



UNIVERSITÀ DI PISA

DIPARTIMENTO DI CHIMICA E CHIMICA INDUSTRIALE

Via Risorgimento 35 - 56126 Pisa (Italy)

Tel: +39 050 2219000 / Fax: +39 050 2219260

Cod. Fisc. 80003670504 P. IVA 0028682 050 1

Prof. Emo CHIPELLINI

Tel: +39 050-2219299 / 2210301

Fax: +39 050-28438 / 2210332

E-mail: emochie@dcci.unipi.it

Drs. J. Clark, A. McLauchlin, S. Patrick and N. Thomas
Department of Materials
Loughborough University
Loughborough LE11-3TU
UK

Pisa, April 7, 2010


Dear Scientist Colleagues,

Recently we had the venture of coming across your respectful Defra's Report on "Oxo-Degradable" polymers, which contains among the others comments on a few of our papers on oxo-biodegradable polyethylene.

We are writing you in order to make clear some of the points of our contributions that have not been properly interpreted and some others of outmost importance that have been completely not commented.

Would any of you, including your colleague S. Patrick for whom we didn't find the e-mail address, coming across Italy, we would be pleased of hosting you at our Laboratory and have frank discussion on biodegradable polymers in general and more specifically on oxo-biodegradables.

Kindest Regards,



Emo Chiellini
Professor

Prof. Emo Chiellini

Department of Chemistry & Industrial Chemistry
University of Pisa
via Risorgimento 35 - 56126 Pisa (Italy)
Tel: +39 050 2219299 / Fax: +39 050 2219240
Laboratory of Bioactive Polymeric Materials for
Biomedical & Environmental Applications
via Vecchia Livornese 1291
56122 Loc. San Piero a Grado (PI)
Tel: +39 050 2210301 (direct line)
Tel: +39 050 2210302/3 (Assistants)
Fax: +39 050 2210332

Dr. Andrea Corti

Department of Chemistry & Industrial Chemistry
University of Pisa
via Risorgimento 35 - 56126 Pisa (Italy)
Tel: +39 050 2219302 / Fax: +39 050 2219240
Laboratory of Bioactive Polymeric Materials for
Biomedical & Environmental Applications
via Vecchia Livornese 1291
56122 Loc. San Piero a Grado (PI)
Tel: +39 050 2210307
Fax: +39 050 2210332



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Comments on Defra Report

Dear Authors,

Dr. Andrea Corti and I have read with great interest your Report on the "Environmental Impact of Oxo-Degradable Plastics".

Considering that in several sections of the Report you refer to our publications in peer-reviewed Journals, as quoted as your references 14, 15, 16, 19 and 47, we would like, for the sake of clarity, to make some remarks on some of your comments which in our opinion deserve attention for a fairer interpretation and hence a correct message to the public.

1. First of all we disagree with the title of your report, which identifies oxo-biodegradable plastics with the ambiguous term "oxo-degradable". We have no doubt that the ultimate destiny of the oxidized degraded fragments of hydrocarbon polymers is their attack by microorganisms leading to the production of genuine microbial biodegradation products (CO₂, H₂O and cell biomass)
2. Ref. 19 – page 20. The article quoted, published in Macromolecular Symposia, simply describes a method for the assessment of biodegradation of slowly-degrading polymer materials in soil, independent of their specific nature, whether they are oxo-biodegradable or hydro-biodegradable. Your report questions the reproducibility of the tests without taking into account the experimental details which describe biodegradation tests carried out in three replicates of three different experiments as clearly reported in Ref. 14, which, apparently, has not been carefully and critically read.
3. Ref. 16 – page 21. The biodegradation tests on oxidized fragments of hydrocarbon polymers carried out in water medium, clearly show that claims of the accumulation of noxious plastic debris from OPBs in water is pure speculation and that they cannot be responsible for the plastic island in the ocean. This is actually associated with the dumping of biostable non oxo-biodegradable plastics.
4. Ref. 15 – The biodegradation rate of OBPs is dependent upon the level of oxidation, which will be influenced both by the environmental exposure conditions and by the amount of pro-oxidant additive present in the sample. No comment has been made in the report on the observed experimental trend between level of hydrocarbon polymer oxidation and molecular weight which fits nicely an exponential decay profile. On the basis of the reported data it is possible to make a conclusive prediction of the time-frame required for oxo-biodegradable samples to become involved in microbial metabolism.



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5. Ref. 47 – page 3 Annex A – In analyzing the results included in the present reference, you completely omitted to mention the carbon balance and formation of biomass at expenses of the organic carbon of OBPs. This is a very important point in favour of the use of OBPs which contrasts with your statement on the detrimental effect on soil by the accumulation of oxidized PE fragments.

The biodegradation of OBP-fragments in soil results in fixation of organic carbon as biomass - exactly the opposite of what occurs in the fast mineralization of many hydro-biodegradable polymers such as cellulose or starch. The overall conversion of organic carbon to CO₂ for hydro-biodegradable polymers is fundamentally bio-incineration and is accompanied by the well known "priming effect", which is an undesirable loss of the organic carbon originally present in the soil.

6. Finally we are very sorry that in your report you didn't comment on another classic full-carbon backbone polymer, poly(vinyl alcohol) (PVA) in various grades, which biodegrades by an initial oxidation followed by a β -oxidation metabolic biochemical pathway. The oxo-biodegradation of PVA, which can be considered as a regioselectively oxidized polyethylene, occurs in water medium at a fairly high rate, influenced by the content of residual acetyl groups.

For your perusal we are pleased to refer you to two papers of ours on this last topic: Progress in Polymer Science, **28**, 963-1014 (2003) and Polymer Degradation & Stability, **91**, 3397-3406 (2006).

Yours sincerely,



Emo Chiellini
Professor

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University of Pisa
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Tel: +39 050 2210302/3 (Assistants)
Fax: +39 050 2210332

Dr. Andrea Corti

Department of Chemistry & Industrial Chemistry
University of Pisa
via Risorgimento 35 - 56126 Pisa (Italy)
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