

## BPI assessment of oxo-degradable films

In 2003, using the Tier 1 tests in the proposed ASTM "Guide for Environmentally Oxo-biodegradable Plastics", the Advanced Materials Center, Ottawa IL (AMC) studied the performance of oxo-degradable films at different temperatures and under high and low humidity conditions. For these tests, bags containing EPI's TDPA (Totally Degradable Plastic Additives) were used. These were purchased from a distributor in the Northeast.

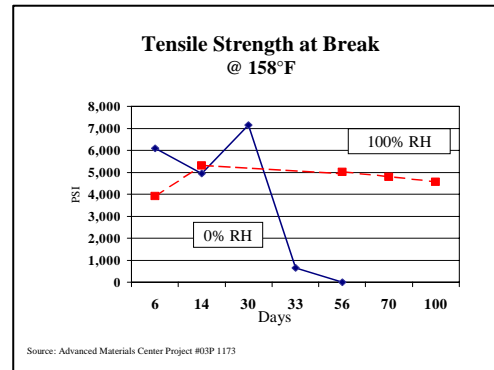
Tier 1 tests are designed to promote or accelerate oxidation of oxo-degradable materials prior to placing the materials in bio-meters to measure the rate of biodegradation. The loss of tensile strength is the signal that oxidation and chain scission are occurring. This step must take place prior to becoming able to be biodegraded.

Results:

The Tier 1 tests revealed the 2 following results:

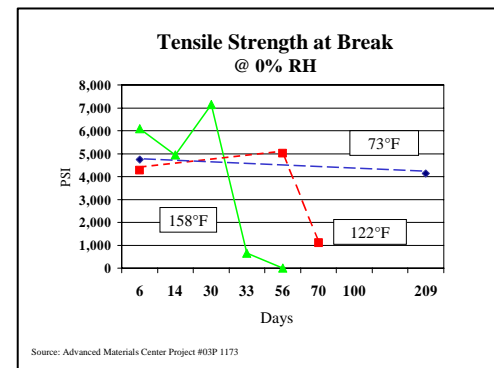
### **1-Moisture or humidity stops or significantly retards the rate of oxidation.**

The moisture in the compost pile significantly slows down the rate of oxidation as shown by property loss changes. Note the the relatively flat line labeled "100% RH" in the chart on the left. This means that the moisture in the compost pile will delay the onset of fragmentation and biodegradation.



### **2-The rate of oxidation is temperature dependent.**

In cooler temperatures, oxo-degradable materials remain intact for very long periods of time, even in arid conditions. This can be seen by the blue line, which shows little loss of strength after 209 days at 73° F.



## Heavy Metal Findings

BPI has had films containing EPI oxo-biodegradable additives analyzed for heavy metals in 2003 and again in 2008. These metals are cited in patent literature to promote chain scission and which will result in fragments that are “ultimately” biodegradable. The samples tested in 2003 contained 1070 ppm of cobalt, which is significantly higher than allowable levels in the ASTM or BNQ specifications. The samples tested in 2008 contained 39.7 ppm of cobalt, much lower than before but still slightly higher the BNQ limits. The BPI believes that the reduced cobalt formula warrants new testing by manufacturers to support their claims of “biodegradability of oxo-biodegradables”.

Cobalt is not a regulated metal in the US, Europe or Japan; however, it is in Canada, under the “BNQ’s Compostable Plastic Bag Certification (BNQ 9011-911/2007).

	<b>D6400 Limits</b>	<b>BNQ 9011- 911/2007 Limits</b>	<b>EPI TDPA Foodwaste Bag USCC 2004</b>	<b>EPI TDPA Produced by Advantage Packaging Jan 2008</b>
Analyzed By			AMC	AMC
<b>Additives</b>				
<b>Calcium carbonate</b>	NA	NA	8,370 ppm	59.6
<b>Cobalt</b>	NA	38	1,450 ppm	39.7
<b>Iron</b>	NA	NA	130 ppm	11.4
<b>Nickel</b>	210 ppm	45	ND	<0.30
<b>Zinc</b>	1,400 ppm	463	160 ppm	2.9

## Conclusions:

1. The moisture in the compost pile delays the onset of oxidation, fragmentation and biodegradation.
2. While cobalt levels have been lowered over the past few years, they still exceed the limits found in Canadian regulations.
3. The formulation of additives in these products varies significantly. When documenting oxidation and biodegradation, manufacturers should provide the concentration of additives, detailing the content of metals and the temperature and moisture conditions under which the tests were conducted.