ECM BIOFILMS

Additives for Manufacturing Biodegradable Plastic Packaging and Products

Mechanism for the Biodegradation of Products Manufactured with ECM MasterBatch Pellets™

We have determined, through years of testing both internally and through independent laboratories, that plastic products that are manufactured with at least a one percent (1%) load, by weight, of our ECM MasterBatch Pellets will fully biodegrade once they are placed in conditions wherein they are in constant contact with other biodegrading materials.

Originally it was not known precisely what the threshold amount of our material was necessary to initiate and sustain the process. Much of the early testing was done with plastics manufactured with five percent (5%) or higher loads of the additives but it has been determined that all that is required is a minimum of a one percent (1%) load. This amount will initiate the process and any significant amount less than this amount will not permit the process to begin or be sustained.

People often wonder whether significantly greater quantities of our additive will reduce the biodegradation times. The answer is yes, but so very marginally that it is rarely worth the potential issues concerning other physical properties in the finished plastic products and cost. To explain this more fully, it will be helpful to understand the basics of the mechanism.

The presence of at least one percent of our additives in a plastic product, which is in contact with other biodegrading organic materials, structures communities of such organisms as are there present on the surfaces of the plastic in such a way that their interaction produces the ability to break down the long hydrocarbon chains of the "non-biodegradable" petrochemical plastics. As most people are aware, an example of a biofilm would be the scum that can form on the surface of a pond or on teeth, for that matter. In the cases of most pond biofilms, the surface layers with chlorophyllic, aerobic organisms can support layers of anaerobic organisms in the deeper layers and the interaction of all of the organisms makes for an ecosystem that in some cases produce byproducts that would not be formed without the interaction. The same can be said of the biofilms formed by the interaction of our additive materials and the naturally existing biota. Importantly, this structuring of communities of microorganism proceeds in anaerobic as well as aerobic conditions.

Once there are the structured communities of microorganisms interacting to produce schisms in the long hydrocarbon chains of the polymers the process continues until all the hydrocarbons are eventually transformed into the carbon dioxide and water (aerobic biodegradation) or carbon dioxide, methane and water (anaerobic biodegradation).

This leads us back to the reason why greater quantities of our additives do not significantly speed up the time for biodegradation. If you have four otherwise identical 100 kilograms of PE products, one with no ECM (100% PE), one with a half a percent of ECM (99.5% PE), one with one percent ECM (99% PE) and one with seven percent ECM (93% PE) disposed of under the same conditions you will see why this is.

The one with no ECM does not form the necessary biofilm and thereby 100-kg of PE sits in the ground in that form for hundreds or thousands of years or more. The one with a half a percent of ECM does not form the biofilm with sufficient sustainability to initiate and continue the biodegradation process so only the very surface amounts of the ECM biodegrades and you will have remaining all of the 99.5-kg of PE and most of the 0.5-kg of ECM for hundreds or thousands of years in that form. The product that has the one percent of ECM will form and sustain the biofilm that will continue to break apart the long chains of the 99-kg of PE until the entire quantity of PE is biodegraded. The sample that has 7 percent ECM will do the same thing; the only difference is that there will be only 93-kg of the difficult-to-biodegrade PE to degrade rather than 99-kg. The difference in biodegradation time is not terribly dramatic but it is less.

As a method of concluding, I think that it may be helpful to illustrate how the mechanism employed by this unique biodegradation technology is an important reason as to why the technology will continue the path it is on to become one of the world's leading technologies for the production of plastic products.

The fact that the mechanism is not based on photodegradation or thermal degradation means that the shelf life and usable life of the plastic products will be the same as they were without the ECM additives. The fact that there is a threshold quantity necessary for the initiation and sustainability of the biofilms responsible for the biodegradation means that the plastics with the ECM additive do not have to be segregated out of the plastics that might be recycled into plastic products that are not meant to biodegrade. And finally, the fact that the threshold quantity is so low (one percent by weight) means that the manufacturer is able to immediately make plastic products with all the same other properties they had when they were not biodegradable and at nearly the same cost.

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