Declaration of Compliance

For materials made from Oxo Biodegradable

Hereby we confirm that our products:

Drinking straws as describe below:

<table>
<thead>
<tr>
<th>Art. Nr.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECOR5BLK</td>
<td>Regular Straw, Ø 5 mm · 205mm – Black</td>
</tr>
<tr>
<td>ECOR5CLR</td>
<td>Regular Straw, Ø 5 mm · 205mm – Clear</td>
</tr>
<tr>
<td>ECOJ3BLK</td>
<td>Jumbo Straw, Ø 6.3 mm · 200mm – Black</td>
</tr>
<tr>
<td>ECOJ3CLR</td>
<td>Jumbo Straw, Ø 6.3 mm · 200mm – Clear</td>
</tr>
<tr>
<td>ECO5BLK</td>
<td>Cocktail Straw, Ø 5 mm · 135mm – Black</td>
</tr>
<tr>
<td>ECO5CLR</td>
<td>Cocktail Straw, Ø 5 mm · 135mm – Clear</td>
</tr>
<tr>
<td>ECO1WR4CLR</td>
<td>Regular Straw wrapping paper, Ø 5 mm · 205mm – Clear</td>
</tr>
</tbody>
</table>

Manufactured in accordance with Regulation (EC) No. 10/2011/EG (last modification by VO321/2011) and No. 1935/2004, both in their relevant versions.

When used as specified, the overall migrations as well as specific migration do not exceed the legal limits. The test was performed according to the Regulation (EC) No. 10/2011/EG.

There is no substance subject to limitations and/or specifications are used in the above mentioned products.

The product containing 1% of Oxo Biodegradable BD93470 additives as mentioned above.

The raw materials used comply with the European Regulation No. 10/2011/EG (last modification by VO321/2011).

The Oxo Biodegradable additive BD93470:

- Has been manufactured in accordance with the Regulation (EC) no. 2023/2006 on Good Manufacturing Practice for material and articles intended to come into contact with food.
- Is in compositional compliance with Commission Regulation (EU) No. 10/2011 on plastic material intended to come into contact with food including it’s updates Regulation 1282/2011 and Regulation 1183/2012.

Tangerang, 15 May 2017
LVE BBPK
BALAI BESAR PULP DAN KERTAS

SURAT KESESUAIAN KLAIM
Nomor : 022/LVE BBPK/XII/2015

Balai Besar Pulp dan Kertas, Lembaga Verifikasi Ekolabel yang teregistrasi Kementerian Lingkungan Hidup dan Kehutanan (nomor registrasi: 01/LPJ/LVE/LRK/KLH), menyatakan bahwa:

**Masterbatch additive, merek Reverte**
(dengan ruang lingkup seperti dalam lampiran Surat Kesesuaian Klaim ini)

yang didistribusikan oleh

**PT. Neochem Indonesia**
Alamat : Komplek Roxy Mas Blok D2 No. 31, Jl. K.H. Hasyim Ashari No. 125, Cideng - Gambir, Jakarta Pusat 10150, Indonesia

dinyatakan

**Dapat Terurai (Oxo Biodegradable)**

berdasarkan metode


Kepala

[Signature]

ANDOYO SUGIHARTO

Tanggal mulai berlaku
8 Desember 2015

Tanggal berlaku hingga
7 Desember 2018
Compliance statement regarding products containing Reverte™
to the ecotoxicity requirements of EN13432 & ASTM D6954-04

EN13432 requires that the residue from the biodegradation of products demonstrates no harmful effects on higher plant species (Section A4 & Annex E). The requirement to demonstrate an absence of ecotoxic effects of the biodegradation residue, is for germination and biomass of plants grown on the test material to be a minimum of 90% of that grown on a control material.

ASTM D6954-04 (Sections 6.9.7 to 6.9.10) in addition to the requirements for plants, requires that survival rates of a minimum of 90% for lower and higher life forms should also be demonstrated for animals exposed to the test material compared to the control.

The biodegradation products from articles containing Reverte™ have been demonstrated to fully comply with the ecotoxicity requirements of EN13432 and ASTM D6954-04 when tested using Oat, Radish and Mung Bean for plant ecotoxicity and Amphipod and Earthworm for animal ecotoxicity as verified in Biosystems Atlanta reports 795-11046-1-T3 & 795-11058-1-T3 dated 9th Feb 2011.

Dr Gary Ogden FIMMM CSci
Technical Manager
23rd June 2013
MATERIALS IN CONTACT WITH FOOD

Declaration of Compliance Statement - Product BD93470

Intended Use: For addition to food contact polypropylene (PP) films for controlled degradation after film use. Recommended addition rate = 1%

Regulations and Standards

With regards to the compliance assessment report, SC2113 (2nd October 2013) we confirm that Wells Plastics Ltd masterbatch BD93470 is:

- Manufactured in accordance with Regulation (EC) no. 2023/2006 on Good Manufacturing Practice for materials and articles intended to come into contact with food as demonstrated by our ISO 9001: 2008 Certification.
- Some of the additives present have specific migration limit (SML) restrictions in food.
- When used in PP film at the recommended addition rate, levels of specific migration of BD93470 additives subject to restriction from PP films will be within their prescribed regulatory limits under any expected condition of use of the film with all food types (calculated as 6 dm² film/kg food). No further specific migration testing for BD93470 additives is required.

Regulation (EC) no.1935/2004 on Materials and Articles intended to come into contact with food

This applies to the final packaging.

- Providing BD93470 is incorporated into regulatory compliant PP film, finished products containing BD93470 will be in compliance with Regulation 1935/2004. This assumes that contact with food occurs within the recommended shelf life of the product and prior to the onset of packaging degradation, where volatile products could taint food.

US FDA Regulations

- When used at the recommended addition rate of 1%, Masterbatch BD93470 may be blended with PP resins otherwise cleared for food contact applications in the manufacture of articles intended to be used in contact with all types of food and without restriction on use temperature.
- When used as such, BD93470 complies fully with the Federal Food Drug and Cosmetic Act and all applicable US food additive regulations.
MATERIALS IN CONTACT WITH FOOD

Declaration of Compliance Statement - Product BD93470

EU Packaging and Packaging Waste Directive 94/62/EC

This regulation refers to finished products. Metal catalysts present in BD93470 are not based on the restricted heavy metals (cadmium, chromium (VI) lead or mercury) specified in the Directive.

REACH SVHC Substances

Based on compositional information received from our suppliers, BD93470 does not contain any Substances of Very High Concern (SVHC) above the 0.1% weight (w/w) threshold as detailed in the European Chemicals Agency (ECHA) candidate list as updated 20/06/2013.

This compliance statement is based on information supplied by the polymer and additive manufacturers, migration modelling undertaken and quality control systems in place at Wells Plastics.

This Declaration is for the materials specified above and is valid for two years. An updated statement will be provided if the information on which the declaration is based changes or regulatory requirements impact on its validity.

Date: 5th October 2013

Signed (Approved Signatory): Dr Gary Ogden FIIMMM CSci
Technical Manager
Sample from **Austraw Manual Factory**

**received 20/03/2013**

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**Sample Details**

<table>
<thead>
<tr>
<th>Description</th>
<th>Thickness</th>
<th>Base Colour</th>
<th>Print</th>
<th>OBD Additive</th>
</tr>
</thead>
<tbody>
<tr>
<td>PP straws</td>
<td>~0.4 mm</td>
<td>Green</td>
<td>None</td>
<td>Reverte BD 93470</td>
</tr>
</tbody>
</table>

**Tested at the laboratory of Wells Plastics Ltd., Stone, Staffordshire, U.K.**

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Julie Simmons  
POLYMER TECHNOLOGIST
Evaluation of the Oxo-Biodegradable Characteristics of a sample of green PP straws supplied by Austraw

1. Background

Austraw is interested in evaluating Wells’ “Reverte” oxo-biodegradable masterbatch for use in their PP straw products.

Reverte oxo-biodegradable masterbatch BD 93470 has been recommended for their potential application. This product contains a mixture of a metal ion pro-oxidant and a photoinitiated initial degradation inhibition package.

The grade utilised is polypropylene based and has been specifically formulated to withstand the higher heat histories that are associated with the production of PP products.

The formulation has been developed for a 1% addition to give thin PP film maintained at 20°C a controlled in-house shelf life of approximately 18 months, a further dwell time, normally around 2 to 4 months after photoinitiation and then a rapid breakdown of properties resulting in acute embrittlement after a further 3 to 6 months. However, thicker sections, product composition, some stabiliser packages and specific polymer blends and pigmentation can significantly extend this embrittlement period.

Austraw supplied one sample for evaluation of its oxo-biodegradable properties. The sample was several green PP straws of ~0.4mm in thickness submitted as containing 1% BD 93470. A group of the straws were cut to an appropriate length and grouped together for testing. They were labelled with a description and an internal test number to identify them by.

2. Samples as received / before testing

![Image of green PP straws]

3. Method

The high molecular weight of commercial grades of polymers render them fundamentally hydrophobic and, therefore, very resistant to direct microbial attack. A reduction of the polymer chain length from its initial value of around 250,000 to a value between 4,000 and 10,000 increases its intrinsic microbial accessibility and enables subsequent biodigestion.
Reverte products initially catalyse the oxo-degradation of the polymer chains and then promote the growth of microbial colonies to expedite the second biodegradation stage.

The initial chain scission (degradation) of the polymer chain causes a serial reduction in polymer molecular weight which ultimately results in acute embrittlement, microfragmentation and biodigestion.

This degradation can be tracked by the measurement of critical physical properties, using test methods such as ASTM D3826 to measure properties such as elongation, but this method is somewhat flawed because as the degradation gets underway the test sample becomes too friable for physical testing.

However, because oxo-degradation causes the formation of a carbonyl group at the point of every scission, measurement of the onset and level of this carbonyl group development in the test product is a more accurate direct measure of its induced degradation by the metal ion pro-degradant system within the Reverte masterbatch. This carbonyl index, as it is directly proportional to the elongation at break, can be used to determine the elongation when the sample is too weak to be conventionally tested. The point of embrittlement in polyolefins is defined as the point at which the elongation at break is ≤ 5%.

Polyolefins are generally reduced to the embrittled state of ≤ 5% elongation when the carbonyl index is greater than approximately 0.1 to 0.6 depending on the type, grade, pigmention and thickness of the product under consideration. Thicker sections, stabiliser packages and heavier pigmentation can give critical carbonyl indices far greater than the range given, but the actual critical carbonyl index is readily determined empirically during the testing procedure.

The test specimen was aged using a modified ASTM D 5208-01 (Cycle C) test method. The ageing cabinet utilised contained UV lamps to simulate gentle outdoor sunlight. The temperature of the cabinet was maintained at 50°C according to the test method. Results from Wells’ standard clear PP film without any Reverte addition was presented alongside the test specimen as a comparative control.

It should be noted that the level of UV exposure generated in the ageing cabinet is very low and should not be compared with the levels generated, for example, in QUV ageing experiments.

In effect, the UV exposure level is around 26kLY per year in the cabinet. To put this in perspective, to simulate a full year’s outdoor exposure in the UK the samples would have to be in the cabinet for around 3 to 4 years, to match a year in mainland Europe they would have to be in the cabinet for around 4 to 5 years and a year in Florida USA would be simulated by 9 to 10 years in the cabinet.

The test piece in this experiment only spent between 2-3 weeks in the cabinet; so we can see that the actual UV exposure was relatively slight and that the acceleration of the ageing process should be largely attributed to the higher temperature (50°C) following the photo-triggering stage of the breakdown reaction.

The test piece was removed after fixed time periods and the carbonyl index determined by Infra-red analysis, using a modified ASTM D 5576 test method. In addition the sample was empirically assessed for friability and state of embrittlement. The carbonyl index at the point at which the test specimen was embrittled was noted and presented as 100% embrittlement. The remaining Carbonyl indices were calculated as a percentage of this and presented as “Degree of Embrittlement”.

Finally, Arrhenius principles were applied to the results obtained at 50°C, transposing them into the real-time results that would be expected at 20°C.
4. Results

4.1 Degree of Embrittlement

<table>
<thead>
<tr>
<th>Accelerated Ageing Time (hours at 50°C)</th>
<th>0</th>
<th>24</th>
<th>48</th>
<th>72</th>
<th>96</th>
<th>120</th>
<th>144</th>
<th>168</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calculated Time (months at 20°C)</td>
<td>0.0</td>
<td>0.5</td>
<td>1.0</td>
<td>1.6</td>
<td>2.1</td>
<td>2.6</td>
<td>3.1</td>
<td>3.7</td>
</tr>
<tr>
<td>Wells PP Control Film</td>
<td>0.0</td>
<td>1.0</td>
<td>2.0</td>
<td>3.0</td>
<td>4.0</td>
<td>5.5</td>
<td>6.5</td>
<td>8.0</td>
</tr>
<tr>
<td>Green PP straws + 1% Reverte</td>
<td>0.0</td>
<td>0.1</td>
<td>0.6</td>
<td>3.1</td>
<td>8.3</td>
<td>13.3</td>
<td>18.3</td>
<td>26.7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Accelerated Ageing Time (hours at 50°C)</th>
<th>192</th>
<th>264</th>
<th>288</th>
<th>312</th>
<th>336</th>
<th>360</th>
<th>432</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calculated Time (months at 20°C)</td>
<td>4.2</td>
<td>5.8</td>
<td>6.3</td>
<td>6.8</td>
<td>7.3</td>
<td>7.9</td>
<td>9.4</td>
</tr>
<tr>
<td>Wells PP Control Film</td>
<td>10.0</td>
<td>20.0</td>
<td>24.0</td>
<td>28.5</td>
<td>33.0</td>
<td>37.5</td>
<td>51.0</td>
</tr>
<tr>
<td>Green PP straws + 1% Reverte</td>
<td>36.7</td>
<td>57.8</td>
<td>66.4</td>
<td>72.8</td>
<td>79.7</td>
<td>86.9</td>
<td>103.6</td>
</tr>
</tbody>
</table>

A photograph of the test specimen after its accelerated ageing period may be found in Appendix 1.

4.2 Graph of results

Initial Degradation Profile for a sample of green PP straws containing Reverte supplied by Austraw Manual Factory
5. Discussion of results

It is always difficult to precisely quantify results obtained in terms of real-time degradation due to the vagaries of natural conditions. However, the Arrhenius principles that we have applied to the accelerated ageing results enable us to present the results that would be expected from ageing in a real environment at a constant temperature of 20°C in sunlight.

The Wells clear control PP film sample demonstrated fairly typical behaviour, not reaching a point of 100% embrittlement during the test period and only reaching a level of embrittlement of around 51% after the 432 hour accelerated ageing period (calculated to around 9.4 months at 20°C).

In marked contrast the green PP straws containing Reverte demonstrated a greatly enhanced degradation profile. The straws showed a distinct “dwell time” of ~73 accelerated ageing hours (calculated to around 1.6 months at 20°C) during which time no induced degradation was evident over the control. This was followed by a steady degradation in physical properties with the sample reaching 100% embrittlement after about 416 accelerated ageing hours (equivalent to around 9.1 months at 20°C).

It can be seen that the green PP straws sample containing Reverte displayed the characteristic “dwell time” normally exhibited by Reverte containing products. This dwell time gives a greatly enhanced window of confidence in the use of oxo-biodegradable additive technology as no induced degradation is evident for the first time period of the product’s calculated lifetime following its photo-triggering.

Finally it should be noted that even when a control sample may have degraded through normal UV/oxidative attack, this doesn’t mean that the chain scission will continue in a uniform and controlled manner until the chains are short enough for microbial digestion.

This is what the use of Reverte additive does and it is this which speeds up and facilitates the ultimate biodegradation of the plastic following the initial oxo-breakdown.

It should be re-stated that these are idealised real-time projections based on accurate accelerated laboratory ageing and, as previously stated, natural climatic conditions of sunlight, soil temperature etc do vary. These extrapolated results have, therefore, been prepared in good faith, but any potential user would have to carry out his own empirical observations to ensure that the product was fit for his purpose in the precise ageing regime employed.

6. Conclusions

1. The addition of Reverte masterbatch to the sample of green PP straws submitted by Austraw has been shown to be effective in introducing an oxo-biodegradable characteristic, giving a readily distinguishable dwell time after photo initiation followed by a steady progression towards full embrittlement.

Julie Simmons
POLYMER TECHNOLOGIST

Wells Plastics Limited,
Emerald Way, Stone Business Park, Stone. Staffordshire. ST15 0SR. UK

This information is correct to the best of our knowledge, but we would recommend that users make their own assessment to confirm that the material meets their requirements. We accept no liability for any damage, loss or injury resulting from the use of this information. Freedom from patent rights must not be assumed.
Appendix I

A photograph of the sample after ageing

Following the ageing process of 432 accelerated ageing hours (calculated to around 9.4 months at 20°C), the sample of green PP straws containing Reverte can be seen to have lost their significant physical properties, are exhibiting extreme friability, and breaking up when handled.

These observations are commensurate with the measurements taken and contained within the body of this report.

This information is correct to the best of our knowledge, but we would recommend that users make their own assessment to confirm that the material meets their requirements. We accept no liability for any damage, loss or injury resulting from the use of this information. Freedom from patent rights must not be assumed.