Aspects of beer-mix beverage product & quality control in turn-key projects

Jean-Jacques MOSER
Company profile
First Aspect : Process flexibility
Second Aspect: Quality Control
Third Aspect : Traceability
The stakes in the Industry

- The World is changing: the Industry must follow it
  - New markets with local and global needs
  - New regulation constraints, food safety, quality, standardisation
  - Packaging weight, & waste reduction
  - Healthy and natural ingredients

- How can we Reduce the Energy, CO₂ and Water consumption footprints?

- How can we Improve all these Performances?
- How can we better produce, measure, track and trace?
Our answer for this complex reality

- **VINCI Energies**, a segment of **VINCI GROUP**, has developed a brand 100% dedicated to industry.

- A global vision:
  - Design
  - Build
  - Maintain

- Process & Control Automation
- Electrical & Instrumentation
- Mechanical & Piping
- Process Utilities

EBC Beer Mix, Vienna sept 2014
ACTEMIUM worldwide Network

- 300 Business Units
- 35 Countries
- 19,000 Engineers & technicians
- 2 Billion € turnover
For the Beverage Industries
One Strategy
One dedicated Team

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At the heart of industrial performance

Advanced process solutions:
- Process solutions
- Quality & control solutions

Advanced automation solutions:
- Production efficiency
- Plant intelligence
- Energy efficiency
- Production operability
Pioneers since 25 Years in alcopops!

Since 25 Years our Experts are validating and integrating advanced technologies for measuring, dosing controlling
- In Collaboration with the Instrumentation supplier.

Advanced process and automation solutions:
- Syrop rooms
- Blendings Stations
- Deaerating station
- Carbonating
- Inline Quality & control solutions
- track and tracing

FOR YOUR FOOD SAFETY

Some references
- AB-Inbev
- Carlsberg
- Heineken: Desperado
- Palm:Smirnoff
Our answers to the New age in the Beverage Industry

- Healthyness
- Wellness
- Naturalness
- Freshness
- Tasty
What do i need to mix for my new Beermix?

An accurate mix and measuring solution for:

- Beer
- Water
- Sugar
- Sweeteners
- Liquid glutenfree malt extracts
- Colours
- Flavours, natural
- Natural extracts
- Stabilisers
- Texturisers

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2. In-line multistream mixing
First Aspect : PROCESS
How can I integrate a Beermix process in my existing brewery and produce faster?
Different Concepts

- 1. Classical **batch** dosing process
- 2. **In-line** mixing
- 3. New **Aseptic in-line** mixing
- 4. New Aseptic carbonation

*With advanced process & automation, Quality control & Traceability solutions*
1. Classical Batch dosing

1. HG Beer
2. Filter
3. Bright Beer storage
4. Bright Beer storage
5. ISO α
6. Mixing
7. Beer Mix Storage
8. Beer Mix Storage
9. Filling line

Batch Mixer
7 components
- Water
- Sirup
- Color
- Juice
- Citric Acid
- CO₂

Beer Mix
- 600 hL
- Bright Beer Tank 2
- Beer Mix
- 750 hL
- Glass bottles
1. Figures: Batch dosing process

- **Products:**
  - Radler
  - Beermix "classical"

- **Advantages:**
  - Proven method

- **Disadvantages:**
  - Large volumes
  - Important CIP time
  - Need for intermediate storage
  - Limits of carbonation:
    - 4° - 1 bar : CO$_2$ 5.5 g/L
    - 2° - 1 bar : CO$_2$ 6 g/L
  - Constant flow rate
2. In-line mixing

1. HG Beer
2. ISO α
3. Filter
4. CO²
5. In-line carbonation loop & mixing
6. Beer Mix
7. Inline Quality control
8. Filling line

Bright Beer storage

Bright Beer Tank Pils

Glass bottles
2. Classical In-line mixing

**Products:**
- Radler
- Beermix
- Softdrinks

**Advantages:**
- High CO$_2$ efficiency
- CO$_2$ up to 10g/L
- Carbonating despite of variable flow rate
- **Carbonating and Mixing directly before the filler without any intermediate storage Tank**
- Easy to clean
- Time reduction during product and packaging changes

**Disadvantages:**
- Hygienic but not aseptic products compatible

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2. New Carbonation loop vs Classical Carbonation!

**Benefits:**

- **CO₂ efficiency > 0.9**
- No losses of CO₂
- Flow proportional injection

- Thermal energy consumption reduced: product can be less cooled down
- No tank so it can be handled as a simple pipe:
  - CIP time and rinse volumes reduced
  - Reduction of Time for format/ products changes
  - Reduction of products losses
  - Full integration into the production operators system
  - A perfect mix of the dosed components thanks to the pump
- **Perfectly dissolved** gas in the liquid and finished
- **Product stability** up to 10G/L visually, no foaming appearance in product

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2. Principle of New Carbonation loop

1. INLET of the loop

2. Carbonation at the level of the carbonator

3. Pressure Increased through the pump in order to get an homogeneous and perfectly linked liquid/gas mix

4. Pressure Decrease at the outlet through a patented piece to be able to fill the product

5. Recirculating of a part of the product to get a constant flow rate at the level of CO₂ injection

6. Final Carbonated product directly to the filler

No buffer tank before the filler necessary

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3. In-line mixing: aseptic

1. Bright Beer

2. Bright Beer storage

3. In-line Mixing

4. Homogenization

5. Inline aseptic carbonation

6. Beer Mix

7. Inline Quality control

8. Filling line

- Glass bottles
- PET bottles

- Water
- Sirup
- Color
- Juice
- Citric Acid

BBT Pils

Heat Exchanger
3. Hygienic Aseptic Carbonation Loop

**Hygienic carbonation loop:**
- Developed according to the EHEDG design rules: self-draining, no retention zone
- CIP: 90° C max

**Ultraclean/aseptic carbonation loop:**
- Developed according to the EHEDG design rules with additional features due to the constraints linked to sensitive products:
  - Maximum of orbital welding
  - Steam barriers on mechanical gaskets
  - CO₂ filtration
  - CIP and SIP: 120° C max

*Ultraclean Carbonation Loop 50000 l/h for the "Européenne d'Embouteillage" (ORANGINA-SCHWEPPES)
In partnership with SIDEL*
3. In-line mixing : aseptic

**Products:**
- Radler
- Beermix
- Softdrinks *with or without food preservatives*

**Advantages:**
- Aseptic products
- PET or glass lines with the same equipment

**Benefits:**
- High CO₂ efficiency
- up to 10g/L CO₂
- Suits Variable flow rates
- *No intermediate buffer necessary : Mixing directly before the filler*
- Easy to clean
- Time reduction during product and packaging changes
Second aspect: QUALITY CONTROL

What should we measure? New technologies?
The new „multi components drinks“

- beermix
- energy drinks
- wellness-drinks
- ice teas
- light / zero drinks
- near water

Ingredients: **base materials**, +

different sweeteners as aspertame, acesulfame, saccharin, acidifier, vitamins, (natural) colourings, caffeine, taurine, tea, coffee essences …
How can we measure these new ingredients?
Non-specific Parameter
- Density
- Brix
- Alcohol
- OWC

Specific Parameter
- Aspertame
- Acesulfame
- Saccharine
- Caffeine
- Vitamin C
- etc.

Density +IR measurement

HPLC measurement system
Ex. Analytics Inline in Process

Non-specific Parameter
- Density
- Brix
- OWC
- Alcohol

Specific Parameter
- Aspertame
- Acesulfame
- Saccharine
- Caffeine
- Vitamin C
- etc.

DAUSCH Technologies-Inline LIQUIGUARD 200
Additives require a selective technology!

Conventional measurement technology delivers only **Sum** parameters and are limited to the basic parameters eg: OWC/BRIX/ALCOHOL

Problem:
with the new innovative mix beverages Additive parameters cannot be identified

**SOLUTION**
LIQUIGUARD* offers **molecular information** about the **chemical** structure of the beverage

* LIQUIGUARD is a product of
Inline Spectroscopie : LIQUIGARD safeguarding and increasing product quality

increasing the efficiency of beverage plants
LIQUIGUARD – How it works
information about the beverage in the ABSORPTION SPECTRUM
### Light beverage Specific vs. non-specific measuring principles

<table>
<thead>
<tr>
<th>Example Light/Zero beverage</th>
<th>Conventional measurement technique for brix, density, conductance value</th>
<th>LIQUIGUARD 200i</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total acid</td>
<td>No !</td>
<td>Yes</td>
</tr>
<tr>
<td>Caffeine</td>
<td>No !</td>
<td>Yes</td>
</tr>
<tr>
<td>Aspartame</td>
<td>No !</td>
<td>Yes</td>
</tr>
<tr>
<td>Acesulfame</td>
<td>No !</td>
<td>Yes</td>
</tr>
<tr>
<td>Saccharine</td>
<td>No !</td>
<td>Yes</td>
</tr>
<tr>
<td>Natural sweetener : stevia</td>
<td>No !</td>
<td>Yes</td>
</tr>
<tr>
<td>Recipe control</td>
<td>No !</td>
<td>Yes</td>
</tr>
<tr>
<td>Vitamin C, B1, B2, B6, B12</td>
<td>No !</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Electromagnetical Spectrum

UV/VIS

NIR

MIR/Raman

Fluorescence

10 200 400

Fluorescence

800 2500 25000 [nm]

UV

NIR

IR

Raman
VIS- and NIR-Spectroscopie

Colour turbidity, kolloidale Structure!!!
# Beer Specific measuring via Spectroscopy

<table>
<thead>
<tr>
<th>Example Beermix drink</th>
<th>conventional measurement technique</th>
<th>LIQUIGUARD 200i</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brix</td>
<td>Yes !</td>
<td>No</td>
</tr>
<tr>
<td>- NADH, NAD, NAD(P)H, FMN, Tryptophan/Tyrosin, Vitamin B₂</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Iso-Amino-Acid</td>
<td>No !</td>
<td>Yes</td>
</tr>
<tr>
<td>Color, Haze Turbidity</td>
<td>Yes !</td>
<td>Yes</td>
</tr>
<tr>
<td>Alcohol</td>
<td>Yes !</td>
<td>Yes</td>
</tr>
<tr>
<td>Recipe control</td>
<td>No !</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Measuring and optimisation parameters

- Cleaning validation
- CIP-parameter
- Product change Optimization
- Flavour carry over
- Extended colour Control of deviations in product water
- etc.
Benefit 1: Quality increasement

Spectroscopic inline-process analysis can detect the following errors:

- Are single components contained in the beverage?
- Is the right concentration of the single components provided?
- Is the right quality of the single components provided?

To sum this up:

- Is my mixing process correct?
- Has my staff done everything right?
- Have I got the right raw materials?
Every 7 sec. LIQUIGUARD determines the following measuring parameters (example)

<table>
<thead>
<tr>
<th>Sirop 1 (S1)</th>
<th>Existent ?</th>
<th>Concentration</th>
<th>Quality?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sirop 2 (S2)</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Edulcorant (E)</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Aroma 1 (A1)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Aroma 2 (A2)</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>ISO α (ISO)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Total acid</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Global parameter</td>
<td>Recipe control Ex: Not ok</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>
Benefit 1.1: Inline monitoring of sweeteners

Inline process data

Ups and downs of sweetener acesulfame, 150 mg/l = 100%
Benefit 1.2: Inline monitoring of total acid

Inline process data

Up and down of total acid
2.75 g/l to 2.9 g/l
Benefit 1.3: Inline monitoring of "recipe control" the PRODUCT FINGER PRINT

- Upper alarm limit "recipe control"
- Spectrum of beverage drink
- Lower alarm limit "recipe control"
Benefit 1: Quality increasement

Bottler’s point of view:
By means of LIQUIGUARD bottlers can minimize the risk of losing consumers’ confidence (BRAND PROTECTION).

Consumer’s point of view:
The consumer can be more sure of a steady quality of the beverage (taste, colour, chemical composition, viscosity, morphology).
Benefit 2: "New" process information

Only those who know the "new" process information can optimize the process more efficiently!
Benefit 2.1: Optimization product change (start-up)
Example 1: more product in the market, less on waste

This phase should be optimized.

Start-up operation.

LIQUIGUARD measuring parameter „recipe control“ shows from this point onwards that the product can be marketed.
Benefit 2.2: Time saving during „line start“

Example 2:

With LIQUIGUARD there is no need to wait for the lab confirmation by the „start up“!

- Higher efficiency of the bottling line
- Optimization CIP-procedures
- Optimization Cleaning validation
- etc.
Benefit 2: „New“ process information

Those who have the „new“ process information can optimize processes a lot more efficiently!

Process optimization in order to save
- time
- raw material
- energy.
THIRD ASPECT: How and why Track and Trace?
Introduction Tracking & Tracing

- Where is that container with special ingredients?
- How do we find the products which are produced with that component?
- What is the assurance that I have dosed the correct material?

- These questions can be answered by using adequate tracking & tracing.
More than Food Safety

- Tracking & tracing is not only related to food safety
- Material flows within manufacturing process (supply chain)
- Improved quality when using accurate material information
- Improved efficiency and reducing material waste
Tracking versus Tracing

- **Tracking** concerns the **logging** of material information in real-time, for example material **location**.

- **Tracing** on the other hand concerns the **retrieval of this logged material information**.

- The dependency between both is obvious, without tracking there’s nothing to trace.
Internal versus External T&T

- **Internal tracking & tracing**
  - Concerns all tracking and tracing requirements within a manufacturing facility
  - Focused on material transformations.

- **External tracking & tracing**
  - Concerns the supply chain as a whole.
  - Focused on material movements.
Business drivers

Better → Service to Customers
Faster → Production
Cheaper → Lowest Manufacturing Costs
In Compliance → Regulatory Guidelines
Most manufacturers introduce a tracking and tracing system to meet legislation in order to tackle legal responsibility towards their customers.

On the other hand, manufacturers' quality programs and customer requirements urge for a tracking and tracing system.

The benefit of implementing a tracking and tracing system is underrated.

From a regulatory compliance perspective, the investment is treated as costs instead of a benefit.

Implementing could give room to opportunities to be more cost effective in the overall manufacturing operations.
Costs versus Opportunities

Costs:
- Regulatory Compliance
- Limit Liability
- Internal Quality Programs
- Fulfill Customer Requirements

Opportunities:
- Increase Cost Visibility
- Reduce Costs in Supply Chain
- Optimize Manufacturing Process
- Increase Market Share
Detail of Tracking

- General traceability requirements imposed by legislation are:
  - The ability to identify direct suppliers and consumers
  - The ability to relate supplier and product
  - The ability to relate consumer and product
When the decision is made to implement a tracking and tracing system, the question arise **what level of information should be tracked in order to meet the traceability requirements.**

On some points this is **prescribed by legislation and may differ per industry.**

For example pharmaceutical companies (regulated industries) must deliver high density information instead of general food companies (non regulated industries) which may deliver a lower density.

Nowadays there’s a **tendency that the high demands in the pharmaceutical industries are copied to non-regulated industries.**
European legislation categories

- Category 1 - Must be set available to local authorities and includes:
  - Name and address of the supplier and the
  - delivered and consumed products.
  - Date of the transaction of the delivered or consumed materials or products

- Category 2 - Is recommend to set available to local authorities and includes:
  - Volume or quantity
  - Order or batch numbers
  - Detailed description of the materials or products
Tracking & Tracing data

- Reaction / response times
  - Category 1 – Data must be **directly available**
  - Category 2 – No fixed response time **but 4 hours per chain is generally accepted**

- Keeping the data
  - Data should be kept shelf life expiration plus 6 months
  - When NO shelf life expiration data should be kept for 5 years
Traceability information:

- Process Modelling

Inbound

Processing

Outbound

- Storage Location
- Lot
- Relation

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In general three basic processes can be distinguished. The first process is inbound which concerns activities like registration of incoming goods, storing them and performing quality checks.

Typical for inbound is the usage of storage locations.

The second process is processing which concerns activities like retrieving goods from inbound and transforming them into (semi) finished goods which are offered to outbound. In processing complex tracking and tracing issues can be found as materials are split, mixed, combined and used on various locations in the production process.

Three types of production processes can be distinguished, batch, continuous and discrete, each with their own tracking and tracing requirements.

Finally outbound concerns activities like preparing for shipment, sending goods to customers or distribution centers (DC). Typical for outbound is the usage of storage locations.

In a full tracing scenario not only material information should be tracked but also context information like current order or batch number. This ensures a working genealogy tree for a specific product or material, which can be visualized in reports and accessed at any time.
Backwards Tracing / working tree
Forward Tracing
Tracking & Tracing techniques

- **Techniques**
  - When tracking materials, data must be logged and historized.
  - This registration could be performed manually and even for simple tracking requirements this will be suitable. However as there’s an increase of data to be tracked an automated system is the most efficient tool to support this.
  - Normally materials are tagged or labeled depending on the technique used.
  - Common techniques are barcode and radio frequency identification (RFID).
  - This way each item, the material lot, will be unique identifiable further on and additional data can be added during the lifetime of the material lot.
Tracking & Tracing techniques

- Using the appropriate readers, for example **barcode scanner**, the materials data can be retrieved at any time.

  **Retrieval** is done by querying the tracking and tracing database in which all data is stored. Besides storing and requesting data, the data can also be used in combination of business logic derived from the business processes.

  For example **an operator has to scan a material before dosing** in order to verify the operator is going to dose the correct material and register the material dosage itself.
Example of dosing and tracking in 4 steps

STEP1 and 2

we have powder dosing
When a batch is started a product list with all the needed powders and liquids appears on a Panel. When the product is scanned with a barcode scanner quantity appears and the product must be weighed.
Step 3: IBC dosing

IBC containers need to be scanned with their position.

Step 4 Sugar dosing

The program selects the necessary products and doses the necessary quantity using the downloaded recipe.
Resume: Tracking & Tracing techniques

- **Logging and historisation**
  - Manually for simple tracking requirements
  - Automated system for increased tracked data – more efficient

- **Product identification**
  - Barcode identification
  - Radio frequency identification RFID

- **Readers**
  - Using readers to retrieve material data
  - Using readers in the process to ensure correct materials
Actemium is always a step ahead!

- Our Experts are **validating and integrating**
- advanced technologies for measuring, dosing controlling

- Quality control, track and tracing
- FOR YOUR FOOD SAFETY

- We have special partnerships with a lot of Manufacturers and suppliers for instruments dedicated to the beverage industry for, components, machinery

- Actemium is Proleit and Siemens certified for software deployment
Many thanks for your attention

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