

## Sustainable Plastics

Core competency of FKUR Kunststoff GmbH is to develop and produce sustainable plastics. Targets of FKUR's sustainable plastics, namely Bio-Flex®, Biograde® and Fibrolon®, are:

1. Reduce using-up fossil resources (like oil and gas),
2. Reduce CO<sub>2</sub> emissions (reduce pollution of the atmosphere),
3. Offer alternative waste route (reduce pollution of soil and water).

Recently, FKUR has been approached by a number of additive suppliers, who claimed that, if FKUR would compound their additive at 1 – 5 % concentration with traditional polymers, the material would become biodegradable.

FKUR found these claims very interesting - would they offer a cost-effective way of sustainable plastics – and examined these additives. The a.m. additive suppliers fall into two broad camps, “oxo-degradable” and “additives with organic materials”.

- **“Oxo-degradable” additives** consist of transition metals (cobalt, manganese, iron, zinc) that foster oxidation and chain degradation in plastics especially when exposed to heat, air, light. Result of this chain degradation are very small, hardly visible polymer particles that do not biodegrade (none of the additive suppliers have provided such data, yet), but move through our eco compartments.
- **“Additives with Organic Materials”** carry some portion which is biodegradable. This portion might be organic, such as cellulose or starch, and will biodegrade in a few weeks. The key point here is that only the portion will biodegrade, but the remaining 95 – 99 % of traditional polymers would only fragmentize to hardly visible polymer particles.

A SWOT (SWOT = Strengths – Weaknesses – Opportunities - Threats) analysis gave us a clear view, why FKUR rejects these supplier's offers, despite its cost advantage:

- “Oxo-degradables” + ... are cost-effective by using traditional polymers
- ... use-up fossil resources by using traditional polymers
  - ... increase CO<sub>2</sub> emissions by using traditional polymers
  - ... use doubtful additives to degrade (additives contain heavy metals, leaving residues to soil and water)
  - ... carry market risk: neither DIN/ASTM certificate, nor Seedling Label.

- Traditional polymers fragmentize by means of additives, even in use and under standard storage conditions. Risk of damaged material and failure; bad smell
- When recycled with traditional polymers, heavy metals accelerate degradation of recycled polymer, if required or not

“Additives with organic materials”

- + ... are cost-effective by using traditional polymers
- ... use-up energy resources by using traditional polymers
- ... increase CO<sub>2</sub> emissions by using traditional polymers
- ... carry market risk: neither DIN/ASTM certificate, nor Seedling Label.
- Traditional polymers fragmentize by means of additives, even in use and under standard storage conditions. Risk of damaged material and failure.

Bio-Flex®,  
Biograde®,  
Fibrolon® F-series  
of FKUR

- ... are more expensive due to synthesis route, totally different to that of traditional polymers
- + ... reduce use-up of fossil resources; contain renewable materials like PLA, PHA, Cellulose-Acetate.
- + ... reduce CO<sub>2</sub> emissions (reduce pollution of the atmosphere); contain up to 100 % natural materials like PLA, PHA, Cellulose-Acetate.
- + ... do not biodegrade in use nor under standard storage conditions.
- + ... offer alternative waste route (reduce pollution of soil and water). Biodegrades 100 % and composts without any harmful residues, only under presence of microbacteria in soil.
- + ... can be detected/separated from waste stream of traditional polymers.
- + ... guarantee biodegradation and compostability through certified tests by authorized third party institutions. Carry DIN Certco + ASTM certificates and Seedling Label.

FKuR Kunststoff GmbH guarantees not to use any a.m. “additives” in combination with traditional polymers. FKUR stands for real bioplastics innovations, based on biodegradable or/and renewable raw-biopolymers like PLA, PHA, Cellulose-Acetate and others. FKUR exclusively accepts EN 13432 and ASTM D6400 certificates including their definition, test procedure and thresholds for biodegradation.