Technical Factsheet: MOL®LIK Catalyst

MOL®LIK – a technical proven catalytic water treatment technolgy – is a biocide-free technology that reduces the risk of fouling, scaling and corrosion on downstream surfaces, even at long distances. With this technology, there are entire cooling systems of power plants operated completely free of any biocide – with less than 2 kg of the special catalyst.

After showing reliable results on areas with quite stable water quality, like tap, cooling and process water treatment, catalytic water treatment was tested in challenging areas of industrial wastewater within INSPIRE WATER. Within the INSPIREWater project, the scope was investigating the potential for improving membrane performance with catalytic water treatment in the field of effluent water reuse.

Working principle

The core element of the MOL®LIK-technology is a proprietary ultra-thin metal catalyst foil, made of nickel, chromium and iron. These catalysts are speeding up solubility by faster supply of molecular water. $H_2O_{molecular}$ is required for preparing the hydration shells. As faster, these shells are prepared as better flux on filter units and as better solubility of substances.

As a side effect the risk of deposits formation is minimized. Occasional interaction of low-energy visible light can additionally facilitate this process. The usage of this special catalyst technology results in a more efficient membranes process with optimized usage of chemicals.

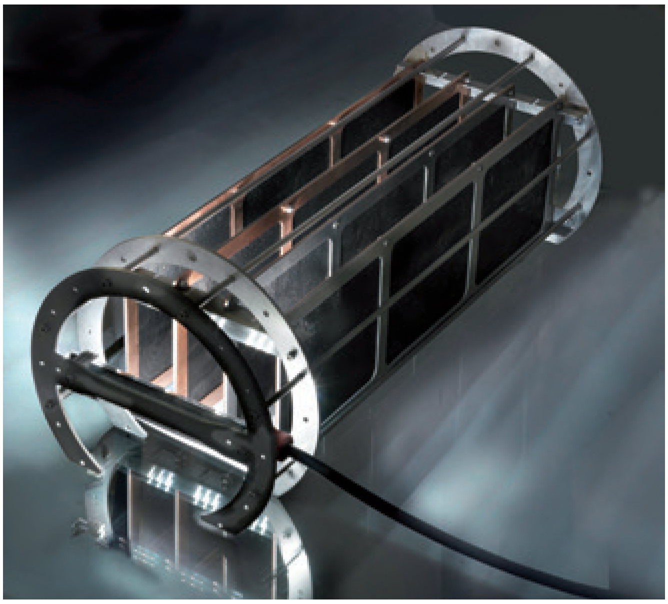

Figure 1: MOL®LIK catalyst module

SPECIFIC CASE AT MEMBRANE APPLICATIONS:
For transferring water through filtration processes, an energy intake higher than the osmotic pressure is required. In this way, the gaseous small water molecules can be guided to the membrane surface. But afterwards these small water molecules are missing on the hydrate shells of dissolved substances. This results in agglomeration and deposition processes, which is highly undesirable from a technical point of view. A possible solution is speeding up the formation of small water molecules by adding thermal energy or a suitable heterogenous catalyst. With the installation of a MOL®LIK, the issues with deposits are minimized and the water can easier pass through membranes.

Figure 2: MOL®LIK installation @ power plant

Effects of catalytic acceleration of the formation of molecular H_2O where found on RO membranes on a pilot installation in the field of wastewater reuse within INSPIREWater as well as the Belgian CARVE project (**C**hemicaliënvrije **A**fvalwater **R**ecuperatie in der **V**o**E**dingsindustrie). The catalysed water stabilizes the flow rate at a higher level than conventional treatment. At the same time, fewer cleaning cycles where been necessary in the catalyzed production line. Parallel there were found improvements on pressure drop in the area of up to 30 percent – in direct comparison with conventional operational mode. This observation fits the water model described before.

Advantages

- Improvement of TMP (transmembrane pressure)
- Reduction of operational costs
- Rising performance of conventional water treatment technologies
- Extension of facility lifetime (trough improvement at cleaning intervals)
- Minimization on negative effects of industrial facilities on environment through optimization of chemicals demand

General data

Typical applications	Applications like cooling towers, process water supply, tap water systems, filter and membranes applications With INSPIREWATER project possibility to explore the field of applications with more challenging conditions of industrial wastewater reuse.
Average energy consumption	0.001 till 5.0 Wh/m³ (day light LEDs)
Average chemical consumption	none

Remarks

- The process is limited by particular facility conditions
- (for example, challenging water with bad filtration or the presence of some special film formation substances in the water, which may block the catalyst – e.g.: silicates)
- Efficiency can be enhanced by a little day-light (which can be reproduced by suitable LED-units)

SWOT analysis

	S	W
INTERNAL	• Simple, plug and play • Flexible system, usage in different areas (membranes, filter systems, cooling tower, tap water supply) • Low CapEx & OpEx (capital & operational expenditure) • Very short payback time (ROI) • Suppress preventive formation of biofilms • Reduction of fouling, scaling and corrosion • Minimizing chemicals demand • Credible references	• Largely unknown • Hard to explain what the mechanism is behind • No direct analytical technique to qualify concentration of "molecular water" - only indirect measurements to evaluate effectiveness and performance • Scientific proof is missing • No worldwide service options
	O	**T**
EXTERNAL	• More areas where scaling and fouling are an issue • Targets of the World Water Development Report • Stricter legislations • European approval for drinking water • Define easily monitored performance parameters • High transferability to sectors with water streams • Public growth of environmental awareness	• Single source supplier • Immediate competition with established technologies • No comparable technology on the market • Commercial regulations at customers stop testing and eventually adoption • Low awareness of economic and ecological value of water treatment by end users

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Key Performance Indicators (KPIs)

At industrial projects – where the catalyst is involved in – the focus is mostly on the development of defining performance parameters, which can be easily monitored and used for demonstrating the efficiency of catalytic water treatment. In Table 1, examples of performance parameters are shown.

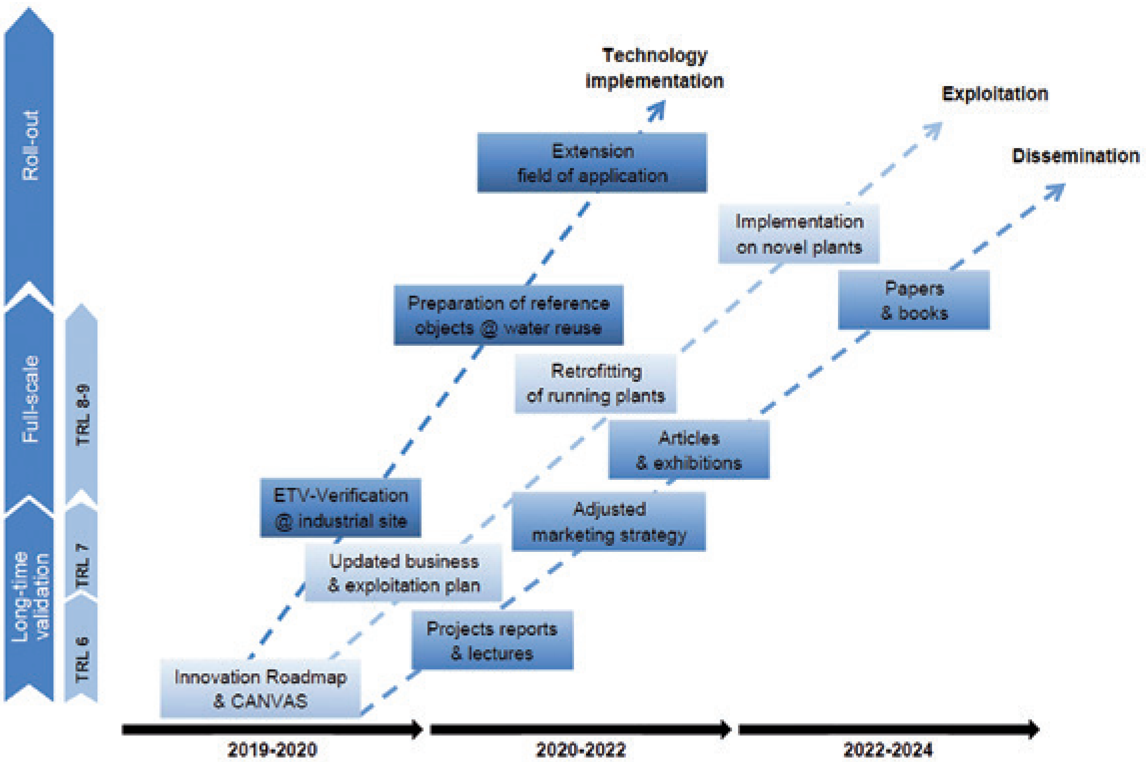
References and patents

References	References in the field in the industry and power sector – but so far, no references in the field of effluent water treatment.
Patents	The catalyst and the technology are patented.

Table 1: Overview of key performance indicators for demonstrating and monitoring the performance of MOL®LIK technology, for references see Deliverable 2.4 Innovation Roapmap INSPIREWATER.

Process	MOL®LIK effect	Measurand	Measured effect
Membranes	Reducing difference in pressure (atconstant flow rate)	Δp (p=pressure)	Pressure drop improved up to 30%
Filtration	Improving filters cleaning interval	$\Delta p/\Delta t$ (t=time)	Cleaning interval improved from 3 days to >30 days
Dissolving	Speeding up dissolving processes	$\Delta m/\Delta t$ (m=dissolved substance)	Dissolving process up to 10times faster
Evaporation	Reducing scaling	Turbidity	Turbidity of cooling circuits less than 5 NTU
Heat exchange	Increasing heat transfer	k-value ΔT (T=temperature)	ΔT improved up to 2K on industrial cooling circuits
Chlorination	Acceleration of chlorine disproportionation	Δredox potential Organochlorides (AOX) chloramine	Improved performance on public swimming pools achieved

Overview Roadmap



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