GO DIGITAL!
AP Analytical Lab & Online Instrumentation dedicated to Spirits Industry

Thursday, 8th of October, 2015

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Product Manager Alcohol Technologies / Technical Manager
Anton Paar India Pvt. Ltd.
## Company Profile

| Establishment | 1922 |
| Owner | Charitable Santner Foundation |
| CEO | Dr. Friedrich Santner |
| Chairman of the Board | Ulrich Santner |
| Employees worldwide (*as of the end of 2014) | 941* in Graz 2.115* worldwide |
| Turnover 2014 | 228 million Euro |
| Exports | > 94 % |
| Investment in R&D | 19 % of annual turnover |
| Quality management | ISO 9001:2008 |
Company Presence

Anton Paar GmbH
4 producing subsidiaries
20 sales subsidiaries
80 sales partners
2 joint ventures
Anton Paar GmbH produces high-quality measuring and analysis instruments for industrial and research applications. In the fields of density and concentration measurement it is the established world leader. Throughout ninety successful years, the innovative spirit of Anton Paar’s employees and their commitment to quality has been the driving forces behind the company.

Openness to the requirements of customers and attention to developments in markets are the basis for new product ideas. Anton Paar’s strong R&D department and its partnerships with external research institutes turn these ideas into instrument sat the cutting edge of technology.

Anton Paar India Pvt. Ltd. is headquartered at Gurgaon - NCR Delhi. The sales and service centers are located in Mumbai, Kolkata, Chennai, Bangalore and Hyderabad and there are four application support centers in Gurgaon, Mumbai, Bangalore and Hyderabad.

Our team of more than 100 people all over India keeps us very close to our customers and ensures quick response times. Our customers benefit from the knowledge and experience of our factory-trained specialists.
Table of content

- Anton Paar – Company Details
- Alcolyzer Spirits ME (Alcohol Meter)
- DMA Generation M (Density and Concentration Meter)
- Snap50 (Portable Alcohol Meter)
- Online Slurry Monitor (L Dens & DPRn)
- Online Fermentation Monitor (DPRn)
- Online DDGS Monitoring (DPRn)
- Online Blending Monitor (L Dens)
- Online Alcohol Monitor -Draw Line & Final Bottling (L Dens)
Measure what is measurable

and make measurable that which is not.
Alcohol Determination in the Spirits Industry

- Distillation and density measurement
- Density and refractive index
- Density with applied obscuration factor
- Near infrared Analysis
Alcolyzer Spirits M/ME
Alcolyzer Spirits M/ME

- Accurate analysis of spirits, without need for distillation

- Whisky
- Cognac
- Brandy
- Vodka
- Gin
- Rum
- Tequila
- Country liquor
- ...

October 8, 2015
## Laboratory configuration:

- DMA Generation M
- Alcolyzer Spirits ME
  - With optional color measurement
- HazeQC ME (turbidity meter)
- pH ME Beverage
- Xsample 122 (Autosampler)
NIR – “Near Infrared”

Why using NIR?

Measuring the absorption of light at a very certain wavelength allows the selective determination of the Alcohol content of a sample.
Saving time means saving money

- No time-consuming distillation required any more.

- Direct alcohol analysis by Alcolyzer Spirits M / ME
### Specifications (1)

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range</td>
<td>0 to 90 %v/v (Specific IMFL range 35 to 65 % v/v)</td>
</tr>
<tr>
<td>Repeatability, standard deviation</td>
<td></td>
</tr>
<tr>
<td>Manual filling:</td>
<td>0.03 %v/v</td>
</tr>
<tr>
<td>Automatic filling:</td>
<td>0.01 %v/v</td>
</tr>
<tr>
<td>Repeatability, standard deviation</td>
<td></td>
</tr>
<tr>
<td>Manual filling:</td>
<td>0.03 %v/v</td>
</tr>
<tr>
<td>Automatic filling:</td>
<td>0.01 %v/v</td>
</tr>
<tr>
<td>Repeatability, standard deviation of optional devices</td>
<td></td>
</tr>
<tr>
<td>Color:</td>
<td>0.1 EBC (0.05 °ASBC)</td>
</tr>
<tr>
<td>Density:</td>
<td>0.000001 g/cm³ (DMA 4500 M) or 0.000001 g/cm³ (DMA 5000 M)</td>
</tr>
</tbody>
</table>
### Specifications (2)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample throughput</td>
<td>Approx. 15 samples per hour</td>
</tr>
<tr>
<td>Sample volume</td>
<td>Approx. 30 mL per measurement</td>
</tr>
<tr>
<td>Measuring time</td>
<td>Approx. 4 minutes</td>
</tr>
<tr>
<td>Interfaces</td>
<td>Ethernet (LAN), 4 x USB, RS-232, CAN bus</td>
</tr>
</tbody>
</table>
Comparison Alcolyzer Spirits M/ME – Distillation

- Number of samples: 60 cognac / brandies
- Reproducibility, 2 s.d.: ±0.1 %v/v
DMA Generation M

Density & Concentration Meters
Basic Information

- Density measurement of Liquids and Gases
  - Check and control production processes
  - Determine quality parameters and product qualities
  - **Determination of binary solutions such as distillates**
    - Determine product quantities

- High resolution, good repeatability & dynamic performance
## Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>DMA 4100 M</th>
<th>DMA 4500 M</th>
<th>DMA 5000 M</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Temp. Range</strong></td>
<td>0–95 °C</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Density Accuracy</strong> (Repeatability, s.d.)</td>
<td>0.0001 g/cm³ (0.00005 g/cm³)</td>
<td>0.00005 g/cm³ (0.00001 g/cm³)</td>
<td>0.000005 g/cm³ (0.000001 g/cm³)</td>
</tr>
<tr>
<td><strong>Temp. Accuracy</strong> (Repeatability, s.d.)</td>
<td>0.05 °C (0.02 °C)</td>
<td>0.03 °C (0.01 °C)</td>
<td>0.01 °C (0.001 °C)</td>
</tr>
</tbody>
</table>
Concentration Determination

- Based on density measurement
- Table: Density vs. known concentration

Very high reproducibility & repeatability over large concentration ranges
Extremely wide field of application
Easy to use & easy to adjust
## Concentration Determination

<table>
<thead>
<tr>
<th>Density Concentration</th>
<th>DMA 4100 M 0.0001 g/cm³</th>
<th>DMA 4500 M 0.00005 g/cm³</th>
<th>DMA 5000 M 0.000005 g/cm³</th>
</tr>
</thead>
<tbody>
<tr>
<td>HNO₃</td>
<td>0.07</td>
<td>0.035</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>H₃PO₄</td>
<td>0.06</td>
<td>0.03</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Ethanol</td>
<td><strong>0.05</strong></td>
<td><strong>0.025</strong></td>
<td><strong>&lt; 0.01</strong></td>
</tr>
<tr>
<td>NaOH</td>
<td>0.04</td>
<td>0.02</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Extract / Sugar</td>
<td>0.025</td>
<td>0.015</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>HCl</td>
<td>0.02</td>
<td>0.01</td>
<td>&lt; 0.01</td>
</tr>
</tbody>
</table>
Advantages of the Oscillating U-tube Technique

▸ **Measures true density**
  ▸ No influence of buoyancy in air
  ▸ No influence of gravity

▸ **Small amounts of sample**
  ▸ 1 mL
  ▸ Easy to control the temperature

▸ **Highest precision**
  ▸ No human influence

▸ **Extremely fast**
  ▸ 1 to 5 min per measurement
Snap 50

Portable Alcohol Meter
One for all

Snap 50

- Distillates in all strengths
- Samples from 0 °C to 40 °C
- 0.1 % v/v accuracy
- Clear results

Quick results
▸ Alcohol concentration checks for distillates throughout the whole production process

▸ Pure distillates, samples during dilution, or ready-to-drink spirits:

All is measured with one and the same instrument
Measurement directly out of the storage tank/cask

- No transfer of sample to a measuring glass necessary!
- 2 mL of sample are sucked into the measuring cell using the built-in hand pump
To fill a sample

Tube stays immersed in the sample
Snap 50 incorporates the well-proven oscillating U-tube principle to calculate the alcohol content.

The basis: density measurement

Relation between density and alcohol concentration % v/v

The higher the alcohol content, the lower the density!
No chance for errors

- Sample identification for perfect traceability of results
- Results are reported on a large digital display
- No recalculation necessary: Just read off the values, store them or send them to a PC!
Sample identification

- **Manually**: Storage of up to 100 sample IDs on the instrument possible

- **Automatically**: via RFID (Radio Frequency Identification)
Wireless communication: IrDA

- Wireless data exchange with a PC
  - Export of measured data (text or csv)
  - Import of ID list, firmware update, etc.
  - Backup of instrument settings

- Wireless data export to an IrDA printer
It’s worth it

▸ Snap 50 saves a lot of time and effort
▸ It replaces all your glass hydrometers
▸ Robust design (protection class IP54)
▸ Easy to clean
Low maintenance effort - Entire pump assembly can be easily replaced

Two easy exchangeable 1.5 V AA batteries

Battery lifetime > 100 hours

Energy saving mode for reduced power consumption is provided
Accessories and Main Specifications

FACTS & FIGURES
# Measuring units

<table>
<thead>
<tr>
<th>Measuring units</th>
<th>Measuring range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density [g/cm³, kg/m³, lb/gal]</td>
<td>Density</td>
</tr>
<tr>
<td></td>
<td>Density @ xx °C</td>
</tr>
<tr>
<td></td>
<td>Specific Gravity SG</td>
</tr>
<tr>
<td>Alcohol</td>
<td>Alcohol % v/v @ 20 °C</td>
</tr>
<tr>
<td></td>
<td>Alcohol % w/w</td>
</tr>
<tr>
<td></td>
<td>Alcohol US @ 15 °F (Proof)</td>
</tr>
<tr>
<td>Baumé</td>
<td>Baumé</td>
</tr>
<tr>
<td>Sugar</td>
<td>°Brix</td>
</tr>
<tr>
<td></td>
<td>Extract (°Plato)</td>
</tr>
</tbody>
</table>

Ten programmable custom functions
## Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range</td>
<td>Alcohol: 0 % v/v to 100 % v/v</td>
</tr>
<tr>
<td></td>
<td>Temperature: 0 °C to 40 °C (32 °F to 104 °F)</td>
</tr>
<tr>
<td>Accuracy</td>
<td>Alcohol: 0.1 % v/v</td>
</tr>
<tr>
<td></td>
<td>Temperature: 0.1 °C (0.2 °F)</td>
</tr>
<tr>
<td>Repeatability s.d.</td>
<td>Alcohol: 0.05 % v/v</td>
</tr>
<tr>
<td></td>
<td>Temperature: 0.05 °C (0.1 °F)</td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>-10 °C to +50 °C (14 °F to 122 °F)</td>
</tr>
<tr>
<td>Supported parameters</td>
<td>Density, alcohol concentration, sugar concentration, 10 additional</td>
</tr>
<tr>
<td></td>
<td>programmable parameters</td>
</tr>
</tbody>
</table>
AP Process Instrumentation dedicated for the Distillery & Blending Industries
Content

▸ Distillery- Production Process
  ▸ Slurry measurement
  ▸ Fermentation monitoring
  ▸ Alcohol measurement
  ▸ DDG Monitoring

▸ Summary
Example of an Ethanol Process (Grains)
Content

- Distillery- Production Process
  - Slurry measurement
  - Fermentation monitoring
  - Alcohol measurement
  - DDG Monitoring
- Summary
Measurement of slurry solids
Measurement of slurry solids

**Configuration**
- DPRn 4122 / L DENS 4X7
- mPDS 1100
Measurement of slurry solids

Benefit:

Higher alcohol content after fermentation

→ Higher production and throughput
→ Higher profit
Content

- Distillery- Production Process
  - Slurry measurement
  - Fermentation monitoring
  - Alcohol measurement
  - DDG Monitoring
- Summary
Fermentation Monitor

Only working when the start point is known !!!
Fermentation Monitor
Fermentation Monitor

The most common questions ethanol producers have during fermentation are:

- How much ethanol have we produced? ✓
- How much fermentable sugar remains? ✓
- Are we free of infection? ✓
- When has the fermentation process ended? ✓
- Can we improve our yields? ✓
Content

- Market
- Distillery - Production Process
  - Slurry measurement
  - Fermentation monitoring
  - Alcohol measurement
  - DDG Monitoring
- Summary
Alcohol measurement
Alcohol measurement

Stripper Column → 96% Ethanol Condenser → Distillation → 96% Ethanol storage

~100% Ethanol Condenser → Molecular sieves → ~100% Ethanol storage

Product cooler
Alcohol measurement

Configurations:

L-Dens 427T Ex
L-Dens 427E Ex + mPDS 1100

Accuracy/repeatability alcohol

±0.06 / ±0.02% w/w (90-100%)
Alcohol measurement

Benefit – Target 99.5%:

Before AP process measurement:
Alcohol conc. 99.65 %

With AP process measurement:
Alcohol conc. 99.55 %

Price of Ethanol: 45 INR/ Liters

Production capacity: 31,200,000 Lit/y (@ 100KL / Day)

Savings: 31,200 Liters per year
Ethanol
= 14 Lakhs per year
Content

- Market
- Distillery - Production Process
  - Slurry measurement
  - Fermentation monitoring
  - Alcohol measurement
  - DDG Monitoring
- Summary
DDG dried distillers grain

Grain Receiving → Grain Storage → Hammer Mill

110-125°C, 15 min → Cook/Sterilizer

85-90°C, 45 min → Liquefaction Tanks

Ethanol Fermentation → Distillation

103-115°C → Molecular Sieve

Carbon Dioxide (CO₂)

Fuel Ethanol Storage

Denaturant

Thin Stillage (8% Solids)

Wet Distillers Grains (30% solids)

Drain Drying

Wet Distillers Grains (30% solids)

Dried Distillers Grains (50% Solids)

Condensed Dried Solubles (35% Solids)

Evaporator System → Syrup Tank
Measurement of slurry solids

**Benefit:**

Measurement of syrup solids to control flow rate in the evaporator

→ evaporation at most efficient level

**Configuration**

- DPRn 4122
- mPDS 1100

Flow rate

Syrup concentration
Content

- Market
- Distillery - Production Process
  - Slurry measurement
  - Fermentation monitoring
  - Alcohol measurement
  - DDG Monitoring
- Summary
The ROI of a Anton Paar process measurement are few month.

- Improved efficiency of the fermentation process
- Improved profitability of the distillation
- End products close to specification limits
- Traceable documentation
AP Process Instrumentation
Alcohol Blending Industry

Contents
Alcohol (Blends) Production Process
Incoming Alcohol measurement
Blend Monitor
Alcohol Monitor (Service Tank - Bottling)
Unloading - Alcohol Conc measurement

- Measurement of Alcohol Conc.
  - Alcohol (%v/v, %w/w, Ref temp)
  - Density (Ref temp)
  - Temp

- L dens.
- mPDS 5

Blending Tank

PLC/DCS (2)
Unloading - Alcohol Conc measurement

- Benefits

- Accurate alcohol measurement - Any desired Unit
- Real-time data of each truck
- Yield Control
- Lean Phase detection
- Raw Material Integrity assured
**Blend Monitor**

- Measurement at Blending tank (Mobile Online system)

- **L dens.**
- **mPDS 5**

- Alcohol (%v/v, %w/w, Ref temp)
- Density (Ref temp)
- Temp

Blending Tank

PLC/DCS (2)

Service Tank
Benefits

- Accurate alcohol measurement - Any desired Unit
- Real-time data
- Quick Blending (Time savings)
- Product Integrity assured
Final Product - Alcohol Conc measurement

- Measurement between Service tank and Filler
  - Alcohol conc measurement.
  - L dens.
  - mPDS 5

- Alcohol (%v/v, %w/w, Ref temp)
- Density (Ref temp)
- Temp

Service/Buffer Tank

PLC/DCS (2)
Benefits

- Quality assurance
- Accurate alcohol measurement - Any desired Unit
- Real-time data
- Lean product identification
- Product Integrity assured
Great People – Great Instruments
THANK YOU FOR YOUR ATTENTION!