SEPARATE

"Enabling market uptake of innovative separation and cleaning solutions for material recycling of all product groups contained in bio-wastes and MSW"

D.2.1

Mobile press and cleaning unit built

Contract number	**333021**	**Instrument**	**CIP Eco-Innovation – First application and market replication projects**
Start date	**2013-09-01**	**Duration**	**32 months**

Co-funded by the Eco-innovation Initiative of the European Union

SEPARATE deliverable fact sheet	
Project start date:	**01 September 2013**
Project duration:	**32 months**
Project web-site:	**www.separate-wastesystems.eu**
Document	
Deliverable number:	**2.1**
Deliverable title:	**Mobile press and cleaning unit built**
Due date of deliverable:	**31.07.2014**
Actual submission date:	**31.07.2014**
Editors:	**Katharina Krell, Greenovate! sprl**
Authors:	**Jan Bevelsborg, Johan Schuur, db technologies**
Reviewers:	**Jan Bevelsborg, db technologies**
Participating beneficiaries:	**db technologies**
Work Package no.:	**2**
Work Package title:	**Long and short term tests and analytical reports**
Work Package leader:	**db technologies**
Work Package participants:	**ALL**
Estimated person-months for deliverable:	**6**
Dissemination Level	
CO (Confidential, only for members of the consortium including the Commission Services)	**n/a**
PU (Public)	**PU**
PP (Restricted to other programme participants, (including the Commission Services)	**n/a**
RE (Restricted to a group specified by the consortium including the Commission Services)	**n/a**
Draft/Final:	**Final**
No of pages (including cover):	**13**
Keywords:	**Press separation, pre-treatment, sorting, bio-waste, test analysis**

Co-funded by the Eco-innovation Initiative of the European Union

SEPARATE WASTE SYSTEMS

TABLE OF CONTENTS

Co-funded by the Eco-innovation Initiative of the European Union

Executive summary

Experience so far has shown that the potential customers for the SEPARATE Waste System find the offer of this innovative set of technologies very appealing but refrain from buying because they want to know specifically what the SEPARATE technologies do to their own waste, in their country operating in their conditions.

They usually find it difficult to believe that the results from treating different waste in another context with the same technology will lead to similar results. Hence, they are particularly interested to understand more specifically what happens with the heavy metals, what is the potential biogas yield, the methane content, how dry is the dry fraction, etc. when treating their own waste.

The main aim of Work Package 2 "Long and short-term tests and analytical reports" is to address this major market barrier by carrying out test of "local" waste with a mobile test machine and by getting the incoming and outgoing waste streams analysed during a range of long-term and short-term tests on-site.

As a first step, Task 2.1 consists of the design and construction of a mobile press that can be used at different sites to carry out the above-mentioned tests. It should be noted that due to the issues with co-beneficiary OMR, the implementation of Task 2.1 had to be partially postponed. Whilst the mobile unit has been fully designed, only some elements have been constructed during the first reporting period (September 2013 – March 2014).

To catch up with the delay caused by the issues related to OMR, the team has been issued a project prolongation of 8 months that allowed to find a new suitable location at the premises of the new project partner EGW in Germany and to make the necessary arrangements for the long-term tests at the EGW site. The remaining elements have been built according to the updated planning for the long-term tests to run during a period of 32 months as foreseen in the amended Annex I of the contract.

This report presents the work that DB TECHNOLOGIES BV as a leader of Task 2.1 "Designing and building the mobile unit" has undertaken in the first eleven months of the project (September 2013 – July 2014).

Co-funded by the Eco-innovation Initiative of the European Union

1. The principle

Mixed Waste, such as Municipal Solid Waste (MSW) or separately collected bio-waste, essentially contains the following five main material groups:

1. Biodegradable waste;
2. Water;
3. Minerals (glass, sand, stones);
4. Metals;
5. Solid rest waste (plastic, cardboard, wood, textiles, paper etc.).

By applying the mixed waste to an extremely high pressure, the soluble organic fraction behaves like a liquid and is separated from the material that is mechanically more resistant.

2. The mobile unit

The mobile unit carries the SEPARATE Waste System consisting of a **hydraulic press** (the OREX PRESS) and a **cleaning system** (the CYCLONE) mounted on several trailers. The principal components of the mobile separation and cleaning unit are:

- Main body of the machine: feeding hopper, main cylinder, extrusion chamber and front door system;
- Hydraulic station: feeding pumps of the cylinders with the relative electric driving motors, tank for the hydraulic oil, distribution parts, valves and distributors, air operated heat exchangers, steel pipes, and flexible pipes for the pump oil and other accessories (air filters, oil filters, levels controls, pressure and temperature sensors);
- Electric box: with the respective electrical apparatus and command panel;
- Buffer tank and auger: to mix organic wet fraction with from a biogas digester and push it into a cylindrical chamber;
- Cleaning system: works as a cyclone containing a rotor and a perforated cylinder;
- Two sink tanks.

The mobile unit is fully designed with the most modern Siemens 3D software and calculated on strength with the finite element method. The structure is overdesigned to be able to safely withstand the forces applied to through during the extrusion process. The mobile unit has been built by high quality materials to ensure appropriate and long-term efficient operations.

Co-funded by the Eco-innovation Initiative of the European Union

The SEPARATE Waste System processing equipment operates at a very high technology level to enable the combination of high-strength and high-speed movements within a very accurate positioning.

3. The OREX PRESS

The OREX PRESS has a modular construction. It consists of the "active part" which is the press ram, the guiding and all the functional parts are located in a self-supporting structure in an electro-welded construction, and the central "passive" part of the structure containing the main cylinder and the extrusion chamber.

The extrusion process is carried out in three phases:

1. Feeding Phase;
2. Compression Phase;
3. Expulsion Phase.

The feed cylinder feeds the incoming organic waste via a pre-press ram from the feeding hopper into the extrusion chamber then the main cylinder compresses the material via the main ram to extrude the material that turns into a liquid under this extreme high pressure. When the compression phase is finished, the ram retracts, a side door opens and the feed cylinder brings out the structural dry material that remained in the compression chamber. The feed ram retracts and the door closes for the next cycle.

Co-funded by the Eco-innovation Initiative of the European Union

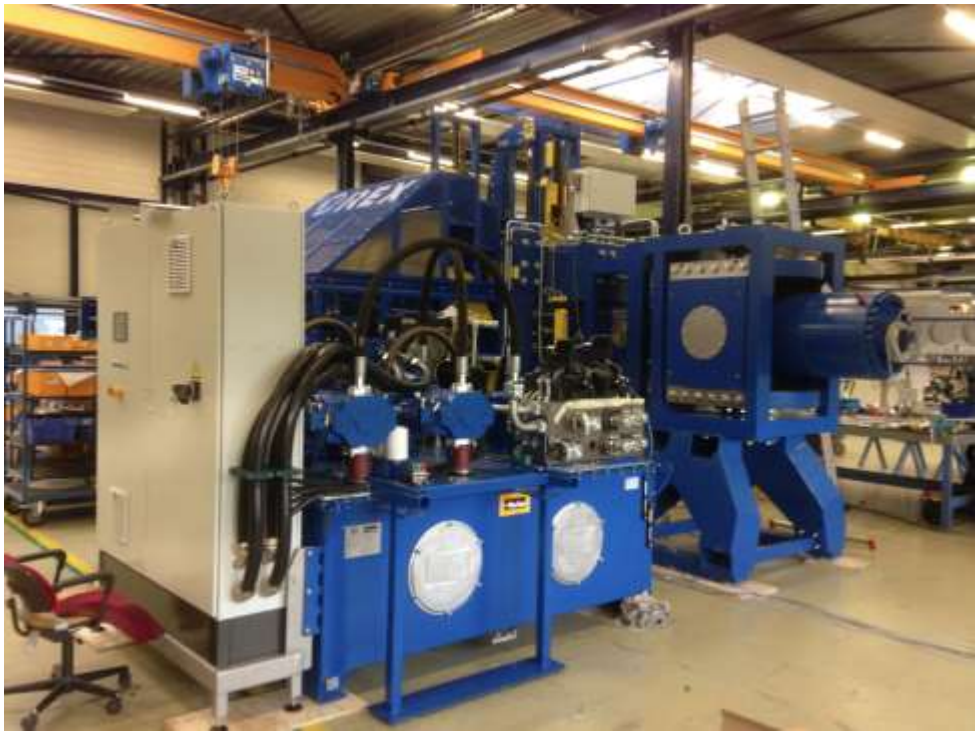

Figure 1: Pictures of the OREX press

Co-funded by the Eco-innovation
Initiative of the European Union

The **main components** of the OREX PRESS are:

- Feed ram to fill the compression chamber;
- Extrusion ram to extrude the liquid product;
- Door to discharge the structural dry fraction;
- The perforations are located at the end of the extrusion chamber and inside the extrusion ram;
- The perforations for the extrusion are made from reinforced steel and are fully exchangeable;
- The guiding of the rams and the door are exchangeable parts;
- The hydraulic power pack contains the hydraulic pumps driven by electro motors, the tank of hydraulic oil, the manifolds, the valves and the piping;
- The heat exchangers are air cooled with proportionally temperature-controlled motors;
- The power pack is equipped with electronic and optical level sensors and temperature sensors;
- The tank has a separate filter with electric pump;
- Several pressure sensors for full control;
- The hydraulic power pack is positioned close to the press;
- Main electric cabinet is positioned near the hydraulic power pack.

The **qualifying characteristics** of the OREX PRESS are:

- Exceptional pressure;
- High speed cycles because of simultaneous operation;
- Exchangeable compression matrix impact-plates,
- Use of materials subject to heavy duty and wear in special alloy and components tested for their high quality and durability;
- Massive, rational sizing criteria as a result of experience in both construction and operation in the use for compaction and extrusion.

For the mobile unit, an OREX PRESS with a capacity of 25 m^3/h and the following dimensions has been designed and has been built: 7.0m length / 7.0m width / 4.6m height.

Installed power:	about 157,5 kW
Working hydraulic pressure:	280 bars
Weight:	about 52 tons
Hydraulic oil tank:	about 3.700 liters

Several temperature and pressure sensors are used to control and supervise the process. There is a VPN connection available for remote control from db technologies. The machine is fully designed according CE regulations, especially the regulations and safety requirements for Presses EN16252.

Co-funded by the Eco-innovation Initiative of the European Union

4. The cleaning system

To make the material more liquid, the organic wet fraction is brought into a buffer tank to be mixed with process water coming from a biogas digester. The best separation results can be obtained with Total Solids of approx. 12-18%.

The material is then pushed with an auger into a cylindrical chamber that works as a cyclone forcing the material to the outside of the cylinder. A strong mixer positioned in the centre of a perforated cylinder rotates the material at high speed, thus creating a strong centrifugal force. Due to the centrifugal force and the added water the material flows through the perforation. Material that is bigger than the perforation – typically plastic film - is not pushed through the holes. A rotor inside the cyclone creates an upward movement to push the plastics up inside the cyclone. Whilst the organic fraction is pressed through the holes of the cyclone, the remaining plastics falls over the top where it is transported away by a screw conveyor.

The organic wet material is then moved into a sink tank where the material comes to rest. Heavy material such as small stones and glass has the time to sink down in this tank. At the bottom, there is a scraper bar that slowly brings the sunken fraction out of the tank, above water level. This tank is equipped with a max level sensor. The tank has an overflow were the liquid comes in a second tank. This tank is equipped with agitating mixers. From this tank the liquid is pumped to the buffer tank for the digesters. The tank has minimum and maximum level sensors to initiate and stop pumping of the liquid.

Co-funded by the Eco-innovation Initiative of the European Union

Figure 2: Pictures of the cyclone

Co-funded by the Eco-innovation
Initiative of the European Union

Figure 3: Picture of plastic film after cyclone in hand

Co-funded by the Eco-innovation
Initiative of the European Union

Figure 4: Picture of the sink tank

Co-funded by the Eco-innovation
Initiative of the European Union

Figure 5: Picture of the full cleaning system with the cyclone and sink tank

Co-funded by the Eco-innovation
Initiative of the European Union