Response to MSU Report

We have carefully considered the report 'Evaluation of Biodegradation-Promoting Additives for Plastics" by the researchers at the Schools of Packaging and Biosystems and Agricultural Engineering, Michigan State University (MSU). It is likely to cause confusion in the marketplace.

We discussed the protocol for this testing at length with MSU prior to the commencement of the programme, but it was clear that they did not understand the basic principles of oxo-biodegradable technology, namely that oxidation is necessary to create the chemical changes in the material that will make it biodegradable. This is clearly stated in ASTM D6954, which is the American standard for Plastics designed to degrade and then biodegrade in aerobic conditions. This point was made directly to Susan Selke on a technical visit to MSU on 27th April 2011.

Nevertheless MSU decided to subject oxo-biodegradable materials to a series of tests that were inappropriate for the purposes for which oxo-biodegradable plastics are intended. The MSU tests were for anaerobic biodegradation, industrial composting, and soil burial, but oxo-biodegradable plastic is designed to combat the blight of littering in the open environment.

Anaerobic biodegradation has no relevance to oxo-biodegradable plastic, which requires oxygen in order to oxidise. We made it clear to MSU that subjecting these materials to anaerobic conditions, where there is no prospect of oxidation occurring, would merely confirm the inertness of oxo-biodegradable plastics under those conditions. It is not therefore surprising that they found no degradation.

With regard to the test presented in figure 1 of the MSU report, it is worth commenting that activity of the cellulose controls at 35°C are more active than those at 50°C. This seems improbable and suggests poor reproducibility or control of their technique.

Oxo-biodegradable plastics are designed to be durable and may be manufactured to have a useful life of between six months and five or more years. If littered they will oxidise in the open environment and become biodegradable. They are simply not designed to oxidise and rapidly mineralise in the timescale of an industrial composting test.

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Whilst the aerobic composting test is irrelevant for an oxo-biodegradable product and the results were entirely predictable, there are some further issues with the MSU approach that need to be mentioned:

- For this test to be valid, according to the recognised standards (ASTM D5338 and its equivalent ISO 14852), the cellulose control needs to obtain 70% biodegradation in 45 days. In the data presented in Figures 2b and 2d the cellulose control achieves only 55% biodegradation after 70 days, and so the test is not valid.

- The progress of the cellulose biodegradation curve is itself erratic, dipping after 60 days, suggesting problems with the inoculum used for the test.

- ASTM D 6954 clearly states that the biodegradation test should be performed after the plastic has been oxidised to achieve a Mw reduction to 5kDa or less. MSU attempted the biodegradation test on material with an average molecular weight of 31.4kDa, so failure was inevitable.

- The attempt to biodegrade a powder with a Mw of 22KDa is again flawed. Whilst this material had a lower molecular weight it remained above 5kDa, but more important it had not achieved those properties through oxidation and will not therefore have acquired the potential to biodegrade.

- The reference to a loading of 1% to 5% shows again a failure to understand oxo-biodegradable technology. By increasing the amount of masterbatch the efficacy of the prodegradant remains relatively constant – but the action of the stabilisers within the masterbatch is significantly increased. Thus, by increasing the 'dosage' the test material becomes less biodegradable.

The third element of the study, the soil burial tests, are likewise of little value. Oxo-biodegradable plastics without access to oxygen to promote abiotic changes will not biodegrade, and certainly not in the short timescale of this test.

Symphony did offer advice to MSU on how to construct an appropriate study for oxo-degradable polyethylene, but since they had their own project funding we were unable to dissuade them of the unsuitability of their approach.

Symphony tried to assist and funded a parallel two-year study that would be conducted according to the established ASTM 6954 protocol. The protocol was not however followed and it became apparent that MSU did not have the experience or equipment necessary to conduct these tests. Symphony decided to terminate the project after 1year.

Being aware of these problems, and in order to prove the biodegradability of the films used by MSU, Symphony asked Prof. Jacques Lemaire at the Centre National d'Evaluation de Photoprotection (CNEP; University Blaise Pascal, Clermont -Ferrand, France) to evaluate them. The films were proved to be biodegradable.

On 15th March 2014, at the Global Plastics Environmental Conferencein Florida we expressed our misgivings Dr. Selke when the results were revealed by her in a presentation entitled 'Independent Study on the Claims of Oxobiodegradable Additives." We publicly voiced our concern regarding the methodology, credibility and accuracy of the entire project, but no corrections or acknowledgements followed.

It is difficult to avoid the conclusion that the testing protocols selected and the headline results claimed and published around the world, were designed to harm the oxo-biodegradable plastics industry.