weight degradation during the course of typical extrusion (in this case about 3.5 minutes) but also maintains molecular weight over even longer extruder residence times.

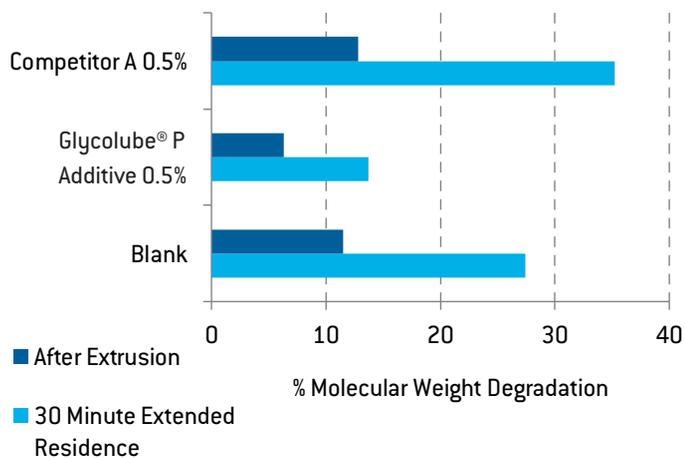


Figure 2: Calculated molecular weight degradation with exposure to 300°C barrel temperature over time

This trend continues with increasing loading of Glycolube® P Additive. As compared to the lower addition level, 1% loading shows more than 5x reduction in % degradation.

In addition to thermal degradation during processing, thermal degradation after production is of concern. Especially in automotive applications and other similar markets. An aggressive heat-aging protocol was used to test thermal stability, where extruded polycarbonate was held in an oven at 130°C for 4 weeks, with color measurements taken weekly.

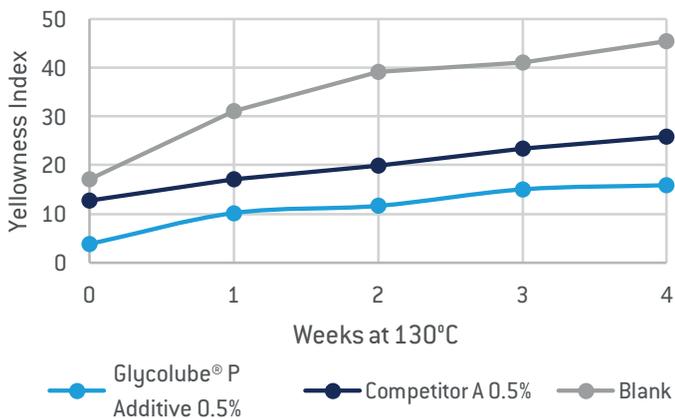


Figure 3: Color stability of polycarbonate over time while exposed to 130°C

Use of Glycolube® P Additive not only delivers lower yellowness post-extrusion but also maintains low yellowness over time, with a smaller overall increase compared to both the blank and the competitive product.

Glycolube® P Additive Even Outperforms Products of the Same Chemistry

Even when compared to competitor materials based on the same chemistry, the premium grade Glycolube® P Additive demonstrates consistently superior results due to its high purity, in particular with regards to unwelcome alkali earth metals.

Sodium, ppm	2.5 Max
Potassium, ppm	2.5 Max

Lonza offers three grades of Glycolube® P Additive:

	Acid Value	Melting Point	Particle Size ST-10M	Particle Size ST-100M	RSP0 Certified	VEG Based
Glycolube® P Additive	1 Max	60 – 65	98% Min	5% Max	No	No
Glycolube® P Additive [ETS]	2 Max	60 – 65	100% Min	10% Max	No	No
Glycolube® P Additive VEG KFG	2 Max	60 – 65	100% Min	10% Max	Yes	Yes



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