ECOCYCLING
Technical Data and Commercial Observations

What is ECOCYCLING?

Definition

ECOCYCLING is a technical chemical-physical process during which, through the introduction of certain mineral and chemical additives, organic and inorganic waste materials are irreversibly transformed into an environmentally friendly raw material. This raw material, in turn, can be used in a variety of new materials or introduced to existing processes.

Types of Waste and the ECOCYCLING Process

Applicable types of hazardous and non-hazardous waste

The **ECOCYCLING** process can be used for various waste mixtures – the composition does not make too much difference. Everything from household and commercial waste, municipal sewage, sludge, certain ashes, contaminated soils, waste containing heavy metal or oil-contaminates, slurry, cesspits and other wastes can be used in one of various defined recipes. The **ECOCYCLING** process can even be used on landfill waste. Tires and reinforced concrete are excluded from the processing whilst scrap metal is extracted.

Explosives, radioactive and highly infectious materials are generally excluded from processing due to their exceptionally dangerous nature.

Any industrial waste stream is a case to case project and needs some upfront development which is carried out based on a customer's contract.

The maximum size of the waste pieces should not exceed 300 mm. If they do, a pre-shredding is needed.

The intended input materials must be analyzed and in combination with the intended target-product properties, transformed into a recipe which defines the information used by the system implementing the process.

It can be assessed that the toxicity and uniformity of the input materials has an impact on the costs and complexity of the process and its management which is fully automatic.

The technology itself is based on two principles

a) the larger the surface area and
b) the more homogeneous the material

the more reliable the chemical reaction will be.

Waste mixtures according to a specific recipe are mixed and processed to a new raw material. For the process, waste classification of the input is irrelevant (e.g. plastic bags, shoes, food

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Waste mixture and robustness in regard to changes in the waste

residues, etc.) but the composition of elements (e.g. Cl, Pb, Cr, H, ...) and their molecules (e.g. SO_4, CO_3, NH_3, ...) is essential. The concentration of the elements and molecules is vital, and this is the major difference with current, competing technologies and cannot be stressed enough. We look at the input material in a completely different way to a traditional waste manager. In accordance with the above-mentioned the process emphasizes grinding and homogenizing the material.

The robustness of the waste compositions which typically changes in its macroscopic appearance is one of the strengths of the **ECOCYCLING** process.

The waste mixture is not all that is being processed. To produce the material properties defined by the target application, additives are required - even though the waste mixture already has a multitude of different ingredients.

Additives

Those additives are comprised of minerals and chemicals. They are what is required to trigger the processes as well as to control the reactions to produce the desired properties.

A "cold" process

The process does not need external energy or heating other than what is required for the electric equipment. The material that is ground from ~ 300 mm to less than 2 mm and homogenized during the **ECOCYCLING** process. The reactions initialized are exothermal. Normally the temperature ranges around 80° Celsius and occasionally the temperature may rise to 140° Celsius.

The initial energy required for the reactions is generated by the exothermal reaction of the additives and the ground waste mixture. During the process, new mineral phases are created which provide additional possibilities and functional groups for various elements and molecules.

Typically, storage minerals such as the following are created:

Ettringit	$Me_6[M_2(OH)_{12} \bullet 24H_2O][(X)_3 \bullet nH_2O]$
Metal-Metal-Hydroxide Salt	$Me_4[M_2(OH)_{12}][X \bullet nH_2O]$
Metal-Hydroxide	$Me_x(OH)_y$

The environment for the reaction is adjusted and controlled as required and defined by the recipe. Functional groups are then generated which allow specific reactions to take place.

It may be necessary due to the different kinematics of the chemical reactions to separate the stages of the reaction.

Problematic substances are "attacked", and the intermediate products are finally transferred into the new stable raw material.

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To allow the automatic control of the process, state-of-art sensory equipment is used. Allowing a timely collection of all relevant data. Aside from the automated collection, a separate manual quality survey process is implemented to secure the continuous quality of the product produced.

The two quality circles are designed to cross-reference each other and to provide the process control with two independent sources for the data, to evaluate the proper function of the various data sources. And thus, allowing the control equipment to raise alarms if any one of the data sources produces foul data for what reason so ever.

The machinery

The technology is robust, simple to maintain and spare parts are readily available globally. This technology is similar to that found in most traditional industrial installations but is adapted to the needs of the specifics of the process. The facility's main components include loading stations, necessary conveyor systems as well as one or more XQZ, for the **ECOCYCLING** process developed cross flow grinder. Homogenization systems that ensure an equal distribution of the ground material are an essential part of the machinery. Screening and separation of various granularities guarantee the quality outcome is obtained. The separated material is re-fed into the production system and processed again. Systems to extract ferrous and non-ferrous metals are integral functions of the equipment used. Any kind of sorting or recycling system may be used before the **ECOCYCLING** system to extract wastes with retail market e. g. PET.

In addition to the purely mechanical reaction systems and the grinding of the waste, X-Ray Fluorescence Analytic (XFA) systems in combination with several other sensors are continually monitoring the quality of the process, waste materials as well as the product. The data form these sensors are fed into the process control system which automatically corrects any inconsistencies that arise in the monitor readings by adjusting input streams.

The production machinery is planned, produced and installed by us, Xproducts Deutschland GmbH.

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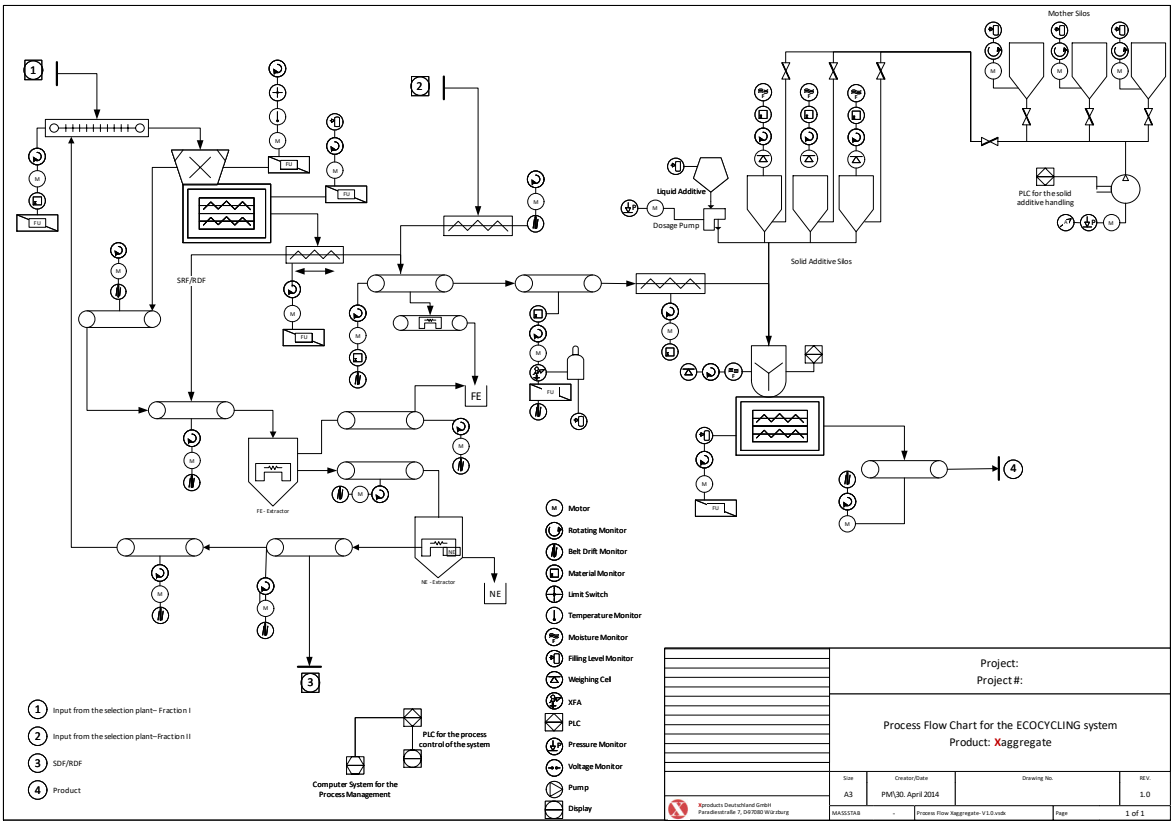

Output

A new raw material

A new, environmentally friendly raw material, possessing all the required technical properties as specified by the downstream use is the result of the **ECOCYCLING** process. All technical qualities required to produce a group of high-quality materials with multi-faceted properties, necessary for the industrial target process, can already be found in its nucleus. We are not talking about one single material, instead, we are referring to an entire group of products, each with optimal individual properties and targeted for a specific industrial application.

Despite these products being artificial, they are environmentally friendly materials which demonstrate no signs of damaging, leaching properties.

It is a valuable raw material

It is a shame to use perfectly good raw material containing some excellent properties in land fills.

The use for example as a concrete aggregate – replacing sand and other fillers – to produce pre-cast bricks and other concrete products is more than attractive. Allowing visualizing and producing of a new class of concrete product, that potentially provides totally new characteristics to the structure, e.g. light weight fire barriers or shot concrete utilizing asbestos remediation.

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Having used the correct recipe, the final product can also be used for the wood fiber board industry as the filler within the boards. Astonishingly, it may even produce nutrient-rich topsoil especially adjusted for the plant families it is intended to grow or to stretch the reach of a high yield phosphorous fertilizer.

Additional products used in other technical processes allow the production of new products with a wide area of applications.

A Marketable Mineral

Installation capacities

Xproducts Deutschland GmbH offers production concepts and installations in five different capacities: 100, 200 as mobile systems and 300, 500, 1,000 and multiples thereof as stationary ones. The capacity is in metric tons per day. All the calculations are based on a 20-hour workday, three shifts per day for the stationary systems and 16 hours – 2 shifts for the mobile ones.

Since the bulk gravity plays an integral role for the throughput and varies with the waste discharged into the system, we assume for all our calculations a bulk gravity of 400 kg/m³.

Footprint & storage space

An **ECOCYCLING** installation does not take up much surface space. Depending on the capacity, as little as 1,500 to 3,500m² is all the space you need.

However, the entire installation including the essential logistics such as delivery and pick-up, infrastructure, storage site for waste and product necessitates 15,000 to 35,000m².

Energy requirements

The amount of energy required for an **ECOCYCLING** installation varies depending on the capacity from anywhere between 0.8 to 2.5 megawatt for the electric systems.

Fully automatic control and monitoring technology

The **ECOCYCLING** installation is fully automatic and a highly innovative sensory system. It automatically readjusts the material processed by controlling the discharge of process additives – within reasonable limits. This sensory equipment as well as the control and assessment systems are part of the installation and delivered by us.

Staff

Due to its state-of-the-art automation, the **ECOCYCLING** installation requires a minimum number of personal, making the installation extremely cost effective. Conscientious staff and skilled craftsmen are a definite advantage. We recommend having an electrician and a fitter on hand for each shift. Depending on the capacity, one or more wheeled loader drivers will need to be employed. Additionally, one would need a couple of laborers per shift.

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Furthermore, an employee experienced in interpreting analysis results and performing analyses is required. This might be a geologist, chemical- or environment engineer. The analytic systems needed for monitoring are also part of the delivered system.

Finally, an experienced shop manager is required.

From waste to raw material to a new material

Conventional waste management procedures are often simply a matter of preparation for disposing waste in a landfill. Landfills are expensive and in order to be cost effective, many waste management programs function based on bulk discounts resulting in waste being disposed of in a concentrated area. Since landfills are facing stiff resistance in residential communities, the waste must be transported long distances to those landfills which are still operational. This all results in the known disadvantages to the environment, humans and national budgets.

The truth of the matter is most waste remains waste.

First and most important, **ECOCYCLING** is not producing waste it is intentionally producing products per precise specifications, that are no longer classified as waste.

ECOCYCLING is the most efficient way to transform waste mixtures and allows a way out of the dead-end that the waste industry is stuck in. **ECOCYCLING** is cost efficient as well as ecological!

ECOCYCLING produces valuable, marketable new raw materials. In fact, the supplemented additives result in an increase in beneficial properties of the material. These additives are mandatory, because they ensure that the new raw material shows the required technical properties for the target application.

This raw material is the basis for several important materials and applications. **ECOCYCLING** plays a significant role in bringing the material cycle full circle by being ecologically clean and economically attractive.

Now it is your turn!

We would happily meet with you to discuss the **ECOCYCLING** concept in greater detail. Please do not hesitate to contact us or any of our partners.

A simple phone call can start the ball rolling.

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