AUGUST 2017

dmas®

OXO BIODEGRADABLE ADDITIVE

Plastic Litter & Solutions

- **Plastic litter** is an unsightly prevailing problem faced by most, countries worldwide.
- Cleaning up such litters is a costly event and neglecting it affects the aesthetic of the region and, causing harm to marine life
- Leading countries in terms of waste management discovered that **banning the use of plastic bags** is **not** the solution to the problem, because the problem of plastic litter stems mainly from the habit of littering, rather than having the bags in circulation.
- Needs to educate that littering is a bad habit that should never be practiced.

UK Environment Agency, Life Cycle Assessment of Supermarket Carrier Bags, Report SC030148

- **No alternative materials** that are more environmentally friendly to be produced into plastic shopping bags aside from **plastics**.
- Likewise, there are **no materials** that are more suitable than **plastics**, due to its characteristics such as lightweight, cost friendly, hygienic, convenient and durable.
- Durability (which is positive aspect) unfortunately happens to be their main downside, causing them to stay intact in dumpsites for centuries.

Alternative Solutions to Plastic Bags Waste

- FIRST, practicing the **3R**'s (Reduce, Reuse, Recycle). Promoting reusable bags to be reused as many times as possible in revamping waste management system
- SECOND, do not ban but discourage the public from using plastic bags by introducing **bag tax**, which can be used to fund waste management.
- THIRD, use of **biodegradable plastic bags**, which can biodegrade naturally in an accelerated manner. The biodegradation period can be reduced from centuries to months.

2 types of biodegradable bags known in the world

- **Oxo-biodegradable plastic bags** (oxygen in combination with heat)
  A degradable plastic bags made from petrochemical derivatives containing Oxo-biodegradable additive and tested according to **ASTM D6954** to degrade and biodegrade in disposal environment. Degradation first occurs in the presence of oxygen in combination with heat. They will then be consumed by microbes and digested to form carbon dioxide, water and biomass. Delicate microbial ecosystem in the soil will not be harmed.

- **Hydro-biodegradable bags** (hydrolysis)
  The plant based polymers degradable (such as starch bioplastic, bio-degradable polyester) plastic bags that are tested in accordance to **EN13432** to biodegradable in the conditions found in composting facilities. It undergoes chemical degradation by hydrolysis and subsequently digested by microbes and converted to carbon dioxide, water and biomass. In anaerobic condition, methane gas will be generated.
  Hydro-biodegradable bags cannot be recycled and have to be recollected and transported to the compost facility unit for disposal.

What are the requirements for Oxo-biodegradation as per ASTM D6954-04

ASTM D 6954-04 Encompasses 3-Tier Tests:

Tier 1. ASTM D 3826-98 Determining Degradation End Point

- Required fragmented plastic film tensile elongation falling below 5% or breaks down to lesser than 5000 in molecular weight

Tier 2. ASTM D 5988 Determining Aerobic Biodegradation in Soil of Plastic Materials after Composting

- Measures the CO2 released to determine the Bio-degradation Process of fragmented oxo product in soil

  Biodegrability result shall be
  1. Single polymer: =>60%
  2. More than one polymer: =>90%

Tier 3. OECD 208 Terrestrial Plants, Growth Test

- Determining EC50 adverse effects on growth of plants by using the Bio-processed soil from Tier 2, **no adverse impacts on the ability of compost to support plant growth**

EN13432:2000 – Composting and biodegradation qualification Test

- EN13432 (& ASTM D6400) is designed for compostable plastic. it is currently the most important guideline for substantiating marketing claims regarding a material's or product's bio based carbon content.
- The CEN/TS 16137 provides a standardised set of methods. The requirement in EN13432 and similar standards for 90% conversion to CO_2 gas within 180 days

NB

- The ASTM standard for oxo-biodegradables is called the Standard Guide for Exposing and Testing Plastics that Degrade in the Environment by a Combination of Oxidation and Biodegradation (ASTM 6954). Both EN 13432 and ASTM 6400 are specifically designed for PLA and Starch based products and should not be used as a guide for Oxo-biodegradable plastics .

Oxo-Plastics Vs Hydro-Plastics

OXO PLASTICS	VS	HYDRO PLASTICS
FROM BY PRODUCT OF OIL OR NATURAL GAS	WHAT IS IT MADE FROM?	FROM VEGETABLE PRODUCTS LIKE STARCH
YES	3R, i.e REDUCE, REUSE, RECYCLE CAPABILITIES?	NO RECYCLE, LOW TENDENCY FOR REDUCE AND REUSE
EMITS CO2 SLOWLY WHILE DEGRADING	CO2 EMISSION	EMITS CO2 RAPIDLY WHILE DEGRADING
INERT	REACTION DEEP IN LANFILL	EMITS METHANE, A POWERFUL GREENHOUSE GAS
LITTLE OR NO EXTRA COST	COST?	MORE EXPENSIVE UP TO 10 TIMES (RESIN, UTILITIES & CONVERSION)
SAME STRENGTH AND WEIGHT AS NORMAL PLASTIC	STRENGTH & WEIGHT	WEAKER AND HEAVIER THAN NORMAL PLASTIC
EASY, DROP IN PRODUCTION ON CONVENTIONAL MACHINE WITHOUT ANY MODIFICATION	PROCESSABILITY	POOR, REQUIRES MACHINE MODIFICATION, LOW PRODUCTION THROUGHPUT

Oxo-Plastics Vs Hydro-Plastics

OXO PLASTICS	VS	HYDRO PLASTICS
DEGRADES ANYWHERE ON LAND OR SEA IN PRESENCE OF AIR	WHERE DOES BIODEGRADATION TAKE PLACE?	TESTED ONLY IN INDUSTRIAL COMPOSTING
APPROXIMATE TIME CAN BE SET AT MANUFACTURE	HOW LONG FOR DEGRADATION?	TIME CANNOT BE CONTROLLED
NO POSSIBILITY OF GM	ANY GM?	POSSIBILITY OF GM
NO FERTILIZER, PESTICIDE, WATER AND FARMLAND USED	WHAT IS USED IN PRODUCTION?	FERTILIZER, PESTICIDE, WATER AND FARMLAND USED

dmas® Oxo-Biodegradable Additive

dmas® Additive Overview

- A very small amount of dmas® pro-degradant additive is added into conventional plastic resin fabrication process, without modification to the current equipment, which will degrade at the end of their useful life.
- In supporting global noble mission in seeking to establish a sustainable environmental solution, :-
- dmas® Oxo-Biodegarable Polymer Additive provides a "Sustainable solution to reduce plastic waste pollution"

PRODUCT DATA SHEET

April 2017

Principal : AddiTech Sdn Bhd (682548-V)

Marketing : T-BRAND POLYMER (M) SDN BHD (751488-X)

Address : No 2 Jalan Mutiara Emas 5/22, Taman Mount Austin
81100 Johor Bahru, Johor, Malaysia

Typical physical properties

Product name	: dmas® **793-1** / Oxo-Biodegradable Plastic Masterbatch
Density ASTM D792	: 0.90 ± 0.1 (g/cm3)
Melting point ASTM D3418	: 97 ± 27 (℃)
Color	: Violet
Particle Form	: Pellets
Dosage Ratio / Weight	: 1% ~ 2%

dmas® 793-1 meets :

- ✓ REACH / Regulation (EU) No.1907/2006 & RoHS Directive 2002/95/EC requirements
- ✓ Plastic product Incorporated with dmas® 793-1 meets Food Contact US FDA 21 CFR 177.1520 and ASTM D6954-04 Oxidation and Biodegradation Standard

dmas® 793-1

- **dmas® 793-1** is added in typically small quantities of 1 to 2% to traditional polymer resins :-
  - polyethylene, polypropylene and polystyrene

  For production of finished plastic products, using standard extrusion equipment and processes.

- **dmas® 793-1** incorporated plastic product is comparable to normal plastic product in terms of quality and performance

How dmas® 793-1 works

- dmas® **793-1** is incorporated into the polymer at controlled dosage, depends on product life span requirement
- In combination with OXYGEN and HEAT (photo - sunlight, thermal - heat and/or mechanical stress), dmas® **793-1** foster oxidation and chain scission in plastics. These fragmented substances are then consumed by microorganisms found in aerobic disposal environment, and converted to natural occurring substances - CO2 and water, and biomass
- Ultimately dmas® **793-1**causes the plastic to completely biodegrade.

dmas® 793-1
General Usage Guideline

- Dosing and effectiveness (to fragmentation) of **dmas® 793-1** incorporated polymer products as follows:

Outdoor applications

- 1% loading - 6 to 10 weeks
- 2% loading - 4 to 8 weeks

Indoor applications

- 1% loading - 6 – 12 months
- 2% loading - 3 – 12 months

Benefits of dmas® 793-1 Oxo-biodegradable additive

- Easy for drop in production :- No special techniques or handling of **dmas® 793-1**.
- No need for capital investment in new equipment.
- Effective way to go green at **no extra cost**.
- **dmas® 793-1** product is recyclable, supporting oxo-biodegradable products recycling.
- Environmental friendly:– non-toxic and contains no regulated heavy metals.
- High energy recovery:- **dmas® 793-1** product can be incinerated with high energy recovery
- In compliant to mandated product safety requirement

Safety Compliances

dmas® 793-1 meets :

- REACH / Regulation (EU) No.1907/2006
- RoHS Directive 2002/95/EC requirements.
- Plastic product Incorporated with **dmas® 793-1** meets Food Contact US FDA 21 CFR 177.1520 and ASTM D6954-04 Oxidation and Biodegradation Standard.

Shelf life & Service Life Control

- **dmas® 793-1** product under warehouse conditions (temperature ~28°C and humidity ~85%) would not degrade up to 12 months of storage.
- Protect **dmas® 793-1** from direct sunlight and from temperature above 40°C.
- The shelf life and service life of **dmas® 793-1** and its finished products are highly dependent on storage environment, finished product design and processing conditions.

Thank You
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