Degradable plastics – frequently asked questions

1. The environmental benefits of using degradable bags?
Normal plastic degrades incredibly slowly possibly over many hundreds of years. Standard plastic bags therefore take up space in precious landfill sites. Bio-degradation reduces the waste volume from 100% down to as little as 15% to 20% as the plastic is converted into CO2, water and biomass.

2. What are degradable bags made of?
Normal plastic bags are made from HDPE (high-density polyethylene), LDPE (low-density polyethylene), colouring and chalk. To make them degradable trace amounts of a special additive which acts as a catalyst to speed up a process causes the bags to oxidise. The structure of the plastic is attacked by oxygen causing it to disintegrate more rapidly. Chalk (or calcium carbonate) is added as a modifier to the polyethylene during the film producing process in order to minimise the use of plastic, speed up the production process and improve the physical strength of the bag.

3. When does degradation begin?
The additive has a built-in time release allowing plenty of time for the bags to be shipped to stores and used by the customer before the degradation process begins. The amount of time it takes for the degradable bag to disappear depends on how it is disposed of. It can take as little as 6 weeks but will typically take a couple of years. Estimates suggest that a standard, non-degradable plastic bag could take many hundreds of years to disintegrate – if ever.

4. How does the additive work?
The system operates by thermo-oxidation, which means that once the additive is activated, the presence of oxygen causes the bag to disintegrate. Heat, sunlight and stress (i.e. movement) trigger and accelerate this process. If all four components are present – for instance a bag stuck in a tree being buffeted by the wind during summer – it can degrade in as little as 6 weeks. However, as long as there is oxygen, “thermal” degradation can occur at any temperature (even at less than 0*C, although it may take several years).

5. And if there isn’t any oxygen?
The bag will not degrade. This is a big advantage over direct biodegradable materials that, in the absence of oxygen, begin anaerobic decomposition, the product of which is methane – a greenhouse gas 20 times more damaging than CO2.

6. What exactly happens – and what is left – when the bag degrades?
The system used is generally a two step process: initially there is a chemical process where oxygen attacks the carbon chains in the HDPE, turning long chains into smaller and smaller chains which now incorporate oxygen in their chemical make-up. At this point, the plastic has been turned into organic functional groups (ketones, carboxylic acids, alcohols etc) which attract water. These transformations (smaller chains and the presence of oxygen and water) create the conditions for a potential second stage: microbial digestion. If micro organisms are present (as they will be in compost or landfill) then these small fragments will be included in their tropic chain, as food. These fragments therefore decompose further into simple elements: carbon dioxide, water and biomass (biomass is just the organic waste of microbe cells). This process is similar to the degradation of lignin in wood.

7. Are they, therefore, biodegradable?
If the conditions are right and microbes are present – such as in active landfill or in maintained compost – then, yes, the carbon chains do indeed biodegrade. In simple terms biodegradable plastics should break down cleanly in a defined time period to simple molecules found in the environment such as carbon dioxide, biomass and water.

8. The process releases CO2 but, as it is a greenhouse gas, isn't it bad for the environment?
CO2 is unavoidably created in all natural breakdown processes. The alternative is to keep the carbon locked up as plastic but that means the bag lasts hundreds of years - potentially longer. CO2 is an integral part of the photosynthetic process in plants, a by-product of which is O2 or oxygen.

9. So what happens in a typical landfill site?
Landfills vary – if they are well maintained and active (compost plants are being turned over) then the bags will rapidly disappear. Estimates suggest that carrier bags take up as much as 1% of landfill space so by making bags degradable frees up a considerable amount of space. A secondary benefit is that any contents of a sealed plastic degradable bag will also be released to degrade.

10. I heard the degradable additive is a heavy metal – doesn't that mean it pollutes the environment?
The active substances in the additive are metal salts that are not classified as heavy metals. The metals used are essential parts of the minerals used in living systems (like our own bodies).

11. Are there any other advantages to bags made from petrochemical based polymers with additives?
They retain their expected properties of strength, durability and water resistance and remain compatible with food use. They remain cost effective in relation to current products available and do not adversely affect the landfill industry.

12. What about starch based polymers?
Manufactured from renewable resources plastics made from these polymers are compostable and biodegradable because they can be broken down by micro-organisms disintegrating within a matter of months or even weeks. Unfortunately they are not suitable for many applications as they do not have the strength and durability of bags produced from petrochemical derived polymers. They are typically three or four times more expensive to produce and the shelf life is often not sufficient for the end user.

13. What about paper sacks?
Plastics are lighter than many conventional materials. For example a biologically produced paper carrier bag can weigh as much as six times more than a plastic bag so plastics produce considerably reduced fuel consumption and transportation costs.

14. Are degradable bags the best solution?
Until we stop depositing litter, devise technology and economic strategies which make re-use and recycling effective the use of oxodegradative Catalysts in polyolefins is an effective means of reducing the environmental impact of plastic and its benefits far outweigh any disadvantages.