Nordson BKG

Presentation for SPE PAM 2016 Conference
Latest Developments in underwater pelletizing

David Bargery
Global Project Manager
Content

- Company Profile: Nordson BKG
- Company Profile: Nordson Corporation
- Pelletizing Technology
- Tempered Water Systems
Company Profile

- Started in 1994
- Market leading company in Underwater Pelletizing
- More than 1000 systems delivered worldwide in over 45 countries
- Approx. 100 employees
- 2,000 m² production area
- State-of-the-art lab for testing, trials, and demonstrations
- Delivering highly-sophisticated downstream solutions as well as individual components
- Modern Quality Management System DIN EN ISO 9001
Company Profile: Nordson BKG

- Filtration Systems
- Underwater Pelletizing Systems
- Melt Pumps

Company Profile: Nordson BKG

Locations

- NORDSON PPS GmbH, Münster / Germany
- NORDSON BKG GmbH, Münster / Germany
- NORDSON Corporation, Roswell, GA / USA
- NORDSON PPS China, Shanghai / China
- Agencies around the world
Company Profile: Nordson Corporation

- Founded in 1954, Westlake, Ohio / USA by brothers Eric and Evan Nord
- First product: hot airless spray equipment
- Expansion to a multinational organization with sales of more than $1 billion
- Traded on the NASDAQ Stock Market: NDSN
- 2013: Introduction of the Polymer Processing Systems Group (PPS Group)
Company Profile: Nordson PPS
Polymer Processing Systems

- Underwater Pelletizing Systems
- Centrifugal Dryers
- Screen Changers
- Melt Pumps
- Polymer Valves
- Extrusion Dies
- Co-extrusion Feedblocks
- Fluid Coating Dies
- Modular Coating Systems
- Screws
- Barrels
- Rolls
- Slide Plate Screen Changers
- Melt Pumps
- Water Ring Pelletizers
- Cleaning Ovens
Nordson BKG Underwater Pelletizers

- Polymer Diverter Valve
- Water Bypass Frame
- Underwater Pelletizer

- Centrifugal Dryer
- Tempered Water System
Pelletizing Technology

Manual Pelletizer with hand wheel cutter advance

- From 5 – 2,500 kg/hr
- Type A 300, A 1000

Automatic Pelletizer with Hydraulic cutter advance

- From 5 – 5,000 kg/hr
- Type Compact, AH
Pelletizing Technology

Automatic Pelletizer type AH D

- Larger capacity pelletizers for Polymerization / Reactor lines.
- Up to 35,000 kg/hr
- Solutions for large-scale micropellet production

- The adjustment of the Cutter Hub to the Die Plate is made automatically by means of a Hydraulic Cylinder.
- For operator safety - Automatic connection of Water Box and Pelletizer via hydraulic locking mechanism.
Pelletizing Technology
Fully Automatic Hydraulic Blade Adjustment

Automatic Blade Sharpening
- set as an automatically recurring function in your personalized program
- Eliminate “tails”

Here’s how it works:

1) Increase of hydraulic pressure
2) Rise of motor torque: indicates blades now in close contact with die face metal
3) Reduction of hydraulic pressure
4) Sharpening pressure
5) Production pressure
Pelletizing Technology
Fully Automatic Hydraulic Blade Adjustment

Customer Advantages:

- Constant pressure of the blades to the die plate
  - No blade “hopping” – hydraulic oil not compressible, unlike air or spring
- Maintain pellet quality independent of wear
  - Eliminate “tails”
- Fully automatic blade re-sharpening
- Low wear of blades and die plate
  - Precision control, use only the pressure you need
- Minimal operator intervention during operation
  - Operators can focus on other tasks
- No die face smearing
- Pelletizing of even the lowest viscosities
Pelletizing Technology

Die plate development

- Designed and manufactured in-house by Nordson BKG
  - ANSYS Fluent CFD Analysis / Solidworks FEA
- Designed for an extensive variety of applications

- Die Plate for Micro-Pellets $\phi=0.4$ mm, 1,110 holes
  - For AH 2000 pelletizer

- Die Plates designed for Oil or Steam heating

- Pressure reduced die plates, e.g. X-in-1 design
Pelletizing Technology
Cutter hub design

**Patented 90° “Straight” design**
- Allows for more blades per hub
- Customer can operate with lower RPM to deliver same capacity as angled-blade hub / conversely the available capacity is increased at higher RPM
- Suitable for most polymers

**45° Angular design**
- Suitable for most polymers
- Especially important for softer materials to prevent smearing on die face
Pelletizing Technology
Polymer Diverter Valve

- 7 frame sizes
- Throughputs from 2 - 35,000 kg/hr
- Shortest possible flow channel length
- Fully integrated into Nordson BKG Underwater Pelletizing System
- Plug-in connection to the Bypass for easy installation
- Special designs on request
Pelletizing Technology
Water Bypass

Full process control with bypass and appropriate PLC program
Pelletizing Technology
Die plate surface grinding tool

Inline automated grinding of the die plate

Benefits:
- Reduce down time; don’t send your dies out for grinding!
- Increase your die plate lifetime
- Suitable for software versions from 2008 and newer
Tempered Water Systems

Master-Line™

Opti-Line™
Optigon™

Combi-Line™
Combigon™
Tempered Water Systems
Master-Line

<table>
<thead>
<tr>
<th>Model</th>
<th>Centrifugal Dryer</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Master 300</td>
<td>TVE 1000 ED</td>
<td>&lt; 500 kg/hr</td>
</tr>
<tr>
<td>Master 1000</td>
<td>TVE 1000 ED</td>
<td>&lt; 1,200 kg/hr</td>
</tr>
<tr>
<td>Master 2000</td>
<td>TVE 2000 ED</td>
<td>&lt; 2,000 kg/hr</td>
</tr>
</tbody>
</table>

- Our entry-level water system
- Modular design
- Completely skid-mounted
- Dual door dryer access for easy cleaning (front and back)
- Contains all the essentials: everything you need and nothing you don’t
Innovations: Master-Line UWP with Belt Filter

Upgrade your Master-Line system, now or later

- Compounding
- Masterbatch
- Recycling
- Brittle materials which can generate a high degree of fines

**Without belt filter**

**With belt filter**
## Why Materbelt
### Manual vs. Automatic Cleaning

<table>
<thead>
<tr>
<th>Master Line with Belt Filter</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Frequent monitoring by the operator required</td>
<td>- Automated monitoring and self-cleaning of the sieve</td>
</tr>
<tr>
<td>- Manual scraping/cleaning of the sieve</td>
<td>- No operator intervention needed</td>
</tr>
<tr>
<td>- Manual emptying of the collecting drawer</td>
<td>- 100 micron filtration</td>
</tr>
<tr>
<td>- 150 micron filtration</td>
<td></td>
</tr>
</tbody>
</table>
Tempered Water Systems
Combi-Series

- Contains all of the features of the Master-Line systems with additional water filtration options

- **Combi-Line** systems available with optional Fines Removal Sieve (curved sieve)

- **Combigon** systems come standard equipped with Polygon™ automatic filter and are available with optional belt filter

<table>
<thead>
<tr>
<th>Model</th>
<th>Centrifugal Dryer</th>
<th>Capacity</th>
<th>w/ Polygon™ filter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combi-Line 1</td>
<td>TVE 1000 ED</td>
<td>&lt; 1,200 kg/hr</td>
<td>Combigon 1</td>
</tr>
<tr>
<td>Combi-Line 2</td>
<td>TVE 2000 ED</td>
<td>&lt; 2,500 kg/hr</td>
<td>Combigon 2</td>
</tr>
</tbody>
</table>
Tempered Water Systems
Opti-Series

- Our top of the line water system offering the optimum level of features:
  - Noise reduction of the centrifugal dryer
  - Pre-dewatering
  - Dryer with window and lights
  - Self-cleaning system for the centrifuge

- **Opti-Line™** systems available with optional Fines Removal Sieve (curved sieve)

- **Optigon™** systems come standard equipped with Polygon™ automatic filter and are available with optional belt filter

- Larger systems on request

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</thead>
<tbody>
<tr>
<td>Opti-Line 1</td>
<td>TVE 2004 SR</td>
<td>&lt; 1,200 kg/hr</td>
<td>Optigon 1</td>
</tr>
<tr>
<td>Opti-Line 2</td>
<td>TVE 2004 SR</td>
<td>&lt; 2,500 kg/hr</td>
<td>Optigon 2</td>
</tr>
<tr>
<td>Opti-Line 3</td>
<td>TVE 6002 SR</td>
<td>&lt; 5,000 kg/hr</td>
<td>Optigon 3</td>
</tr>
<tr>
<td>Opti-Line 4</td>
<td>TVE 6002 SR</td>
<td>&lt; 7,500 kg/hr</td>
<td>Optigon 4</td>
</tr>
<tr>
<td>Opti-Line 5</td>
<td>TVE 12000 SR</td>
<td>&lt; 15,000 kg/hr</td>
<td>Optigon 5</td>
</tr>
</tbody>
</table>
Polygon Water Filtration System
For use in Combigon and Optigon systems

- The BKG Polygon water filtration system is an automated, self-cleaning, tempered water system which minimizes operator intervention to help maximize productivity and reduces energy consumption in order to increase operating profit.
Why Polygon?

- Conventional UWP systems requiring fine filtration of the process water utilize a secondary filter (curved sieve) external to the water tank.
- The use of a secondary filter requires installation of a 2nd process water pump to move process water from the water tank to the top of the curved sieve and back to the tank.
Why Polygon?
Manual vs. Automatic Cleaning

<table>
<thead>
<tr>
<th>Conventional</th>
<th>Polygon</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Conventional Image" /></td>
<td><img src="image2" alt="Polygon Image" /></td>
</tr>
<tr>
<td>Frequent monitoring by the operator required</td>
<td>Automated monitoring and self-cleaning of</td>
</tr>
<tr>
<td>Manual scraping/cleaning of the curved sieve</td>
<td>the Polygon filter drum</td>
</tr>
<tr>
<td>Manual emptying of the collecting drawer</td>
<td>No operator intervention needed</td>
</tr>
<tr>
<td>150 micron filtration</td>
<td>70 micron filtration</td>
</tr>
</tbody>
</table>

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Why Polygon?
Energy savings

- The 2\textsuperscript{nd} process water pump contributes a considerable amount of energy consumption to the overall process.
- Alternatively, the Polygon water filtration system eliminates this pump, and only a small motor (for rotating the filter drum) and gravity facilitate the fine filtration of the process water.

![Pie chart showing energy consumption comparison between conventional and Polygon systems.](chart.png)

Based on 8000 hours – energy consumption per year of the water filtration process.
Tempered Water Systems
POLYGON water filtration system

cleaning nozzles

clean water side
dirt/fines water slide

ΔP

dirty water side

process water filter

dirt and fines
Tempered Water Systems
Dryer Series TVE – ED (non-insulated)

- Front and rear doors for easy access and cleaning
- Centrifuge screen available with quick clamp removal
- For Master-Line and Combi-Line / Combigon systems
Tempered Water Systems
Dryer Series TVE – SR (insulated)

- Sound insulation < 80 dba
- For Opti-Line / Optigon systems
Tempered Water Systems
Additional dryer options

- Pre-Dewatering
- Self Cleaning Device
- Pellet Diverter Valve
Tempered Water Systems
Fines Removal Sieve BS

Continuous water filtration system employing a separate, dedicated water pump

Fines removal sieve BS 700
Sieve cassette drawer
Curved filter screen
Innovations: CrystallCut®

Pelletizing and Crystallization of PET in one process step

- Viscosity between IV 0.4 – 0.9
- PET crystallized approx. 40% without additional use of energy
- Complete, continuous process
- Verifiable reduction in production costs
- Lower energy consumption
- Direct conveyance into the SSP possible
- The product is almost dust free
- No sticking together of the PET
- The bulk density is up to 8% higher
- Quick and easy start-up and change of product
Highlighted installations
Highlighted installations
Nordson BKG

Thank you for your attention!

David Bargery
Project Manager
david.bargery@nordson.com