Waste-to-Fuel Conversion with Advanced Separation and Treatment Technologies

23 Feb. 2018
Waste Treatment Overview

Chapter
History of Waste Collection

Start Waste Collection in the US: since 1965
Start Recycling in the US: since 1998
Waste Collection Method: Source Segregation

**Countries:** W. Europe, Japan, Korea and others

**Advantage:** High Efficiency and Customized Treatment ⇒ good for SRF and MRF

**Disadvantage:** High Transportation and Treatment Costs and Big Fleet

**Methods:**

- **Direct Landfilling**
- **Direct Incineration**
- **SRF production**

**Recycling:**

- **MSW**
  - ① Direct Landfilling
  - ② Direct Incineration
  - ③ SRF production

- **Recycle Waste**
  - ① MRF (Material Recovery Facility)

- **Food Waste**
  - ① Fertilizer and Animal Food Production
  - ② Biogas Production
Waste Collection Method: Commingled Collection

Advantage: Small Fleet and Low Collection Cost
Disadvantage: Low Separation Efficiency and Purity

Mixed Collection, and Total Treatment and Separation
(UK, Australia, Spain, China, Italy, Singapore, and others)
Waste Collection System

Chapter
iTainers are IoT-based Automatic compacting containers linked by wireless internet to management server. iTainer weighs waste and charges cost. Operator monitors and maintains iTainers remotely.

**Advantages and Benefits**

- **Cost Reduction**
  - Less collection workers and trucks by 80%
  - No new waste collection bag
  - Less traffic burden to social system and CO₂ emission

- **High Efficiency**
  - Collecting fully loaded containers only
  - Compacting the fluffy waste bags up to 80%
  - Easy to hookup type container

- **Added Beauty**
  - No waste dispersion, No odor, No vermin
  - No waste bag breakup by animals

**Model and Application**

- iTainer-W - Municipal Solid Waste
- iTainer-B - Food Waste
- iTainer-R - Recycle Waste

**Locations**

- Residential area
- Market
- Festival
- Big complexe
- Apartment complex
SMART Compacting Container for MSW

Residential complex, Shopping area, Market, Apartment complex, Festival area
iTainer-B Concept

SMART Collection Container for Bio Waste

Nature Store

- Fuel Savings
- Reduced CO₂
- Clean City
- Easy Payment

Residential complex, Shopping area, Market, Apartment complex, Festival area
iTainer-R Concept

SMART Compacting Container for Recycles

Nature Store

Fuel Saving, Reduced CO2, Clean City, Recycling

Residential complex, Shopping area, Market, Apartment complex, Festival area
**netbin** provides timely warnings when they are full, permitting optimized route planning for collections which reduces the waste collection costs by 30–40%. It notices fire and flip over.

### Advantages and Benefits

**Cost Reduction**
- Fuel Saving and Reduced Fleet size
- Reduced wear and servicing on collection trucks
- Fully utilize the work forces

**Operation Efficiency**
- Empty only the bins needed emptying
- Optimized the collection routes
- Increase the capacity in rapid fill areas

**Monitor and Report**
- Analyze existing collection routes against actual fill level
- Gather the data for new collection improvement scheme
- Identify trends in bin behaviors
Waste Bin Level Sensor

Nature Store netbin

Fuel Saving  Reduced CO2  Clean City  Less Traffic

Residential area, Shopping area, Market, Apartment complex, Park, Festival area

8 Minutes

ACI
Ecopro C is a waste collection management system for all collection machines (iTainer, iUnderground, netbin, Bigbelly and Nature Store) communicating with machines through internet for fill level sensing, status checking and remote maintenance.

**Advantages and Benefits**

- Easy to control with full overview
- Reliable database for future planning
- Small waste management fleet
- Flexible and reliable management from analyzed data
- Dumping fee collection guaranteed

**Applications**

- Public waste collection
- Commercial waste collection
- Industrial waste collection
- Big complex waste collection
Ecopro C Concept

SMART Collection Management System

Nature Store

Ecopro C

n: netbin
T: Ttainer
B: Bigbelly
U: iUnderground
NS: Nature Store

Collection vehicle driver’s handheld device
Monitoring
Material Recovery Facility
ACI 재활용품 선별처리 계통도 버전4  ACI MRF(Material Recovery Facility) Ver.4

MRF Process

고비용선별동
Heavy Material Handpicky Station

바롱선별공기
Bag Splitter

부중량분리기
Bulky Material Handpicky Station

바로방분리기
Air Buffalo Separator

경사선별공기
Optical Sorting Machine

바로방선별기
Buffalo Operator

경사선별공기
Optical Sorting Machine

벼중량분리기
Light Material Handpicky Station

ACI 서비스 팀
ACI Service Team
Precess Flow: 1. Bag Splitting Machine

Bag Splitter
- To Split open the bags
- Fitted with the rotating knives
- Whole Loader feeds the bunker
- Splitter and Continuous Feeding
Handpicking Station for Bulky Materials

- Hand Picking the Long or/and Bulky Materials
- To screen the bulky materials for the following machines → to increase the sorting efficiency
- Worker Friendly Sorting Station with Colored Chute and Wood Finish
- Air Conditioned Work Station and Air Cleaning System Equipped
Precess Flow: 3. Air Ballistic Separator

Air Ballistic Separator
- Principle: Combination of Air Shifter and Ballistic Screen
- Enabling the Serial Sorting System (Heavy/Mid Heavy/Light/Inerts/Dust)

Presorting in Five Categories
- 1: Heavy – Glass, Ceramic, Metal...
- 2: Mid Heavy – Plastics Bottles
- 3: Light – Film and Paper
- 4: Inerts – Food, Broken Glass, Sands...
- 5: Dust from Cyclone or Bag Filter
Precess Flow : 5. Heavy Material Sorting

Glass Bottle Handpick / Gas Can Piercing

- Hand Sorting the Glass Bottles by Color (Brown, Green, Clear)
- Lift to transport the Glass Bottle Boxes
- Magnetic Belt to sort the Gas Can
- Piercing Gas Can to remove the remaining gas
  -> Gas Explosion and Fire Prevention
Precess Flow : 6. Fe/NFe Sorting & Baling

**Magnetic Belt**
- Permanent Magnetic Belt – no Electricity
- Sorting the Ferrous Material

**Eddy Current**
- With the Eddy Current
- Sorting Non – Ferrous Metals mostly Aluminum Cans
Optical Sorting Machine with NIR

- The Scanner reads the Reflected NIR
  → Recognize the Materials
  → Blowing the selected material
- Can record the new materials and easy to change the sorting materials
Precess Flow: 8. Storage Bunker and Balers

- Baling the plastics by material (PET, PP, PS, PE) after storing them in the bunkers
- At the high level, the storage conveyor takes out the material to the baler

**Plastic Baler**

- Baling the plastics by material (PET, PP, PS, PE) after storing them in the bunkers
- At the high level, the storage conveyor takes out the material to the baler
SRF Production Facility

Chapter
SRF Production Process

생활폐기물 전처리 및 폐기물 고형연료 생산시설 MBT (Mechanical Biological Treatment)
Pre Shredder with Hook Knives

**Equipment Technical Specifications**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Throughput</td>
<td>20 ton/hr</td>
</tr>
<tr>
<td>No. of Shafts</td>
<td>Twin-shaft</td>
</tr>
<tr>
<td>Size</td>
<td>Cutting Table: 2,000(W) X 3,144(L) Overall: 2,300(W) X 4,072(L)</td>
</tr>
<tr>
<td></td>
<td>Power Pack: 450(W) X 1,980(L)</td>
</tr>
<tr>
<td>No. of Knives</td>
<td>12</td>
</tr>
<tr>
<td>Distance X</td>
<td>60mm</td>
</tr>
<tr>
<td>Grain Size</td>
<td>&lt;150mm (&gt;90%)</td>
</tr>
<tr>
<td>Power Consumption</td>
<td>180kW X 2 Sets = 360kW</td>
</tr>
</tbody>
</table>

**Coverage**

- Household Waste
- Large Waste
- Wooden Waste
- Bed sheets, Blankets, Clothes
- Commercial Waste
- Biomass & Green Waste

**Features & Advantages**

- 2-axis asynchronous bi-directional cutting method
- Handling long & elastic material like rubber band.
- Sustainable operation by hard facing
- Knife openings, it ejects sand, small stones etc. automatically. And this makes knife’s lifetime longer and has economical effects.
Disc Screen

Equipment Technical Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Throughput</td>
<td>30~50 ton/hr</td>
</tr>
<tr>
<td>Power Consumption</td>
<td>3.0kW</td>
</tr>
<tr>
<td>Shaft No.</td>
<td>8/10/12/14/16/18</td>
</tr>
<tr>
<td>Power Supply</td>
<td>380~400V, 50/60Hz</td>
</tr>
<tr>
<td>Dimension</td>
<td>1220 X 4400 X 2400</td>
</tr>
<tr>
<td></td>
<td>1620 X 4400 X 2400</td>
</tr>
</tbody>
</table>

Coverage

- Glass & Plastic
- Paper & Film
- Sand & Soil
- Bulky Waste
- Landfill Excavation Waste
- Size sorting of Recycling sorting facility
- Mixed size sorting of MSW & Industrial waste

Features & Advantages

- Screening with Various sizes of Disc
- Screening of organic waste
- Sorting impurities and other waste
- Minimize Clogging with High Moisture Content
- Interchangeable Disc depending on sorting purpose
Air Shifter

Coverage

- High-density: plastic containers, Non-ferrous, cans and glass bottles, porcelain etc.
- Low-density: combustibles like paper, plastic film and etc.

Features & Advantages

- Screening with Air Blowing
- Effective screening of High density waste
- Internal Air circulation type /no dust emissions

Equipment Technical Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Throughput</td>
<td>12 ton/hr</td>
</tr>
<tr>
<td>Power Consumption</td>
<td>26.5 kW</td>
</tr>
<tr>
<td>Dimension</td>
<td>3,680 (W) x 13,350(L) x 4,303(H)</td>
</tr>
<tr>
<td>Power Supply</td>
<td>380V / 3Ø</td>
</tr>
<tr>
<td>Type</td>
<td>internal Air Circulation type</td>
</tr>
</tbody>
</table>
**Coverage**

- Household Waste
- Paper & Paper Board
- All kinds of plastics
- Industrial & Commercial Waste
- Rubber & Tires
- Fabric & Clothing
- Wires & Computer Scrap

**Features & Advantages**

- Various materials shredding (like tough & smooth together)
- Hydraulic maintenance flap/door makes maintenance easier
  
  (Knife & Screen replacement / cleaning dirt)
- Application of safety clutch prevents damaging rotor
- Electrical safety control

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<tr>
<th>Item</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Throughput</td>
<td>9~33 ton/hr</td>
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<tr>
<td>No. of Shafts</td>
<td>Twin-shaft</td>
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<tr>
<td>Shaft length &amp; Diameter</td>
<td>2014 x 665</td>
</tr>
<tr>
<td>No. of Knives</td>
<td>Up to 216 (X2)</td>
</tr>
<tr>
<td>Shaft speed</td>
<td>70~180 rpm</td>
</tr>
<tr>
<td>Grain Size</td>
<td>10~100 mm</td>
</tr>
<tr>
<td>Power Consumption</td>
<td>200kW x 2Sets</td>
</tr>
</tbody>
</table>
Magnetic Separator

**Coverage**
- Household Waste
- Construction Waste
- Industrial Waste

**Features & Advantages**
- Permanent magnet
- Sorting metal(Fe) kinds in MRF & MBT
- Excellent Separation Efficiency
- Easy to maintain

**Equipment Technical Specifications**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Throughput</td>
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<tr>
<td>Power Consumption</td>
<td>1.5kW</td>
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<tr>
<td>Dimension</td>
<td>W700 X L900 X H220</td>
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<tr>
<td>Power Supply</td>
<td>380V</td>
</tr>
<tr>
<td>Type</td>
<td>Permanent magnet type</td>
</tr>
</tbody>
</table>
Balers

Coverage
- Paper & card boards
- Plastic Film
- Steel and Aluminum cans
- Recyclables and Organics
- Waste from MRF

Features & Advantages
- Baler (5 line PP Softband—twine knotting method)
- Hardox plate in waste material contact, durable & lifetime secured
- High compressive forces shows great performance and easier to store/transfer bales.
- Plastic twine—knotting method saves more cost
- Plastic twine—knotting method secures working area
- Saving operational costs compared to power handling capacity
- Bale specifications: 110 X variable X 75cm

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<tbody>
<tr>
<td>Throughput</td>
<td>12 ton/hr</td>
</tr>
<tr>
<td>Power Consumption</td>
<td>82 kW</td>
</tr>
<tr>
<td>Dimension</td>
<td>W2,250 X L12,000 X H5,500</td>
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<tr>
<td>Power Supply</td>
<td>380V</td>
</tr>
<tr>
<td>Type</td>
<td>PP Automatic binding format</td>
</tr>
</tbody>
</table>
Wrapping Machine

**Coverage**
- Storing wastes before SRF, MBT, incineration for long-distance transportation of bulk materials
- Leachate generation material
- Retention of physical properties

**Features & Advantages**
- Wrapping time: 60sec/1 bale
- Lowest oxygen permeability
- 3 wrapping programs depending on type of waste
- Movement controller for checking bale length
- Belt type EP500 has great durability and minimize damage to bale

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<table>
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<tr>
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<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Throughput</td>
<td>15ton/hr</td>
</tr>
<tr>
<td>Power Consumption</td>
<td>25kW</td>
</tr>
<tr>
<td>Dimension</td>
<td>W3,700 X L13,000 X H3,300</td>
</tr>
<tr>
<td>Power Supply</td>
<td>380V</td>
</tr>
<tr>
<td>Type</td>
<td>Auto transfer &amp; Wrapping method</td>
</tr>
</tbody>
</table>
High Efficiency with MPS Drum (Multi Purpose)
Small Size and High Efficiency
Minimized Over Drying
Pelletizer for SRF

- Easy to Control the Gap between Die and Ring
- Hydraulic Breaking System – for Foreign Materials
- Twin V-Belt
- Automatic Stoppage for overload
- Centralized Greasing System
Incineration Energy
The empty fruit bunches (EFB) are either recycled in the plantation or used as fuel for other energy plants like for a palm oil refinery, where a chemical process also demands for steam and power. The challenge has always been to provide a stable and reliable energy source during the processing of each batch of oil. Be it using oil palm waste like empty fruit bunches as fuel for energy production or even palm kernel cake, VYNCKE has the proven experience and know-how to help you meet this challenge.
Given the upward trend in both price and worldwide demand for a finite supply of fossil fuel, coupled with concerns about global climate change, many greenhouse farmers are switching to renewable energy. VYNCKE offers heating systems adapted to a wide range of biomass fuels. The possibility of equipping our boilers with CO2 capture systems, which allow carbon dioxide to be utilized for greenhouse grown vegetable crops, is a well appreciated extra feature.
Producing pellets is an energy demanding process, where the biggest proportion is used for drying. Single-pass drum dryers utilize flue gases from our waste fired combustion systems, while belt dryers are steam heated or hot water heated and can be used in combination with cogeneration. To help you meet this challenge in a cost-effective way, with maintained high reliability and availability, VYNCKE offers a wide range of fuel flexible biomass energy solutions.
감사합니다!