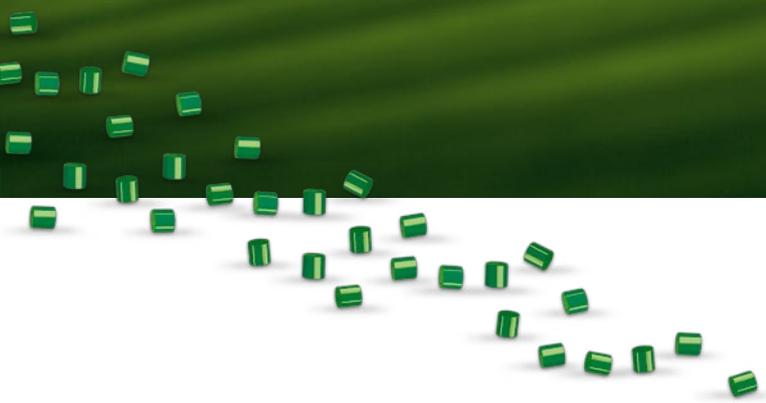


GREEN SELECTION

**Alternative plastic solutions
A contribution to the environment**



PERSPECTIVES ON PLASTICS

GREEN SELECTION

THIS IS WHERE THE CIRCLE IS CLOSED

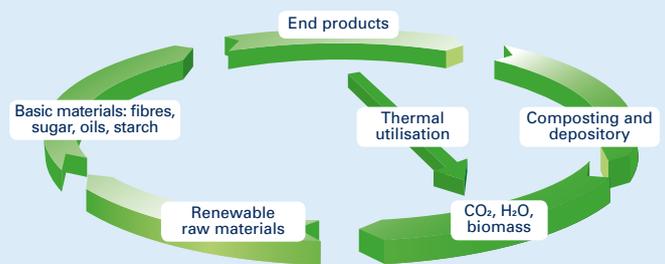
Climate change and the danger that our fossil fuel resources will run out are, without a doubt, two of the most important challenges facing society in the 21st century. As a manufacturing company, we accept the challenge and are responding to this responsibility with energy and commitment.

With efficient production plants, clean energy sources, and by avoiding harmful emissions and waste wherever possible, manufacturing industry is already on the right track. However, in the field of innovative product ideas, there is still immense potential waiting to be tapped. The marketplace in particular is driving the surge for new ways to conserve our natural resources.

In this brochure we have put together a selection of alternative plastic solutions for you, which make a wide variety of contributions to the conservation of fossil fuel resources. One thing is especially important to us in this context: whether recycled, renewable and/or bio-degradable – all of our material solutions have sophisticated properties and consistently high material quality.

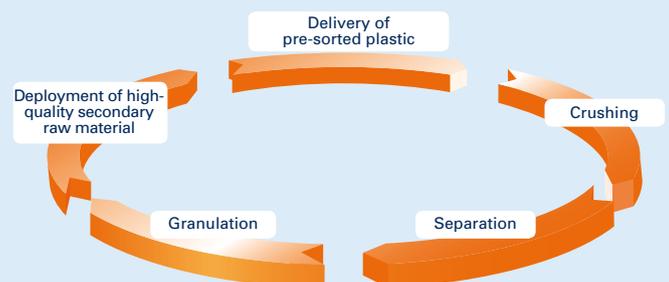
THE BIOLOGICAL CYCLE OF PLASTIC

The cycle of plant growth is as old as nature herself. Everything that the plant world produces eventually finds its way back to its origin, with no waste, clean and renewable. Plastics based on renewable raw materials join in this cycle – either partly through environmentally friendly incineration, or even completely by natural decomposition.



THE RECYCLING PROCESS

If the cycle of production, disposal, recycling and reutilisation is closed, then we refer to a genuine recycling of materials in the field of plastics. Here, unsorted, used plastics are utilised to create high-quality recyclates, which eliminate the need to process oil again. An environmentally-friendly cycle that also saves high levels of energy in the production process.



TECNARO ARBOFORM®

THE ALTERNATIVE: LIQUID WOOD

TECNARO GmbH is a spin-off of the Fraunhofer Institute for Chemical Technology (ICT), and today produces high-quality compounds based on natural materials in various material groups. The company's special focus is on the unique product ARBOFORM®, also known as liquid wood. This product is based on the renewable raw material lignin, which plays a role in the growth process of trees, helping ensure that they lignify and develop stability. As a by-product of paper manufacturing, lignin is available in almost unlimited quantities nowadays.

The maximum possible consistency of quality, together with its material properties, make ARBOFORM® predestined for applications that combine the limitless mouldability of thermoplastics with the characteristics of wood. Among these are the natural appearance and the fact that wood is warm to the touch, important for example when building furniture or musical instruments. In other applications, the expansion properties of ARBOFORM® play an important role, such as veneer wood substrates for car interiors. Incidentally, like naturally grown wood, ARBOFORM® products are 100 % bio-degradable.

| | ARBOFORM® | ARBOFILL® | ARBOBLEND® |
|------------------------------|---|--|--|
| Raw materials | <ul style="list-style-type: none"> • Lignin • Natural fibres • Natural additives | <ul style="list-style-type: none"> • Natural materials • Plastic | <ul style="list-style-type: none"> • Bio-polymers • Natural additives • Natural fibres |
| From renewable raw materials | 100 % | > 30 % | > 60 % |
| Bio-degradability | 100 % | – | 100 % |
| Features | <ul style="list-style-type: none"> • combines all properties of naturally-grown wood • unique worldwide, and protected by patents | <ul style="list-style-type: none"> • highly aesthetic and economical materials due to the combination of plastics and natural materials | <ul style="list-style-type: none"> • different formulations • mechanical property profile similar to impact-resistant plastics |



ALBIS CELLIDOR®

THE ALTERNATIVE: CELLULOSE

CELLIDOR® is an organic thermoplastic cellulose ester produced by ALBIS which consists of approximately 45 % cellulose, a renewable natural material. This means that, unlike traditional plastics, it is only partially dependent on finite fossil fuel resources. On the one hand CELLIDOR® has a conservation effect in the production phase, whilst on the other its cellulose content makes it climate-neutral once recycled.

Not least, because of its outstanding property profile, CELLIDOR® can already look back on over 100 years of market success: it combines the classic strengths of a thermoplastic with the advantages of a bio-plastic. These include the characteristics of a pleasant and warm surface, the self-polishing effect as well as the almost unlimited range of possible colours. In addition to opaque colours that have a high brilliance and depth, translucent and highly transparent colours are also easy to manufacture.

| PROPERTIES | FORMULATIONS AVAILABLE |
|--|--|
| <ul style="list-style-type: none">• High fracture resistance• Excellent transparency• Lasting surface brilliance• Good electrical insulation properties• No susceptibility to stress cracking• Excellent acoustic damping properties• No formation of dust particles | <p>Cellulose Propionate (CP)</p> <ul style="list-style-type: none">• Standard formulations with 8 % – 20 % softening agent for injection moulding and extrusion• Formulations for use with foodstuffs• Heat stabilised formulations• Customised formulations, e.g. with marble or metallic effect |
| APPLICATIONS | |
| <ul style="list-style-type: none">• Stationery• Sports equipment• Automotive | <p>Cellulose Acetate Butyrate (CAB)</p> <ul style="list-style-type: none">• Standard formulations with 5 % – 20 % softening agent for injection moulding and extrusion• Formulations resistant to UV light and weatherproof for outdoor use |

cellidor



MBA Polymers

THE ALTERNATIVE: HIGH-QUALITY, POST-CONSUMER COMPOUNDS

Every year, millions of tonnes of plastics are disposed of all over Europe in the form of electrical and household waste and parts from scrapped cars. The globally active company MBA Polymers is recognised as the world market leader in the manufacture of sustainable, high-quality plastics that are reclaimed from plastic waste in an innovative separation process. The process involves removing harmful substances from highly complex waste flows with a high plastic content, so-called shredder fractions, then separating them according to types of plastic and processing quality; these are then returned to the primary cycle in the form of high-quality granules.

This process is fully automated and is purely physical and mechanical in nature – no chemicals are used. Compared with plastics produced from oil, up to 90 % energy can be saved. Moreover, every tonne of MBA granulate produced saves the environment 2 – 3 tonnes of CO₂ emission. The properties of the post-consumer material are only slightly inferior to newly-manufactured plastics. Rigorous checks ensure constant quality at the highest level and the EU WEEE Directive (Waste Electrical and Electronic Equipment) guarantees a constantly growing supply of raw material, as feedstock.

| | POST-CONSUMER ABS, HIPS & PP |
|--------------|---|
| Raw material | Plastic-rich waste flows from old electrical equipment |
| Features | <ul style="list-style-type: none">• 90 % less CO₂• Constant availability• Constant high quality• EvoSource™ premium compounds (impact modified, UL-HB, light colours) |



ALBIS

PERSPECTIVES ON PLASTICS

MANUFACTURING FACILITIES

D-Hamburg
D-Zuelpich
GB-Knutsford

SALES OFFICES IN GERMANY

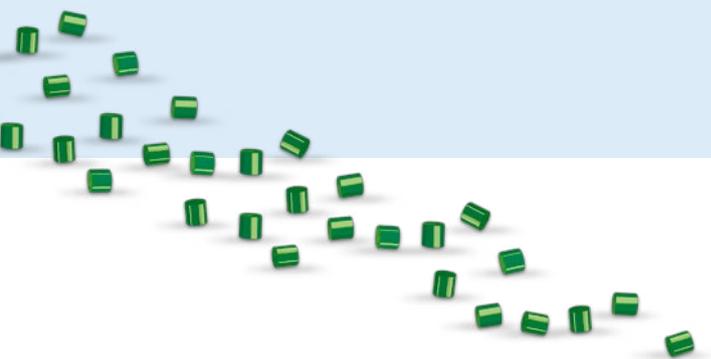
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