

# Xproducts' Ecocycling: pioneering technology in waste management

*Peter Merkel, head of process engineering, Xproducts*

German technology company Xproducts Deutschland GmbH has developed two innovative processes, one utilising waste streams such as municipal or commercial solid waste to produce a range of industrial products and another which converts sewage sludge into fertiliser. Both technologies produce market-ready products and reduce the volume of waste sent to landfill. This means customers who buy from Xproducts have the opportunity to significantly reduce their use of natural resources such as sand or wood.

## **An alternative to waste incineration**

Ecocycling has been designed as an alternative process to waste incineration – currently the main method of municipal waste disposal in Germany – and landfill, the world's most common waste disposal solution. Ecocycling does not replace traditional recycling, instead, it complements and enhances this. In traditional recycling, significant quantities of residue are still sent to landfill or incineration. Ecocycling makes use of recycling residues thereby sending almost nothing to landfill.

Ecocycling cannot process radioactive materials as current technology does not provide effective solutions. Neither can it be used to treat ammunition, explosives or hazardous medical waste as these provide significant risks for employees. Tyres, metal and reinforced concrete are generally also removed from the waste input stream, as these cause significant wear and tear on machinery.

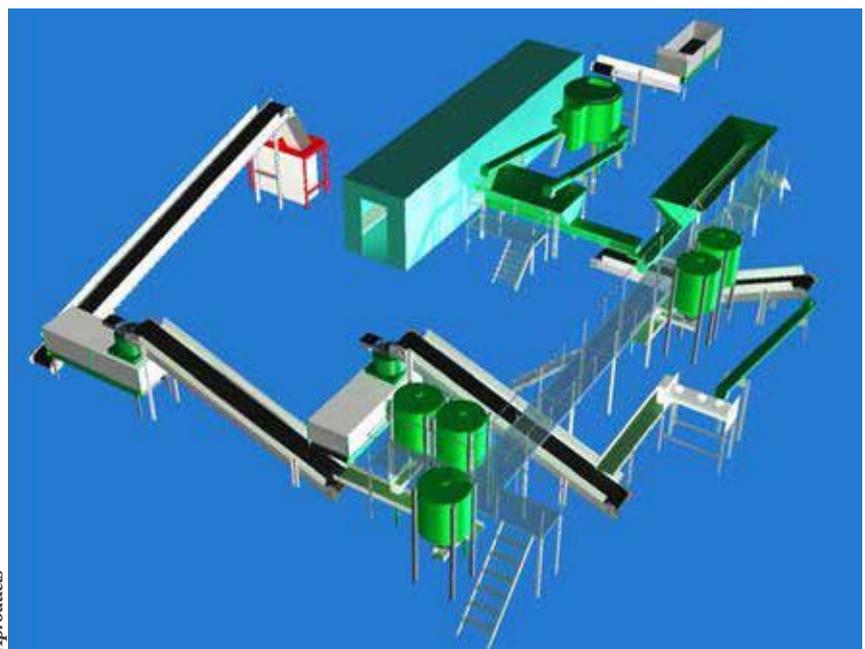
## **The process**

Waste processing methods generally handle a specific type of waste: metal, PET, glass (white or coloured) or other forms of homogenous input, while the Ecocycling process treats mixed waste basing the treatment process on the chemical composition of the mixed waste overall. Specific chemical recipes are created, tailored to the chemical composition of the input waste, the type and quantity of additives and the required properties of the desired end product determined by the target application.

Ecocycling does not require extensive pre-sorting of waste, the use of pressure or external heat inputs. It produces no CO<sub>2</sub> or other exhaust gas. It is a zero-

waste technology, with no by-products. If raw waste is selected as the input, the process commences by sorting the waste stream (optional but recommended). Sorting is tailored to the specific needs of Ecocycling selecting the appropriate 'ingredients' to produce the desired end product and removing contaminants.

This technology does not extract heavy metals from waste, but it locks and 'immobilises' them. Other contaminants are either destroyed or chemically altered and detoxified. Input material are preserved in the end-products. No substances are released into the environment during processing and none leach from the end product.



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The technological process itself involves grinding the input material to a very small grain size, maximising surface area to facilitate the chemical reactions required to manufacture the end products. This is achieved using 'Cross-Flow' grinding technology, developed by an affiliated company. The system is extremely robust and cost efficient size serves to homogenise the material as necessitated by the process.

Quality control is effected via two independent quality cycles: one integrated online system (independent of the system operator) and one operated manually. The most important sensors used are X-Ray fluorescence

devices (one online and one off-line). The online system gives readings every 20 seconds of up to 1 ppm. The off-line, manually operated, XFA delivers results with the same precision at 10 minute intervals. All results are fed back into process control, analysed and used to calculate any real-time adjustments needed. Process adjustments, calculated and implemented by process control, are effected by altering the discharge of the additives.

There are two types of plant design. One, designed to process solid domestic and/or commercial waste producing three different products: Xaggregate, Xboard and/or Xsoil; the other, designed to process sewage sludge producing Xfertilizer. Waste composition and target product determine the chemical additive recipe used. This recipe determines all process control parameters and thereby the system configuration

### **Xaggregate – for construction use**

Xaggregate is a raw material used to replace aggregates in concrete production, either in part or in full. It is employed in the concrete production process in the same way as a traditional aggregate. This new material also introduces new desirable properties. Products manufactured using Xaggregate benefit from significantly higher insulation properties than traditional concrete, they are lighter, and extremely fire resistant. The production process allows the material's traits to be specifically tailored according to desired end use.



Xaggregate provides all the benefits of aerated concrete without the disadvantage of the costly manufacturing process. A fire resistance test for construction blocks manufactured with Xaggregate had to be cut short after 120 minutes in order to avoid permanent damage to the testing institute's equipment, which proved less able than Xaggregate to withstand the heat. The concrete block itself was exposed to heat of over 1,000°C for more than 120 minutes and still showed no significant change, though the side of block exposed to the furnace remained at that temperature for over two hours during the test, the other side of the block remained at an ambient temperature throughout. Xaggregate blocks share the same properties as aerated concrete.

### **Xsoil – substrate**

Another product range, Xsoil, can be used as a substrate for pot soil or as soil enhancer in horticulture and agrimarkets. It is highly nutrient-rich containing nitrogen, phosphorous, magnesium and potassium, or other nutrients as required. These are released gradually over time so very little of this nutritional value is wasted. Any concerns of heavy metals potentially leaching into the soil and thereby getting into the plants have been dispelled on the back of successful lab testing and growing trials.

Xfertilizer, a fertiliser with specific properties (NPK-PK), can be manufactured utilising sewage sludge. This process offers a sustainable usage path for this increasingly expensive waste stream disposal. The technology used to produce Xfertilizer differs in that the sludge needs to be filtered to 80% water and as sludge is handled differently to solid waste.

### **Xboard – for wood chip industry**

Xboard product is a filler for wood-fibre board industry (LDF, MDF, HDF and particle board) and reduces use of the primary material wood.

### **Commercial production**

Xproducts has been operating a pilot plant in Würzburg, Germany for a number of years. Here, it tests and develops all the different additive recipes and processes for industrial-scale product trials.

A full commercial-scale plant is currently under construction on the Isle of Wight, UK, with the sorting system already in operation. The grinding technology 'Cross-Flow Grinders' is currently being installed and refuse-derived fuel/solid recovered fuel RDF/SRF will initially be produced. The Ecocycling specific equipment and software will be installed later this year.

Xproducts plans to build its own plants across Europe and in developed markets. In frontier markets, the company prefers to licence its technology, including the machinery, and provide technical assistance to implement the process on-site through selected local partners.

A typical Ecocycling plant, including pre-sorting technology, of 300 tpd, based on a 20 hour workday, can be built at a cost of €12-15m (\$15-19m\*), while a plant of 500 tpd costs around €20-22m.

With appropriate maintenance, the plant life is expected to be 15-20 years.

Xproducts has also signed a contract to sell turnkey plants into Russia, is considering projects in Asia and is negotiating a partnership agreement with a Saudi Arabian company.

\*Conversion made October 2014