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Pioneering Oxo-biodegradable Plastic Technology

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Introduction

This memo is intended to respond to the unfounded concerns of those who challenge the reported performance of oxo-biodegradable polyolefin plastics ("polyolefins"). Specifically it will be emphasized that much of the material in position paper on oxo-biodegradables is misleading or incorrect recently presented by the special interest group known as the Bioplastics Council (the "BPI Council").

Terminology

Please note that the correct descriptor is oxo-biodegradable, not the abbreviated and meaningless term oxo-degradable. The oxo-biodegradable plastics with which I am most familiar are those produced using the proprietary formulations developed by EPI Environmental Products Inc. ("EPI") for polyolefins. The test data to which I refer below relate, therefore, specifically to EPI-based products.

Biodegradable and Compostable are NOT Synonyms

Much of the alleged confusion about the significance of the term oxo-biodegradable arises because of the incorrect assumption that biodegradability and compostability are the same process. They are not. The list of Test Standards, Requirements and Specifications discussed in the BPI position paper (ASTM, EN, ISO) refers to compostable plastics. These documents are not relevant to oxo-biodegradable polyolefins or to any other plastics that are not intended to be composted. In contrast, the ASTM test method for biodegradability is D 5338. It has been shown repeatedly in many laboratories that EPI-based polyolefins, after oxidative degradation has occurred, are biodegradable using biometric methodology such as that described in ASTM D 5338. This testing has shown that biodegradation of EPI-based oxo-biodegradable polyethylene reaches a level of 60%, albeit too slowly to qualify as compostable, and that biodegradation continues beyond that point. Of course, most post-consumer plastics are not subjected to composting anyway.

The position of the BPI Council appears to be deliberately misleading. They correctly define a biodegradable plastic but go on to state that this can only be evaluated using what they call "accepted industry standards" which as noted above is a list of specifications/requirements for compostability. This attitude is clearly unjustifiable. As soon as the standards-writing organizations have prepared performance specifications for oxo-biodegradable plastics that, like most plastics, are not designed for rapid composting then it will be appropriate to use those standards.

Two-Stage Process

The noteworthy characteristic of oxo-biodegradables is that, after use and disposal, oxidation converts bio-inert plastic to hydrophilic biodegradable oxidation products. Evidence for this two-stage process has been reported in the scientific literature for many years.

Numerous arguments in the BPI position paper indicate confusion and uncertainty on the part of the authors. The following sentences near the top of page 3 are examples. “In a second phase, the resulting fragments are claimed to eventually undergo biodegradation. While there is a chemical theory to support a very slow biodegradation, the absence of light, presence of moisture or very low temperatures act as a dimmer switch for the process, resulting in a very slow or absent chemical process.” None of this makes any sense. Carbon dioxide production from the biodegradation of oxidized polyethylene, for example, begins soon and is reasonably rapid in biometric tests. Such tests are normally carried out without photochemical stimulus in an aqueous medium at room temperature. What is it that the BPI Council doesn’t understand here?

No Accumulation

There can be and is no accumulation of plastics fragments in the environment from oxo-biodegradable polyolefins. The oxidative degradation of oxo-biodegradable EPI-based polyolefins converts bio-inert, hydrophobic material into hydrophilic, polar chemicals (the oxidations products) that biodegrade in contact with the soil. All arable land is microbially active. That there is no risk of accumulation of persistent substances in the environment has been demonstrated in numerous peer-reviewed scientific publications over the years.

Recycling and Recovery

Third party testing has shown that commercial bags made from EPI-based oxo-biodegradable polyethylene are fully compatible with conventional plastic recycling streams. There was no reduction of physical properties in the final recycled product having up to 50% oxo-biodegradable polyethylene in the feedstock. The same study showed that commercially-available plastic bags made from hydro-biodegradable material (that met the compostability requirements of ASTM D 6400) completely ruined the utility of the normal recycled plastics stream. Perhaps the BPI Council should address that troubling issue.

Recovering the value of used plastics is acknowledged to be important from both an environmental and a practical point of view. Incineration with heat recovery and recycling are acceptable methods. In this context, it should be noted that any plastic that meets the time requirements of compostability as defined in ASTM D 6400 or, even worse, EN 13432 is converted to greenhouse gas during composting. No value can be or is recovered.

In summary, there are numerous errors in the BPI position paper, too many to deal with here. It is a misguided, confused and confusing document that does not contribute anything worthwhile. In contrast to the opinions of the BPI Council, a great deal of evidence has been published that proves that oxo-biodegradable polyolefins based on EPI prodegradants perform as claimed, i.e., after being used and discarded these plastics will oxidize under a variety of disposal conditions and the oxidation products are indeed biodegradable. No accumulation of small particles occurs. Moreover, these oxo-biodegradable plastics can be processed with the conventional waste plastic recycling stream.

For more information, please contact the writer or Joseph G. Gho, EPI's President and CEO.

Yours truly,

Dr. David M. Wiles
International Scientific Advisory Board

About the writer.

Dr. David M. Wiles, Canada, is a scientist with over 36 years of experience in polymer stabilization and degradation of plastics in the environment. Dr. Wiles is internationally recognized as an expert in the photochemistry and microbiology of macromolecular materials. From 1975 to 1990, he was Director-General of the Chemistry Division at the National Research Council of Canada, and is currently the President of Plastichem Consulting. Dr. Wiles is a Fellow of the Royal Society of Canada, the Chemical Institute of Canada and the Textile Institute (UK). He is a recipient of the Queen's Silver Jubilee Medal and the Dunlop Lecture Award. He holds a Ph.D. in Physical Chemistry and has authored over 200 research papers, 6 book chapters and is credited with 13 patents in the field of chemistry. He is a member of the Editorial Board of the SCI/Wiley periodical Polymer International. In 1989 the Society of the Plastics Industry of Canada presented him with the Canplast Award for outstanding leadership and continuous contribution to the Canadian plastics industry. Dr. Wiles has been a consultant to EPI since 1992 and oversees many research and certification projects.