Circular Water Treatment Technologies
The industrial approach

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Kurita Europe GmbH
1. Kurita Eco Journey
2. Challenges in Industrial Water Treatment
3. Steps to Circular Water Treatment Products
Kurita Eco Journey
Realize sustainable energy use

- **Reducing** Kurita’s *in-house* energy consumption
- **Optimize** energy use at Kurita’s *customers’* plants

<table>
<thead>
<tr>
<th>Metrics</th>
<th>Long Term Targets</th>
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</thead>
<tbody>
<tr>
<td>FY 2031</td>
<td>FY 2051</td>
</tr>
<tr>
<td>Scope 1 and 2 emissions reduction</td>
<td>27,5 %</td>
</tr>
<tr>
<td>(Reduction rate from FY2020)</td>
<td></td>
</tr>
<tr>
<td>Scope 3 emissions reduction</td>
<td>27,5 %</td>
</tr>
<tr>
<td>(Reduction rate from FY2020)</td>
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</tbody>
</table>
Realize sustainable energy use

CO₂ emissions reduction at customers through proposals of Kurita

Reduction in fuel use by improving heat efficiency in boiler and cooling water treatment.

Savings by adopting inverters in water treatment facilities.
Creating Shared Value

The Kurita Group defines:

**Products, technologies or business models** that make **significant contributions to water-savings, CO₂ emissions reduction and waste reduction** compared with previous levels as "CSV businesses."
Spreading energy-creating technologies

Cetamine® Savings Calculator

Calculate the savings you can get in your own system applying Cetamine

<table>
<thead>
<tr>
<th>Boiler pressure</th>
<th>20 bar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steam production</td>
<td>50.0 m³/h</td>
</tr>
<tr>
<td>Make-up water</td>
<td>10.0 m³/h</td>
</tr>
<tr>
<td>Condensate return</td>
<td>90.0 %</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fuel Cost</th>
<th>2.50 €/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Cost</td>
<td>0.047 €/kWh</td>
</tr>
</tbody>
</table>

| CO₂ Allowance Price in EU ETS | 98.00 €/ton |

Annual water savings

| 53.125 €/year | 21.250 m³/year |

Annual energy savings

| 277.363 €/year | 5.899.205 kWh/year |

Annual savings for water & energy

| 330.388 €/year |

Reduction of CO₂

| $1.770 t/year | 173.437 €/year |

Assumptions:
- Operating hours: 8500 h/a
- System efficiency: 85%
- Make-up water temperature: 20°C
- Air, fuel calorific value: 5.3 kg CO₂/kWh

This calculator can be applied to boilers up to 40 bars.
The calculations are based on 30% blow-down reduction referring to Kurita's approved experience.
Corporate (CCF) & Product Carbon Footprint (PCF)

Scope 1
Direct emissions
(i.e. generated in own facilities)

Scope 2
Indirect emissions
(i.e. purchased energy)

Scope 3
Other indirect emissions in the upstream and downstream value chain (> 90 %)
Driver of total emission is Scope 3

Biobased Products can reduce raw material CO$_2$ footprint
Challenges in Industrial Water Treatment
Industrial Cooling Water Principles

• Drinking water only for human consumption
• Use water according to its quality / Make water usable for intended use
• E.g. Boiler water after use still suitable for applications with lower quality demand
• Reuse Water / Blow Down - CTBR
Cooling System Conditions

- Water Quality
- Suspended Solids
- Bacteria
- Legionella
- Airborne contamination
- Concentration effect – coc
- Holding Time Index
- Temp
- …
- …
Cooling System Conditions

• Water Quality
• Suspended Solids
• Bacteria
• Legionella
• Airborne contamination
• Concentration effect – coc
• Holding Time Index
• Temp
• ...
• ...
Circular Cooling System

A “circular” application

Evaporation

Air

Make Up water

Blowdown

System Parameters

RR = Recirculation

MU = Make-up

BD = Blowdown

E = Evaporation
Increased Salt Concentration due to Evaporation

- Only pure water ($H_2O$) can evaporate
- Evaporation causes the cooling effect
- Evaporation causes a concentration of salts

### Concentration Effect

\[
Coc = \frac{MU}{BD} \quad (m^3/h)
\]
Holding Time Index

Proportional to the rise of the cycles of concentration

- ~ 1 week
- ~ 5 days
- ~ 2.5 days

The holding time index rises and so does the need for more stable products.
Cooling System Conditions

- Water Quality
- Suspended Solids
- **Bacteria**
- **Legionella**
- Airborne contamination
- **Concentration effect – coc**
- **Holding Time Index**
- Temp
- ...
- ...

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The growth of microorganisms depends on:

- Water / humidity
- Nutrients (water, materials, air)
- Temperature (psychotrophic, mesophilic, thermophilic)
- pH value
- Time (stagnation / flow / surface)
Microbiologic categories

**ALGAE**
Sources: freshwater
Characteristics: grow in sunny places like cooling tower, open water basins

**MOLD + FUNGI**
Source: air, water, soil, wood, additives
Characteristics: most grow at acidic pH’s, form spores, degrade cellulose

**BIOFILM**
Sources: initiated from slime-forming bacteria such as Pseudomonas aer.
Characteristics: Natural habitat of microorganisms

**BACTERIA**
Sources: all over in nature
Characteristic grow: Aerobic - require O₂, Anaerobic - without O₂, Facultative - both aerobic & anaerobic environments
Steps to Circular Water Treatment Products
R&D bases to create innovations

- Environmentally conscious R&D fundamentals
- Spread of energy-creating technologies
- Biobased Polymers at the Kurita Europe Technology Center (KETC)

KURITA INNOVATION HUB
- Established in 2022 in Akishima, Tokyo, Japan
- The Technical Education Center (TEC) includes the exhibition area and training facilities
- The Technology Innovation Center (TIC) includes R&D facilities and joint research with stakeholders

KURITA EUROPE TECHNOLOGY CENTER
- Established in 2021 in Viersen, Germany
- Cutting-edge research and development facilities
- Equipped with an employee training center and a visitor center for introducing customers and business partners to R&D efforts.
Biodegradable Products

Circular Water Treatment Products

Biodegradable  Biobased

Fit to meet the application demands
Biodegradable Products

OECD 301 Ready biodegradability

- DOC Method
- Diluted product sample + bacteria suspension
- 70% removal in a 10 days window
- within the 28 days test period
Biodegradable Products

- Need to protect products during use
- When released to environment no protection → biodegradation
Corrsave® 100 Technology

- The new standard in CW Treatment
- Environmentally friendly & active corrosion inhibition
- Low Phosphate - contribution to comply with stricter limits
- Readily biodegradable
- Reduction of corrosion and pitting
- Synergistic effect with Zn / phosphonate treatment
Biodegradable Products

Circular Water Treatment Products

Biodegradable

Biobased

Fit to meet the application demands
Biobased Dispersant for organic matter

contains Natural Oils (Orange sweet)
→ Aquatox H 412

Readily biodegradable (OECD Methode)
Biobased Products

- Not automatically environmentally friendly
- Low ecotox
- No Food

**Aquatox** = environment Fish, Algae, ...

- 48 h, 72 h, 96 h
Summary

- **Cooling** System HTI – typically > 1 week

- **Biodegradability** → bacteria

- Effect test time **10/28 days**

- **Aquatox** = environment Fish, Algae, Effect test time **2-4 days**
Biobased Products

Profile

**BIODEGRADABLE**

- Preferably natural non food or food waste
- Availability

**PERFORMANCE**

- Comparable performance level to currently used products
- Stable (protectable) performance in the application
Biobased Products

Profile

BIOBASED
ANTISCALANTS

Biobased Aquatox

BIOBASED

Preferably natural non food or food waste

Availability

AQUATOX

Low Aquatox:
- Fish
- Algae
- Bacteria
# Next Generations Biobased Scale Inhibitors

## Hybrid Polymers (some already commercially available)

- Combination of **fossil** based raw material (polyacrylic) with renewal / **natural** raw materials (starch)
  - Flocculants
  - Cleaning & detergents
  - …

- Possible adaption for water treatment applications
Next Generations Biobased Scale Inhibitors

Bio Polymers (non food)

- Screening
  - Based on algaeas
  - Based on pectins
Biobased Products – Next steps

**Bio Polymers** (non food)

- Biodegradation
- Aquatox

**Step Two**

- Modifications
- Performance

**Step Three**

- Production facilities
- REACH
- .....
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