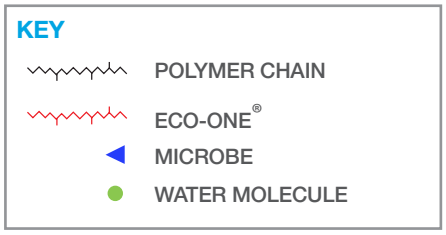
ECO LOGIC
Smarter Plastic. Cleaner Planet.

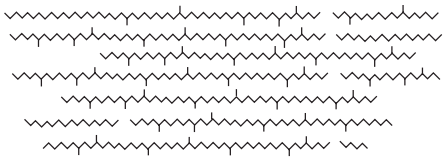



## The Mechanism of Biodegradation using Eco-One®

Plastics (or polymers) are made of long molecular chains of organic molecules called monomers. Polymers do not exist naturally and most are designed to be incredibly stable – as a result they do not easily biodegrade and will last in the environment for centuries and possibly forever. They are air-tight and water-tight.

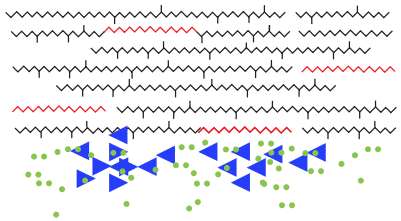



Eco-One® is an organic additive that causes plastic to biodegrade through a series of chemical and biological processes when disposed of in a microbe-rich environment such as a landfill or composting site. It allows the plastic to be consumed (as a food and energy source) by the microbes.



### 1. FORMATION OF BIOFILM

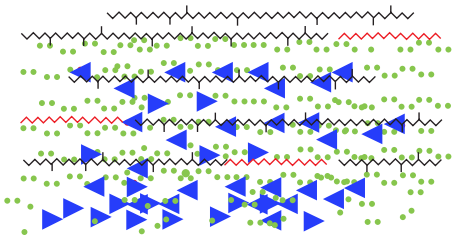
Eco-One®, acting like a surface-active agent, renders the hydrophobic base resin much more hydrophilic in the presence of microbes. This facilitates a rapid formation of a moisture-borne and microbe-rich biofilm on the surface of the plastic.



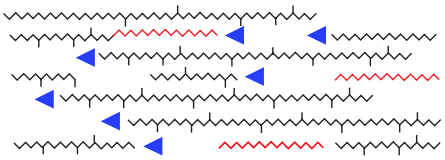
Enzymes secreted by microbes activate the hygroscopic properties of Eco-One®. This allows moisture to be retained thus facilitating an intimate adhesion of the biofilm to the plastic.

### 2. EXPANSION OF THE POLYMER MATRIX

Aggressive accumulation of water expands the plastic matrix and gives the microbes access to the entire polymer matrix. The most likely points of attack on hydrocarbon polymers are at or near the chain ends.



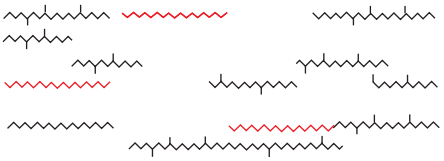
### 3. INITIAL BREAKDOWN OF POLYMER CHAINS



The microbes break down the larger "synthetic" polymer chains into simpler "organic" monomers thus allowing for the consumption of the entire polymer matrix. In the process, they secrete certain signaling molecules that other microbes can detect. This signaling process, called quorum sensing, is an invitation to others to come join the feast.

Volatile organic fatty acids, hydrogen, and carbon dioxide are formed in the initial stages.

### 4. BREAKDOWN CONTINUES

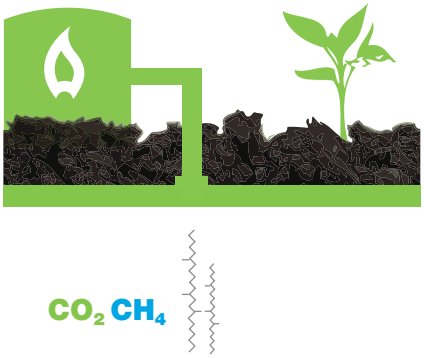


Different types of microbes join the feast. Each one uses different elements of the polymer and/or various by-products of the intermediate biological reactions as a food source, breaking down the complex polymer chains.

Certain enzymes (from microbes) begin reducing the complex polymer branching while others look for bulkier chains similar to fatty acids.

A syntrophic environment containing diverse species of microbes is established to complete the complex chemical steps of biodegradation. Throughout this process, microbes continue to multiply through quorum sensing.

### 5. FINAL STAGES OF BREAKDOWN




The molecular weight reduction has occurred on chains of all lengths in the original plastic material matrix. During the biodegradation process the molecular weight of the plastic material is reduced and the molecular weight distribution is broadened.

As individual polymer chains completely biodegrade, biomass (humus), and biogases (methane and carbon dioxide) are left behind. The carbon dioxide produced in the intermediate steps is being consumed in each subsequent step; therefore, not much is left at the end. The methane can then be captured for energy use.

## Let us help you build a greener future.

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