OXO-BIODEGRADABLE PLASTICS ASSOCIATION

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BAD NEWS FOR BIOBASED "COMPOSTABLE" PLASTICS FROM GERMAN GOVERNMENT STUDY[1]

NOT BEING COMPOSTED[2]

The present study has found that the expectations associated with the special regulation have not come true.[3] Bioplastic packagings were overwhelmingly thrown into the yellow bag. There has been no market breakthrough. Exempting biodegradable beverage packagings from deposits did not work either because there are no such packagings in the German market. In view of this situation, it is hardly possible to advocate a continuation of the special regulation in the Packaging Ordinance.

From an overall ecological point of view, these bioplastics are not necessarily better than conventional plastics but rather level with them.[4]

*"One can certainly say that a high percentage of bioplastic packaging was recovered in one way or another, but **predominantly via waste incineration plants** with energy recovery and in part by thermal recycling, most of all in cement works. **Composting did not gain a relevant share** as a disposal route for used bioplastic packagings, which was in contrast to expectations initially raised."*

*[Pladerer et al. 2008] also makes some statements on anaerobic treatment. According to them, various operators of fermentation plants **refuse to treat PLA materials in their plants**. They refer to the Lobau composting plant in Vienna as an example. They also point out that the fermentation of PLA materials would probably not yield more favourable results than incineration in a LCA because that would require high-quality use of the compost in addition to utilizing the biogas.[5]*

NOT USEFUL FOR COMPOST[6]

*According to [Pladerer et al. 2008], PLA material does not contain any plant-available nutrients and does not contribute to building a soil structure. Composting PLA would **therefore have to be considered disposal only**. According to the LCA calculations by [Pladerer et al. 2008], composting shows less favourable results than waste incineration.*

The manufacturers of biodegradable materials think that biodegradable materials participate in structure-building [Wellenreuther 2008b] but a major factor affecting

[1] Study of the environmental impacts of packagings made of biodegradable plastics Institut für Energie- und Umweltforschung Heidelberg, Germany. Commissioned by the Federal Ministry of the Environment, Project no. (fkz) 37
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the LCA result of composting bioplastics is the assumption of benefit achieved. Since bioplastics (other than bio-waste from households) ***do not contain any nutrients****, they do not substitute mineral fertilizer.*

Its use could then be soil structure building (in principle, humification), which could be considered peat substitution. The assumed degradation rate is primarily relevant for eco-balancing purposes. However, since bioplastics that are certified biodegradable have to prove 90% degradation in a laboratory test, it would be obvious to assume a respective degradation rate during composting. A ***direct structure-building effect would then be negligible****. In a waste balancing calculation of PLA based on such a degradation rate in [Detzel et al. 2006],* ***composting proved ecologically less favourable than thermal treatment*** *with energy recovery, thermal recycling in a cement works, or anaerobic treatment.*

But the manufacturers of bioplastics point out that the degradation behaviour of bioplastics in a composting plant could be different from a laboratory test. In their opinion, a degradation rate of just about 50% similar to bio-waste was conceivable, which would enhance structure-building. **[If this is true the material would not comply with EN13432 which requires 90% conversion to CO2 gas within 180 days**, and could not therefore be marketed as compostable according to that standard]

Bioplastic packagings whose properties are mostly geared towards composting typically contain larger percentages of fossil copolymers. In addition, their packaging performance is often limited. LCA results of this group of bioplastic packaging therefore may even show an unfavourable overall environmental performance as compared to the conventional competitors.[7]

LAND USE CHANGE[8]

Some, but by far not all of the studies we analysed provide information on farmland required for supplying biomass for the bioplastic packagings under review. Except for [Liptow and Tilmann 2009] and [Kauertz et al. 2011], none of the studies analysed considers the aspect of ***direct or indirect land use change (LUC) and the associated problem of competition for areas in foodstuff cultivation****. It can only be hoped that the area problem is at least described in future life cycle analyses and that justifications are provided if land use changes were not considered in the LCA.*

The increased use of land for agricultural and forest products does not only affect environmental aspects such as interference with nature conservation, impacts on biodiversity or changed carbon sink conditions. Social aspects require increased attention since land used for agriculture and forestry is associated with specific property relations, production structures, and income situations depending on the country or region.

In this context, it should be pointed out that the ***use of renewable raw materials for energy and material purposes competes with foodstuff production.***

The Millennium Development Goals of the United Nations include two goals, "elimination of extreme poverty and hunger" and "ensuring environmental sustainability" ***which could be impaired by increasing competition for farmland use.***[9] *The ongoing long-term conversion process towards a biogenic carbon network will only proceed without adverse environmental and social impacts if we manage to utilize residual biomass as a raw material.*[10]

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INTERFERENCE WITH RECYCLING[11]

Because biodegradable packagings do not end up in the biowaste flow but in the flow of recyclable materials, there are ongoing discussions about their role as an ***interference or even risk to the established routes of material recycling****. This can result in rejection among decision-makers, especially among traders, and the otherwise positive perception of biodegradable plastic packagings could be reversed.* By contrast, oxo-biodegradable plastic does not compromise recycling schemes.[12]

FAILURE TO STUDY OXO-BIODEGRADABLE PLASTIC

For the reasons given in the OPA paper on "The Relevance of Degradable Plastic"[13] Oxo-biodegradable plastic would be much more useful to Germany than "compostable" plastic. The authors of the German report accept that *"Oxo-degradable plastics can be characterized as oxo-biodegradable[14] based on ASTM 6954-04*," but they say[15] that in their Report *the term "biodegradable" does not include the oxo-degradable plastics that are often also called biodegradable*." However, they admit that *"the second degradation step is the typical biodegradation of these chains into their original elements by microorganisms."*[16] That being so, they should be correctly described as "oxo-biodegradable

The authors say that *"Oxo-(bio)degradable plastics are not actually considered biodegradable plastics because their degradation process has two steps and requires additives."* This is not however a valid reason. Why should it matter whether it is a one-stage or a two-stage process so long as no human intervention is necessary? The additives are put into the plastic when it is made, and do not have to be added later in order to create biodegradability.

The bio-based plastics - which the authors do consider to be biodegradable - also undergo a two-stage process – the first stage is hydrolysis and the second is biodegradation. In the case of oxo-biodegradable plastics the first stage is oxidation and the second is biodegradation.

The authors continue *"Unlike the process for compostable products, this process is not subject to a predetermined time limit and may take years*." This is true, but irrelevant. There is no requirement in ASTM D6954-04 (as there is in EN13432) for the plastic to be converted to $C0_2$ in 180 days because, while timescale is critical in an industrial composting process, it is not critical for biodegradation in the environment. Also, an oxo-biodegradable product can be programmed to degrade in whatever approximate timescale is required.

[11] Page 95
[12] http://biodeg.org/files/uploaded/Recycling%20of%20Plastics.pdf
[13] http://biodeg.org/files/uploaded/biodeg/Relevance%20of%20deg%20plastic.pdf
[14] Oxo-degradation is defined by CEN (the European Standards Organisation) in TR15351as "degradation resulting from oxidative cleavage of macromolecules." And oxo-biodegradation as "degradation resulting from oxidative and cell-mediated phenomena, either simultaneously or successively."
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The first stage of the process requires only oxygen. It does not need sunlight or elevated temperatures, but these will synergistically accelerate the process. It does not need to be in moist conditions and does need a biologically-active environment such as compost. The time taken to reduce to an average molecular weight of 5,000 Daltons depends on the amount and intensity of heat and/or light, but would normally be less than 6 months from commencement of oxidation in the open environment in temperate climates. In warmer climates it would be faster and in arctic conditions slower.

This is the timescale on which legislators and consumers need to focus, because the material will then be no longer a plastic; it will have lost its strength and will be no longer capable of entangling wildlife or blocking drains. It will not by that time be visually intrusive, and it is not toxic.

Biodegradation in the environment then ensues. Nature's wastes such as leaves twigs and straw may take ten years or more to biodegrade, but oxo-bio plastics will biodegrade more quickly than that and much more quickly than ordinary plastic. It is for the end-users, and governments with relevant legislation, to determine, having regard to the test reports written pursuant to ASTM D6954 whether the product is suitable for their purposes and their environment, and it is not for a Standard to prescribe arbitrary timescales.

In the case of both types of plastic the first stage produces microscopically small fragments, but the authors say *"In contrast to compostable plastics, the ecotoxic effects of this process [for oxo-biodegradable plastics] are not exactly known.*" This is not a valid distinction, because both types of plastic are tested and shown to be non eco-toxic according to the same international standard ie EN 13432 Annex A.1.2 and A.4 and Annex E.

Oxo-biodegradable plastics are now seen in the Middle-East, Asia and Africa as preferable to banning plastic products as a way of dealing with plastic waste in the environment. Oxo-biodegradable plastic is now mandatory in the UAE, Pakistan, DR Congo, Mauritania and other countries, and Europe ought to be following their example. Banning plastic bags is a crude and unacceptable approach.[17]

OMISSION OF LCA'S

The Report refers to a number of Life-cycle Assessments, but it omits two important LCA's done by Intertek in 2011 and 2012.

The LCA published in 2011[18] was commissioned by the UK Environment Agency, and compared oxo-biodegradable plastic bags with bio-based and conventional plastic bags, and puts oxo-biodegradability ahead in its potential to reduce the plastic waste problem and its less harmful impact on the environment and on global warming.

The LCA published in 2012[19] was commissioned by the British degradable plastic specialist, Symphony Environmental Technologies Plc. Intertek were requested to compare the environmental impacts (including litter) of conventional plastic, oxo-biodegradable plastic, and bio-based (compostable) plastic, for use as carrier bags and bread bags. Symphony's d_2w oxo-bio additive was used throughout the assessment.

[17] http://biodeg.org/files/uploaded/biodeg/PLASTIC%20BAG%20BANS.pdf
[18] http://biodeg.org/files/uploaded/Sym_response_to_EA_LCA(6).pdf
[19] http://biodeg.org/files/uploaded/Intertek_Final_Report_15.5.12(9).pdf

Key findings from the study were that:

*The oxo-biodegradable bag performed 75% better than the conventional bag in the litter category. In all other categories the oxo-biodegradable and conventional bags were the same.

*The bio-based “compostable” bag had the worst performance in 10 of the 11 environmental impact categories

*The bio-based “compostable” bag was superior to the conventional bag in only the litter-effects category, but inferior to the oxo-biodegradable bag even in that category.

*The impact of oxo-biodegradable plastics in landfill is the same as conventional plastics, with no anaerobic degradation and no emission of methane. The report further confirmed that “compostable” bags emit methane (a powerful greenhouse gas) in landfill.

*Bio-based “compostable” plastic cannot be recycled with conventional plastic in a mixed, post-consumer waste stream without compromising the recycling process, but oxo-biodegradable plastic can.

* The best way to reduce the impact of plastic carrier bags is to re-use them more often, minimize the transportation needed for recycling, and make them oxo-biodegradable. The LCA noted that carrier bags are often re-used and should not be described as “single-use” bags.