Kemira – focus on water quality and quantity management

Tarmo Siir
Kemivesi AS, Member of Board
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Water is the connection
Kemira at a glance

- Kemira is a global, over two billion euro water chemistry company serving customers in water-intensive industries.

- Kemira offers water quality and quantity management improving its customers’ energy, water, and raw material efficiency.

- Headquartered in Helsinki, Finland.

- Kemira is present in 40 countries, with around 5,000 employees and 71 sites.

Offering

- Tailored chemistry
- Monitoring, control and dosing support

Key capabilities

- Customer intimacy and service
- Application expertise and support
- Water chemistry technology
- Production and logistics efficiency
Our mission

Our mission is the efficient use and reuse of water.

Our vision is to be the leading water chemistry company.

We offer smart and sustainable solutions for water quality and quantity management.
Four values guide our work

We are dedicated to customer success

We care for people and the environment

We drive performance and innovation

We succeed together
Business segments and revenue breakdown (12/2012)

**Paper**
Offers chemical products and integrated systems that help customers in the pulp and paper industry.

**Municipal & Industrial**
Offers water treatment chemicals for municipalities and industrial customers.

**ChemSolutions**
Offers chemical products to the feed and chemical industries.

**Oil & Mining**
Offers a large selection of innovative chemical extraction and process solutions for the oil and mining industries.
Research and Development

• The driving force behind our R&D is to improve profitability and sustainability.

• Four research and development centers in Espoo (Finland), Atlanta (USA), Shanghai (China) and São Paulo (Brazil).

• 350 employed water chemistry experts

• Our R&D expenses in 2012 were EUR 38.1 million.
Kemira in the municipal water process

**Mexico City**
The largest potable water treatment facility in Mexico uses Kemira’s extremely pure aluminum coagulant in the treatment of potable water for the Mexico City metropolitan area. Reliable supply of chemicals has strategic importance to guarantee water for millions of users.

**Los Angeles**
Kemira’s iron based chemistry has prevented corrosion and controlled unpleasant odors in the complex sewage system of Los Angeles since the 1980’s. This application also improves the process efficiency at the wastewater treatment plants in the LA region.

**Sao Paolo State**
The wastewater treatment process at Valinhos, Sao Paolo, uses iron coagulants to improve the quality of treated wastewater. Chemically enhanced primary treatment (CEPT) is preferred as a sustainable and cost efficient solution.

**Stockholm**
The carbon-containing organic matter in wastewater sludge is digested in an anaerobic process where biogas, mainly methane, is produced. After digestion the sludge is hygienized and dewatered in the Kemira Kemicond process making it safe to use in agriculture.
“...during the rainy season when our consumption is extremely high, Kemira has always supplied us the needed amounts of high quality alum for our plant.”

Francisco Velasco Islas, Director General, CAPAMA, Acapulco, Mexico
“We now have much greater flexibility in the biogas process, as it is far less sensitive to changes and possible upsets.”

Marcus Möller, process engineer, NSR, Helsingborg, Sweden
“The state of California knows what it takes to manage its water sustainability programs. Projects for water reuse and cost-efficient wastewater management are areas where we can work closely together.”

Roderick Abinet, Applications Manager, Kemira M&I North America
Applications
Dedicated to smart and sustainable water management

Water is the connection
# Applications

Dedicated to smart and sustainable water management

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<td>Membrane applications</td>
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<td>Scale control -&gt; to sludge &amp; biogas</td>
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* Application offering may vary by market and region.

** H₂SGuard, DesinFix and KemiCond are trademarks or registered trademarks of Kemira Oyj or its subsidiaries.
# Product lines

Dedicated to smart and sustainable water management

## Inorganic coagulants
- Aluminum sulfates (ALS, ALG, ALK, AVR, AVK, AVL)
- Polyaluminum sulfates (PAS, PASS)
- Aluminum chlorides (ACL)
- Polyaluminum chlorides (PAX, ACH)
- Sodium aluminates (SAX)
- Iron sulfates (PIX, FERIX)
- Iron chlorides (PIX, BDP)

## Organic polymers and coagulants
- Anionic polyacrylamides (Superfloc)
- Non Iionic polyacrylamides (Superfloc)
- Cationic polyacrylamides (Superfloc)
- Cationic polyamines (Superfloc)
- Cationic polyDADMACs (Superfloc)

## Specialty chemicals
- Antiscalants (KemGuard)
- Biocides (Fennocide, Fennosan)
- Defoamers (Bevaloid, Callaway)
- Dispersants (KemGuard, KemSper)
- Disinfection chemicals (DesinFix)
- Odor control chemicals (H₂SGuard, OCC)
- pH adjustment chemicals
- Sugar industry chemicals (KemTalo)
- Carbon source chemicals (KemCarbo)
- Boiling & cooling water chemicals
- Cleaning chemicals (Fennopur, KemClear)
- Corrosion inhibitors (KemCorr)

* Product offering may vary by market and region.

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Raw water treatment
Safe potable water from lakes, rivers, reservoirs and by desalination

Intro
Surface water is known to be colored and contain colloidal, dissolved and suspended impurities; bacteria, viruses, organic decomposition products, algae, sand, clay and pesticides. When raw water contains salts a desalination process based on a membrane application is needed.

All potentially dangerous substances – dissolved or suspended – must be identified and removed before the water is safe to consume. Apart from the aspect of health risks, contaminants can affect the water’s taste, odor and visual appearance.

Solutions
- **Turbidity removal**
  Suspended solids are removed by chemical precipitation.
- **Color removal**
  Color originated from suspended and dissolved material is removed.
- **Metals removal**
  Chemical precipitation is adjusted for maximum metals removal.
- **Improved taste**
  Chemical precipitation is optimized to prevent algae growth.

Benefits
- Thorough analysis to determine the best performing chemistry.
- Process know-how to resolve specific water quality problems.
- Reliable and continuous supply of treatment chemicals.
- Water & time saved due to less frequent filter washes.

Desalination
Applications for RO processes.
Chemical precipitation for potable water
Optimum coagulation and flocculation

Intro
Suspended solids and colloidal particles are separated using coagulation and flocculation in potable water treatment. Surface waters from rivers and lakes high in color and suspended matter become of potable quality when water is treated with coagulants and polymers.

Tailor made coagulants and polymers with unique properties for suspended solids removal can give you exceptionally low residual particle matter. Drinking water that meets the highest quality requirements can be produced from greatly varying raw water qualities.

Products

- **Aluminum coagulants**
  Commonly used for potable water treatment all over the world.

- **Iron coagulants**
  Improved chemical precipitation that requires good process control.

- **Organic coagulants**
  No impact on process pH, often used with inorganic coagulants.

- **Organic polymers**
  Coagulation aids optimizing the floc properties and precipitation.

Benefits

- Improved water quality with lower turbidity and color.
- Safer potable water with certified chemicals.
- Improved precipitation means less disinfection by-products (e.g. THM).
- Less water and time lost in filter washes.
# Lake restoration

Cleaning a lake or water reservoir affected by eutrophication

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<th>Solutions</th>
<th>Benefits</th>
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| When a lake’s natural balance is shaken, the water can be cleaned and restored to health. Chemical precipitation with coagulants removes the turbidity in water speeding up the nature’s own process of sedimentation. | **Lake restoration**  
Lakes suffering from eutrophication are restored for improved water quality.  
**Water reservoir restoration**  
Potable water treatment is improved due to better water quality from raw water reservoirs.  
**Dredging**  
Sediment sludge is dewatered chemically using polymers. | Cleaner environment for wildlife and recreation.  
Increased value of clean environment to tourism industry.  
Savings and improved quality for potable water treatment. |

Chemical restoration of lakes and water reservoirs is a lasting solution to eutrophication by binding the phosphorus in the sediments and regulating the excess growth of organic matter in the lake.
## Wastewater treatment

**Chemical and biological processes are often combined for improved efficiency**

### Intro

Our chemicals and applications are used widely in municipal and industrial wastewater treatment processes. As a global supplier we have the resources to combine different applications with a clear focus on making the processes of our customers more efficient.

Today our applications combine chemical precipitation with biological processes, control odor and corrosion, secure efficient disinfection, optimize sludge & biogas management and keep the membranes clean in MBR processes.

### Solutions

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<td><strong>Chemical precipitation</strong></td>
<td>Completing biological processes.</td>
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<td><strong>Phosphorus removal</strong></td>
<td>Preventing eutrophication and recycling valuable nutrients.</td>
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<td><strong>Bulking sludge control</strong></td>
<td>Supporting biology.</td>
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<td><strong>Energy efficiency</strong></td>
<td>Carbon capture for biogas.</td>
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<td><strong>Odor and corrosion control</strong></td>
<td>Saving the assets from H₂S.</td>
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<tr>
<td><strong>Scale control</strong></td>
<td>Preventing struvite and other scale.</td>
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### Benefits

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<tr>
<td><strong>Lower investment needed for more compact treatment plants.</strong></td>
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<tr>
<td><strong>Lower energy consumption and greater biogas production.</strong></td>
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<tr>
<td><strong>Improved treatment capacity of existing processes combining chemistry and biology.</strong></td>
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<tr>
<td><strong>Drier final sludge with lower disposal volumes.</strong></td>
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</table>
Chemical precipitation
The environmentally friendly wastewater treatment process

Intro

Today chemicals can be used to develop, improve and optimize almost every process area of a wastewater plant no matter if a treatment plant uses mechanical treatment or advanced nutrient removal.

Chemical precipitation is typically at its best the earlier the coagulant is added in the process to reduce the energy consumption of the process. Maximum precipitation of solids and organic matter also improves the carbon capture in the sludge, making it possible to produce more biogas in anaerobic digestion.

Solutions

Direct precipitation (CEPT)
Chemically enhanced primary treatment.

Pre-precipitation
Efficient chemical precipitation reduces the need for biological process.

Simultaneous precipitation
Coagulation takes place during the biological process.

Post-precipitation
Water quality is improved after the biological process.

Benefits

Less energy is used in the treatment process.

Improved treatment capacity of existing processes combining chemistry and biology.
Efficient P-removal.

Reduced capital cost.
Reduced cost for sludge management.
More biogas produced.
Phosphorus removal
Lower discharge of nutrients prevent eutrophication of water bodies

Intro
Phosphorus and nitrogen are the main nutrients encouraging the growth of organic matter and algae which cause eutrophication in water bodies. Water quality is now improving in water bodies all over the world in areas like the Baltic Sea thanks to projects that reduce phosphorus discharge from wastewater treatment plants.

The dominating process for the removal of phosphorus is chemical precipitation. Typically it is done with aluminum and iron coagulants before the biological treatment but phosphorus can also be precipitated in the biological treatment or as the final step of the treatment process.

Solutions
Direct precipitation
Chemically enhanced primary treatment with P-removal.

Pre-precipitation
P-removal before biological process.

Simultaneous precipitation
Coagulation takes place during the biological process.

Post-precipitation
Additional P-removal for improved water quality.

P-recovery
Phosphorus is available for reuse.

Benefits
Less energy is used for P-removal in the treatment process.

Efficient P-removal adjusted to the treatment needs.

P is available for reuse in the sludge.

Reduced capital cost. Reduced cost for sludge management.
Nitrogen removal
Chemical applications for improved biological nitrification and denitrification

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</table>
| Nitrogen and phosphorus are the main nutrients causing eutrophication in water bodies. Nitrogen is removed from wastewater by biological processes which are energy demanding and highly investment intensive. However, chemical pre-precipitation can reduce the cost and energy demand dramatically. | Pre-precipitation
Removal of suspended nitrogen and organic matter before biological process improves the nitrification speed. | Less energy is used for N-removal in the treatment process. |
| Ammonia is removed from wastewater in two steps. First ammonia is oxidized to nitrate by air in a process called nitrification. The nitrate is then converted to nitrogen gas by anaerobic bacteria in the denitrification process. These biochemical processes can be accelerated by adding the right carbon source to the wastewater treatment. | Carbon source
Optimizing the nitrification and denitrification processes with the right biological environment by adding external carbon source. | More nitrogen can be collected for reuse from the sludge reject water. |
|                                                                       |                                     | Reduced capital cost. Savings from lower energy consumption. |
Bulking sludge control
Preventing the formation of foam and floating sludge in biological processes

Intro

Bulking sludge and foam are complicated and unpredictable challenges for wastewater treatment plant operators. The sludge will not settle properly, the biological treatment process does not perform correctly and foam can float all over the plant.

Kemira FilamentEx™ concept prevents bulking sludge and foam problems typically caused by filamentous bacteria. At the same time this treatment maintains or improves the performance of the treatment plant. We don’t only resolve the existing problem, but also prevents recurrences.

Solutions

Problem analysis
Microbiological cause of the problem is identified.

Bulking sludge control
Sludge properties are improved by chemical conditioning of the biological treatment process.

Foam control
The conditions for foam formation are controlled chemically.

Continuous monitoring
Maintenance program to keep desired sludge properties.

Benefits

Improved efficiency of biological treatment and aeration process.

Better sedimentation of sludge improves treated water quality.

Savings from improved sludge dewatering.

Safe and clean working environment without nuisance of foam.
Energy efficiency in wastewater treatment
Combining processes to generate an excess of energy

Intro
Water, energy and the environment go hand in hand. With smart use of chemicals in wastewater treatment, you can get the double effect of producing more energy from biogas, while at the same time requiring less energy to run your plant. The result is improved economic efficiency of your wastewater treatment plant.

Kemira offers a holistic approach to the energy potential of wastewater and sludge treatment. Energy consumption and the plant’s energy production are optimized to create a process that eventually generates an excess of energy.

Solutions

- **Chemical precipitation**
  With improved primary treatment less energy is needed for aeration.
- **More and better sludge**
  More carbon is captured as primary sludge with higher energy potential.
- **Improved digestion**
  Anaerobic digestion is enhanced chemically to produce more biogas.
- **Sludge treatment**
  Efficient dewatering of sludge means less volume to transport.

Benefits

- Lower energy consumption in the biological process. Higher biogas yield from sludge digestion.
- Savings with improved energy balance and income from biogas.
- Reduced volume of final sludge to be disposed.
**H2SGuard™**
Odor and corrosion control

**Intro**

When wastewater gets septic in the sewer system, sulfate reducing bacteria forms a toxic and bad smelling gas, hydrogen sulfide (H₂S), which further leads to severe corrosion of concrete pipes.

The Kemira H2S-Guard™ solution is a complete package for odor and corrosion control in sewer systems. The service consists of chemicals, equipment, installation, online access to results, service, maintenance, training and education.

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<tr>
<th><strong>Solutions</strong></th>
<th><strong>Benefits</strong></th>
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<tr>
<td><strong>Odor control</strong></td>
<td>Automated operation and online monitoring of H₂S control.</td>
</tr>
<tr>
<td>Unpleasant smell can be eliminated for a specific area or period of time.</td>
<td>Odor control for touristic and populated areas.</td>
</tr>
<tr>
<td><strong>Corrosion control</strong></td>
<td>Safe working environment free of H₂S.</td>
</tr>
<tr>
<td>Typically corrosion is prevented throughout the drainage system.</td>
<td>Reduced maintenance work and costs.</td>
</tr>
<tr>
<td><strong>Control &amp; monitoring</strong></td>
<td>Reduced wastewater treatment costs.</td>
</tr>
<tr>
<td>Real time results are available online enabling remote control.</td>
<td></td>
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<tr>
<td><strong>Dosing</strong></td>
<td></td>
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<tr>
<td>Based on real time data chemical dosing can be automated.</td>
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# Scale control

Preventing mineral scale formation to reduce operational costs

## Intro

Anaerobic digestion of wastewater sludge transfers magnesium, ammonium and phosphate from the solid phase into ionic form in the liquid phase. This causes the formation of struvite deposits that usually occur in pipes and on surfaces in post-digestion processes and systems, leading to flow restriction, pipe blocking and production limitations.

The use of metal salts to reduce the phosphate levels is the most common treatment method for struvite problems. Additionally KemGuard antiscalants can be used to control scale of vivianite and calcium carbonate.

## Solutions

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<th><strong>Struvite control</strong></th>
<th>Iron salts are used to prevent scale formation in post-digestion processes at wastewater treatment plants.</th>
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<tr>
<td><strong>KemGuard antiscalants</strong></td>
<td>Specific mineral scale problems of struvite, vivianite or calcium carbonate are identified and treated chemically with antiscalants.</td>
</tr>
</tbody>
</table>

## Benefits

- **Improved operability with clean pipes and equipment.**
- Digestion process is improved when dosed ahead in process.
- **Savings and less time lost for plant maintenance.**
- Improved heat transfer and lower energy consumption for pumping.
**DesinFix®**

A powerful and sustainable disinfection solution

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**Intro**

Kemira DesinFix® is a totally chlorine free disinfection technology including chemicals, equipment and related services. The technology is developed by Kemira to meet the increasing demands of wastewater and industrial process water disinfection.

Kemira DesinFix® is a patented technology combining Kemira’s application know-how and high performance disinfection concept. It enables you to reach required pathogen levels in the wastewater treatment plant effluent to be used for diverse reuse applications.

**Solutions**

**Irrigation water disinfection**
Agricultural and landscape irrigation free of disinfection by-products.

**Recreational water use**
recreational applications meeting the requirements of the bathing water directive (EU).

**Industrial reuse of water**
industrial applications such as disinfection of internal service water.

**Benefits**

- Safe storage, handling and dosing of chemicals.
- No harmful disinfection by-products are formed.
- More disinfected water can be reused for specific purposes.

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**Kemira Municipal & Industrial**

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# Sludge & biogas

## Managing the quality and quantity of sludge

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<tr>
<td>We have a great variety of polymers designed for sludge dewatering. Also our coagulants are beneficial to improve the dewatering properties of the sludge. The right chemistry in sludge treatment means reduced emissions of hydrogen sulfide and ammonia.</td>
<td><strong>Sludge dewatering</strong>&lt;br&gt; Anionic and cationic polymers and iron coagulants for a dryer sludge.</td>
<td>Lower final sludge volume and total cost of sludge management.</td>
</tr>
<tr>
<td>Sludge from municipalities and some industries is rich in energy and nutrients. It can be conditioned chemically to produce more biogas and energy out of it and the final sludge volumes are reduced to a minimum. Phosphorous removed from wastewater is accumulated in the sludge and can be reused in agriculture or for soil conditioning.</td>
<td><strong>KemiCond</strong>&lt;br&gt; Patented process for very dry and pathogen free sludge.</td>
<td>Phosphorous recycling back to food chain.</td>
</tr>
<tr>
<td></td>
<td><strong>Biogas enhancement</strong>&lt;br&gt; Chemical conditioning for improved yield of anaerobic digestion.</td>
<td>Improved biogas yield from sludge.</td>
</tr>
<tr>
<td></td>
<td><strong>Phosphorous recycling</strong>&lt;br&gt; Phosphorous in sludge can be recycled back to agriculture.</td>
<td>Cleaner reject water from sludge dewatering back to the treatment process.</td>
</tr>
</tbody>
</table>
Sludge dewatering and the disposal of sludge are costly for a wastewater treatment plant. Sludge disposal costs are reduced by keeping the sludge volumes at a minimum and producing sludge with high dry solids content.

Kemira’s variety of polymers are designed for sludge dewatering while iron based coagulants can also be beneficial in this process. A combination of a polymer and a coagulant typically gives improved dewatering properties, but can also lead to reduced emissions of hydrogen sulfide and ammonia.

**Intro**

Superfloc organic polymers
Anionic, cationic and non ionic polyacrylamides are available as dry, liquid and emulsion polymers.

Inorganic coagulants
Adding a trivalent inorganic iron or aluminum salt improves the dewatering process of sludge.

KemiCond
Unique patented sludge conditioning process for dewatering, while simultaneously hygienizing the sludge and reducing odor.

**Products**

**Benefits**

- Reduced sludge volume.
- Improved reject water quality.
- P-capture in the sludge.
- Hygienized sludge.
- Reduced total costs.
- Lower energy cost.
Kemira biogas program
Your trusted partner for biogas enhancement

Intro
Each biogas process is unique and has different needs depending on substrate composition, digestion technology, digestate treatment and gas utilization. By improving the environment for the microbes, plant capacity and biogas production can be increased. Another important factor for cost efficient biogas process is the viable handling of the digestate.

Kemira biogas program is a combination of application know-how and high performance products for the whole process from biomass feed to nitrogen removal with better process economics and higher biogas yield.

Solutions
Digestion performance enhancement
Kemira BDP technology improves digester performance increasing capacity and biogas yield, providing stabilized operating conditions.

Digestate treatment
Customized offering for both digestate dewatering and reject water treatment.

Scale & foam control
Preventing of foam in the process and scaling problems that may occur after anaerobic treatment.

Benefits
Higher biogas yield to be used as renewable energy.
Improved reject water quality.
Increased dewaterability of sludge.
Stabilized operating conditions.
Cleaner biogas for better energy production.
Thank you!

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