

PICKLING LINE

PICKLING INHIBITORS & RINSE ADDITIVES



Steel Industry Chemicals

Kimya Steel Industry Chemicals Division deals with the formulation and production of specialty chemicals and lubricants used in the Steel and Metalworking Industry.

Kimya innovative solutions help Customers to raise productivity and product quality and achieve unrivalled HSE benefits: eliminate operator's exposure to VOC, risk of fire and carcinogenic compounds.

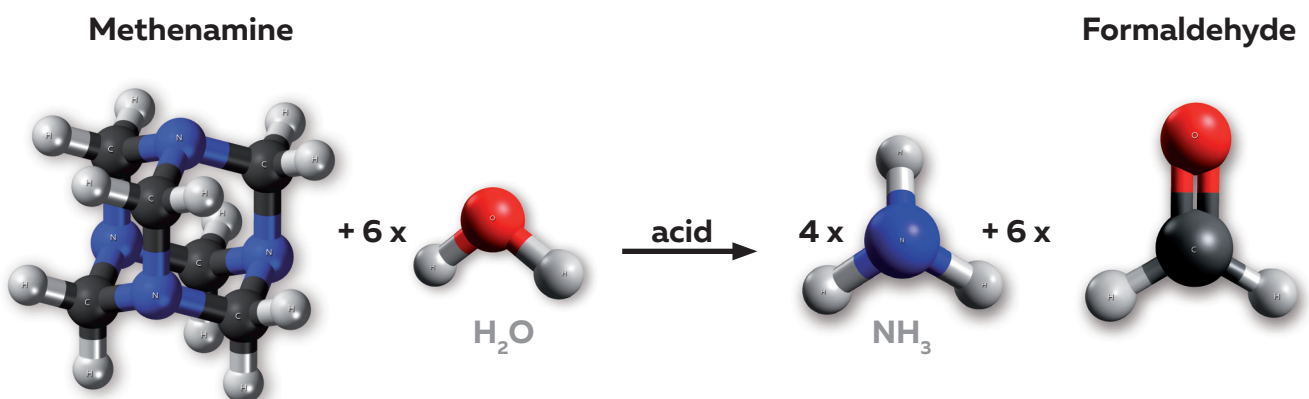
Chemicals

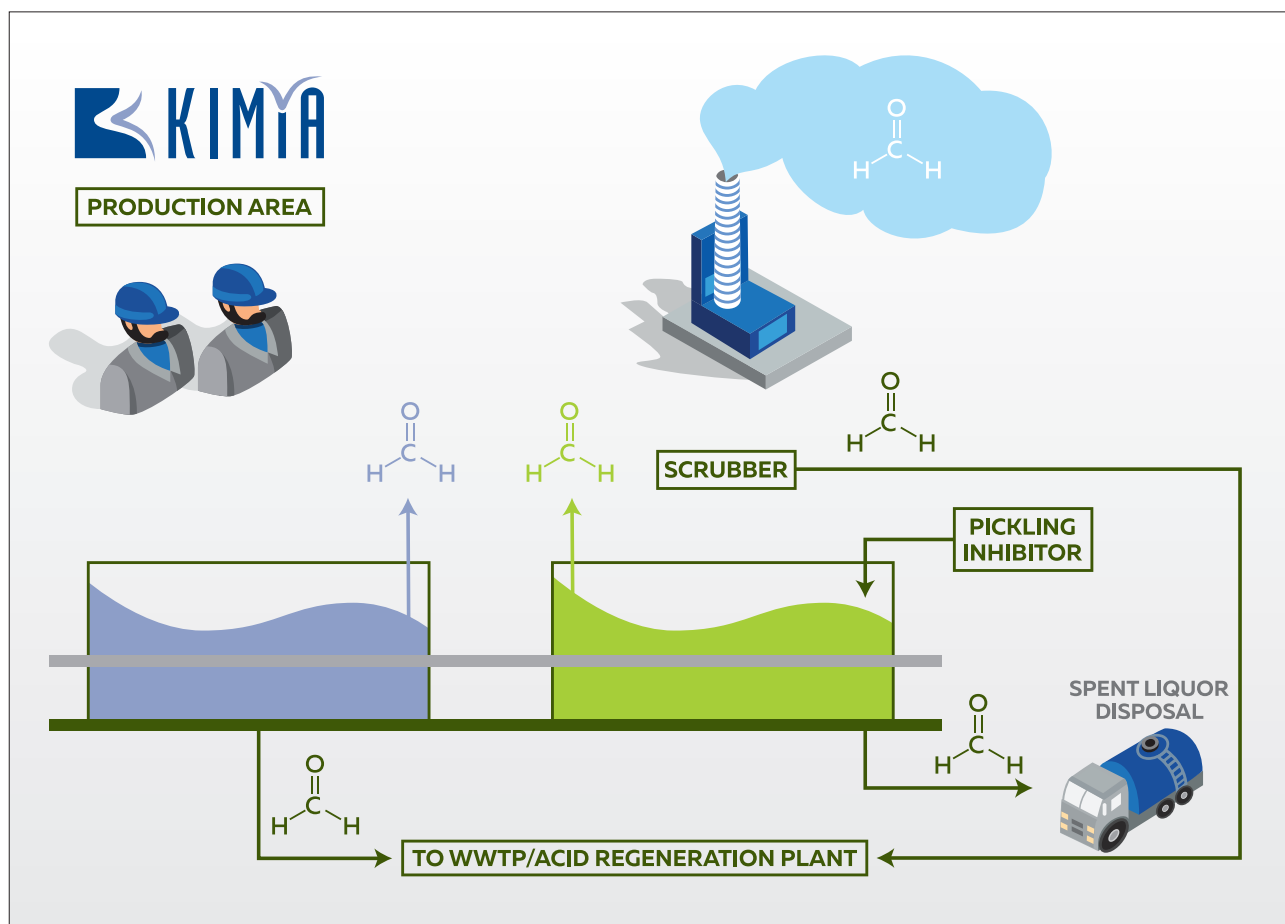
- Dust Suppressants.
- Hot Rolling Oils (Throughput Enhancement).
- Cold Rolling Oils (Bio-based Dispersions Disruptive Technology, **ADT**).
- Pickling Inhibitors (free of Formaldehyde releasers).
- Pickle Line Rinse Aid (prevent discoloration & stop marks, reduce water consumption).
- Wet Temper Fluids (Water-based, Boron and Nitrites-free).
- Metalworking Fluid (Bio-based).
- Rust Preventive Oils.



PICKLING INHIBITORS are used in the **PICKLING LINE** to prevent over-pickling, especially during prolonged shutdowns that cause high acid consumption, loss of valuable material and black carbon smut on the steel surface.

Nearly all pickling inhibitors available on the market are based on Formaldehyde releasers (e.g. Methenamine). These substances are not harmful as such, but when injected in the pickle liquor generate Formaldehyde, a carcinogenic substance that is released into the environment and production areas.





Production and HSE departments are most of the times not aware of this risk because the MSDS describe the product HSE characteristics as such, in its original container. There is no mention to the risks associated with specific applications.

Nevertheless it is quite simple to confirm that Formaldehyde is being released by analysing the emissions at the chimney and rinse water to the WWTP.

Besides Formaldehyde releasers, other extremely harmful substances are commonly used to formulate Pickling Inhibitors:

SUBSTANCE	RISK	HAZARD IDENTIFICATION
O-TOLUIDINE	Carcinogenic	  
THIOUREA	Carcinogenic	  
2-BUTYNE-1,4-DIOL	Very Toxic	  
PROPARGYL ALCOHOL	Very Toxic	   



PICKLING INHIBITORS Kimya Technology

In line with its mission, Kimya has developed formulations free of toxic and carcinogenic substances that ensure excellent corrosion protection, low acid consumption and great performance in terms of surface quality.

The benefits of Kimya technology include:



Product safety during operations, handling and disposal.



Environmentally-friendly formulations.



Excellent surface quality and minimum loss of weight.



Proven technology: already used by several Clients around the world.



Custom-made formulation for a wide range of steel grades and pickle liquor chemistry.



RINSE AIDS

RINSE AIDS are used in the rinse section of the Pickle line to **prevent flash rust, stop marks and surface discoloration** especially during line stoppages and slow runs.

Kimya developed **RINSE AIDS** specifically formulated to **reduce up to 50% the flow rate of RO water** used in the rinse section of the Pickle Line, leading to major economic savings, environmental benefits and a positive impact on Company social profile.

Kimya **RINSE AIDS** formulations have **favourable toxicological profile** (non-ADR, non-toxic) and better performance compared to traditional products available on the market, i.e. **dosing rate can be reduced by more than 50%.**



HEALTH & SAFETY

No toxic substances used in the formulation.



ENVIRONMENT

Up to **50%** reduction in the RO water consumption → 15,000 m³/year saved.

Reduction of the emissions at the boiler chimney resulting from lower flow rate of RO water being heated up to the pickle line operating temperature.



OPEX

Reduced cost of raw water supply, RO water production and heating → more than 50,000 €/year.

50% reduction in the Rinse Aid consumption.

Lower pumping energy (less water pumped into the line).



QUALITY

Same strip surface quality obtained with traditional products

No impact on downstream operations (Cold Rolling Mill and Galvanizing Line).



Positive impact on Company social profile.

“ PICKLING LINE CASE STUDY

The leading group worldwide in the steel processing sector based in Ravenna (Italy), with 6.2 million tons of steel processed yearly, was investigating ways to eliminate Pickling Inhibitors based on Methenamine that generates Formaldehyde (carcinogenic substance) upon reaction with Hydrochloric Acid.

PROPOSAL

Kimya proposed a new technology, free of toxic and carcinogenic substances to replace traditional Pickling Inhibitors.

Moreover Kimya proposed to use a Rinse Aid specifically designed to reduce the flow rate of RO water used in the rinse section of the pickle line.

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Trail Results

Trial was conducted from February till June 2019 on a continuous pickle line with an annual throughput of 1.2 Million tons.



Successful replacement of traditional Pickling Inhibitor with a safe product that does not release Formaldehyde.



22% reduction (1.2 m³/h) in the RO water consumption resulting in major savings: 50,000 €/year and 12,300 m³/year.



50% reduction in the Rinse Aid consumption.



Strip surface quality remained unchanged.



No impact on downstream operations (Tandem mill and Galvanizing Line).



Reduction of the emissions at the boiler chimney resulting from lower flow rate of water being heated up to the pickle line operating temperature.



Lower pumping energy (less water to pump into the line).



Positive impact on Company social profile.

RO Water Flowrate Reduction: Savings



RO WATER COSTS

$1.2 \text{ m}^3/\text{h} \times 7,177 \text{ h/year}$ (plant yearly on-stream time) = **8,612 m³/year**

$8,612 \text{ m}^3/\text{year} \times 2.30 \text{ €/m}^3$ (cost of RO Water) = **19,808 €/year**



ENERGY COSTS

Water shall be heated up from 20 to 55°C before entering the Rinse Section.

$$Q = m \times c_p \times \Delta T = \mathbf{175,560 \text{ KJ/h}}$$
 where: $m = 1200 \text{ kg/h}$
 $c_p = 4.18 \text{ KJ/Kg}^\circ\text{C}$
 $\Delta T = 35^\circ\text{C}$

$\text{CH}_4 \text{ Consumption} = 175,560 / 33,390 \text{ (CH}_4 \text{ LHV)} / 0.85 \text{ (Boiler Efficiency)} = \mathbf{6.19 \text{ kg/h}}$

$6.19 \text{ kg/h} \times 7,177 \text{ h/year} \times 0.28 \text{ €/kg}$ (CH₄ Price) = **12,439 €/year**



ACID WATER TREATMENT COSTS

Acid waters discharged from the rinse section shall be treated to meet the discharge limits.

$8,612 \text{ m}^3/\text{year} \times 2.00 \text{ €/m}^3$ (cost of treatment) = **17,224 €/year**



TOTAL SAVINGS

49,471 €/year



WATER SAVINGS

$8,612 / 0.7$ (RO plant efficiency)
12,303 m³/year

“ RINSE AIDS CASE STUDY

A leading steel re-roller located in Saldanha (South Africa) was investigating ways to improve the efficiency of Rinsing operations:

- Discoloration and stop marks, caused by line stoppages and slow runs, were resulting in false reading of the gauge control system, forcing the CRM to reduce the speed to avoid line breakages.
- Cape Town region was affected by a severe drought. Company was forced by local authorities to reduce water consumption to keep the plant in operation.

PROPOSAL

Kimya customised Rinse Aid formulation helped Client to achieve their goals:

- Increase CRM productivity by preventing occurrence of discoloration and stop marks.
- Reduce rinse water consumption from 7 to 3.5 m³/h.

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*Trial conducted in July 2018 demonstrated that both objectives were achieved using Kimya **RINSE AIDS** at a dosing rate of 500 ppm!*

Savings for Client



RINSE (DEMINERALIZED) WATER

3.5 m³/h X 6000 h/year (plant yearly on-stream time) = **21,000 m³/year**

21,000 m³/year X 2.25 €/m³ (cost of Demin Water) = **47,250 €/year**



ENERGY

Water shall be heated up from 20 to 80°C before entering the Rinse Section.

$$Q = m \times c_p \times \Delta T = \mathbf{877,800 \text{ KJ/h}}$$
 where: $m = 3500 \text{ kg/h}$
 $c_p = 4.18 \text{ KJ/Kg}^\circ\text{C}$
 $\Delta T = 60^\circ\text{C}$



COAL

Coal Consumption = $877,800 / 27,000 \text{ (Coal LHV)} / 0.8 \text{ (Boiler Efficiency)} = \mathbf{40.6 \text{ kg/h}}$

$40.6 \text{ kg/h} \times 6000 \text{ h/year} \times 0.13 \text{ €/kg (Coal Price)} = \mathbf{31,668 \text{ €/year}}$



TOTAL SAVINGS: 78,918 €/year

Total Savings do not include tangible and intangible benefits, which are more difficult to estimate:

- 1** Cost of treatment of Acid Water discharged from Pickle Line.
- 2** Improved strip surface quality after stoppages and slow runs
(higher rolling speed at the mill → higher productivity and less strip breakages).
- 3** Lower pumping energy (from 7 to 3.5 m³/h).
- 4** Reduced load at the Demin Plant: less frequent regeneration cycle (lower chemical consumption) and higher resins lifetime.
- 5** Lower environmental impact
(lower water consumption and emissions at the boiler chimney).
- 6** Positive impact on Company social profile.



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