

Certificate

Add-X Biotech

Nr. 0117072024 India

UNO A SOLUCIONES COMERCIALES SAS

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**This certificate confirms that above mentioned company
is a qualified producer using the Bio-Transformative Additive
Addiflex® in its products.**

The oxo-induced biotransformation additive AddiFlex® complies with the standards ASTM D6954 In particular ASTM D5208; ASTM D5510 and successively with ASTM D3826

The following verifications of the technical specifications and performance of the AddiFlex® additive are hereby certified. AddiFlex® is an oxo-induced biotransformation additive that causes certain polymers to biodegrade when exposed to heat, air and/or light. The additive is used in concentrations of 1-3% and is therefore an economical solution for many biodegradable formulations.

AddiFlex accelerates the natural oxidative cleavage as a precursor to biodegradation.

The biotransformation is defined as degradation resulting from oxidative cleavage of macromolecules followed by biodegradation (CEN/TR 15351:2006,5.2)

The Add-X Biotech biotransformation technology is designed to ensure satisfactory performance in storage and use followed by oxo-induced degradation and biodegradation in appropriate environments. The technology is used with conventional polymers, such as polyethylene, polypropylene, polystyrene.

The degradation mechanisms can be studied separately but they usually occur simultaneously and there is often synergy between them.

- The induction period during which oxidation catalysis by the pro-oxidant(s) is prevented by the antioxidant(s). During this period there is no change in the polymer but the antioxidants are consumed.
- Rapid oxidation of the polymer during which chain scission produces low molecular weight fragments, which are oxidised, hydrophilic, dense and polar.
- The period of bio-assimilation of the oxidised fragments leading to mineralisation to CO₂ H₂O and cell biomass.

After the additive has completely broken down, no harmful residues remain.

The biodegradable additive AddiFlex® meets the requirements of Directive 94/62/EC of the European Parliament and of the Council of 20 December 1994 on packaging and packaging waste according to Article 11 Concentration levels of heavy metals in packaging: AddiFlex® does not exceed these values of lead, cadmium, mercury and hexavalent chromium in packaging or packaging components.

AddiFlex® does not add sulphur, nickel, cobalt or salts related to these metals to the polymers.

The biodegradability of PE modified with AddiFlex® was tested in the study carried out by Prof. Jakubowicz, SP and Dr. Kaiser, EMPA (ELSEVIER: Evaluation and degradability of biodegradable polyethylene) using the test methods prescribed in ISO 14855 and prEN 14046 as well as ASTM D 6400. The plant growth test and the ecotoxicity effects on above have been studied with positive results above 100% according the EN 13432 (Requirements for packaging recoverable through composting and biodegradation) and the Standard OECD 208 (Terrestrial plants, growth test) EMPA test report Nr. 422809.

The AddiFlex® effect on the biotic degradation was demonstrated by Prof. Jakubowicz: Evaluation and degradability of biodegradable polyethylene and disintegration of a polypropylene-based film under simulated composting conditions at the SP institute.

The additive is safe to be used in direct contact with food products, in accordance with the stipulations from Directive 2002/72/CE regarding the materials approved to enter in contact with food products. NORMPACK certificate; FDA / KELLER & HECKMAN AddiFlex HES Degradable Additive, March 2008, the HEALTH CANADA approval re Addiflex HES Jan. 2009, and the CAMBRIDGE migration test October 2008 (ref. 490342B-08).

However, the manufacturers of products intended to be in contact with food products have to assure that all the other materials used, meet this standard.



Akash Sharma
Director



Eugen Karl Mössner
Director