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kolb Cleaning Technology: Thinking ahead is daily business

## **Environmentally sound: Aqueous cleaning with minimum water consumption.**

**"Water is not a problem of the future, but a key issue of our time for businesses: In the future, urgent water risks will increase in many areas of the world. A growing population, a changing consumer behavior and climate change will have an immediate impact on the availability and quality of water and thus build further pressure on governments, businesses and societies." (Quote from the summary of the 2014 WWF study "The imported risk. Germany's water risk in the age of globalization.")**

"Will water become the new oil?" This was a recent headline in a popular German daily newspaper, referring to the "World Water Development Report," published annually by the United Nations. Many experts answer this question with a resounding clear "yes". Excessive pessimism? Maybe, but a few statistical facts should be considered: 140 liters of water is consumed for that cup of coffee enjoyed at our breakfast table; it takes approximately 1,300 liters of water to harvest a kilo of wheat, and 15,000 kilos of water to produce a kilo of beef. In school we learned that 70 percent of our planet is covered by water, but fresh water makes up only three percent of it and only 0.65 percent is directly available, because the remaining resource is mostly bound in the polar ice caps or glaciers.

But what does this really mean in respect to population growth? Current UN reports predict global population will reach 9.1 billion in 2050. What is the impact when accompanied by the corresponding demand for food and consumer goods?

### **We already consume significantly more water than nature produces**

The demand for water by 2050 is expected to increase by another 55 percent. However, our current freshwater resources are already totally over exploited, particularly in the agriculture and industrial markets which consume massively more water than the natural cycle regenerates. By 2030 this gap is expected to be about 40 percent according to the UN. In a global review: In the plains of northern China (a country with about 20 percent of the world's population, but with only eight percent of the global fresh water resources) groundwater levels have dropped by about 130 feet. In Saudi Arabia which owned one of the world's largest ground water reservoirs have succeeded to empty it almost completely within a single generation due to excessive agricultural and cattle breeding projects.

In Australia only praying seems the last aid against the water shortage. ((Pic 1)) Heinz Zimmermann, managing director of kolb Asia Pacific PTY in Bankstown, Australia, knows water shortage from very personal experience. In his country for quite some time watering private lawn, washing the car or filling a swimming pool is strictly forbidden and watering garden plants is only allowed on two days a week - and then only between six and eight a.m. and from eight to ten p.m.

In Rio de Janeiro or São Paulo, water is completely turned off on a daily basis; on the Spanish island Mallorca tank trucks are carrying water to the tourist hotels; and Cyprus imports water from Turkey and the USA. Studies by the National Center for Atmospheric Research (NCAR) suggest that the Southwestern States in North America, including



California show dry conditions are the new standard with a continued downward trend in precipitation levels year over year. In California it is becoming common place to extract dry and withered grass and replace it with a beautifully painted shade of green shade. ((Pic 2)) In fact, residents are given incentives to “paint” rather than water.

According to a study of the US government droughts, lack of tap water will increasingly fuel conflicts, inevitably leading to significant economic distortions in the not so distant future. On top of that large food companies such as Nestlé, Danone, Coca Cola and Pepsi worldwide are buying water resources or turning to privatized water supplies.

Does this mean in the future one can only drink if one can pay? "The right to water is a human right, namely in an amount of 25 liters per person per day, (...) that counts for 1.5 percent of water consumption. The remaining 98.5 percent must not be declared as human rights (...) water is foodstuff. And like any other food it should have a market value." (Posted by Nestlé CEO Peter Brabeck-Letmathe at the World Economic Forum 2012 in Davos). On this subject German “Handelsblatt” wrote in 2013: " Critics fear that soon the Swiss (Nestlé) will expand to a controversial source of income in Germany, critics fear - our groundwater."

Additional to depletion and commercialization the world is facing an increasing pollution of drinking water mainly caused by agriculture and industry, representing about 75 percent of global freshwater consumption.

It is a fact that China has drastically intensified its environmental protection legislation last year and seems willing to enforce these laws. Countries like the United States, India, Pakistan, Iran, Saudi Arabia and Mexico, whose aquifers are hopelessly overexploited, are under enormous pressure to handle the shortages. For Germany, whose industry is dependent to a great extent on exports and companies with global production facilities, means that water management will become an important factor in many respects and in the near future - especially for companies where the use of water is a basic element for their products or processes.

Such a company is kolb Cleaning Technology GmbH in Willich, Germany, a manufacturer of cleaning machines and chemicals for electronic components and tools. The problem described here is ubiquitous all over the globally acting company.

Efficiency measures must be employed and measures taken wherever water is used significantly now and into the future. Whether through government regulations or taxes, or whether through privatization and thereby commercialization - if the visions mentioned by Peter Brabeck-Letmathe come true, 98.5 percent of the (dwindling) global freshwater resources will become an asset like oil. In respect to this trend, experts predict price increases in some regions of 200 percent and more. Users in California have seen water rates increase by 30% over the previous year, with year over year rate increases anticipated and promised.

### **Water shortage will change the conditions of industrial production**

Georg Pollmann, managing director responsible for product development and sales along with his counterpart Christian Ortmann, consider it important that this issue is not only a “topic for the top”. "Certainly not all of our employees are informed of all details of the increasing global water shortage, but we encourage and demand a fundamental awareness of careful and economical use of resources across the enterprise," affirms Ortmann. And this does not happen on the basis of eco-romanticism, but predominantly to look in advance at the change in economic conditions.

In that respect three years ago, the company initiated an energy and water savings certification by an independent institute for the complete range of machines. Drying methods such as the patented VMH® (Venturi Mixed Hot air)



or CWA® (Compressed Hot Air) technologies allow high temperatures with minimum energy consumption. Good for all the environment, but especially good for the operating costs.

Kolb Cleaning Technology is an innovative company and pioneer in cleaning technology, with a continual emphasis placed on advancements with aqueous machine cleaning in the electronics industry. In the late 80s tool cleaning (screens, stencils, solder frames, carriers, etc.) solvents and manual cleaning were the norm, and in 2001, when the 31 BImSchV (Regulation on the limitation of emissions of volatile organic compounds (VOC) when using organic solvents in certain plants) came into effect those solvent cleaners may be used in Germany only severely restricted. As an environmental corporate citizen, kolb had already developed alternative cleaning methods.

In 2006 kolb developed the first neutral cleaner with patented Ternary Sequence® technology, which for example allows rinsing without water in automated stencil cleaning systems.

The use of aqueous alkaline cleaners however will still require rinsing with tap and / or DI water. Accordingly, kolb began to consider early on about neutralizing rinse water contaminated with heavy metals. Ten years ago kolb engineers developed the first wastewater treatment system. Since 2008, the now common WPSD200 ((Pic 3)) is commercially available. The WPSD200 is able to process (including pH regulation) rinse water with a high heavy metal content of lead, tin, silver and copper to such an extent that it may be introduced indirectly into the public sewage system after application to the local authority according to the rigid German § 151, Annex 40 WHG, paragraph 7 (water act).

#### **Using water without saving water has no future**

At the beginning of the millennium the focus was still mainly on water pollution but in the meantime, consumption reduction scored a similarly high priority, meaning rinse consumption needed to be addressed. Kolb R & D director Georg Pollmann estimates: A conventional PCB cleaning system requires 100 liter of fresh water per cycle for rinsing. Systems without a separate process tank, the so-called "open-loop" systems, operate on the principle as a normal consumer dishwasher with an open circuit without processing tanks. After each cleaning process, water is disposed. Considering eight to ten cycles per day, the monthly consumption can easily go exceed 15,000 liters. You just write a small current cost number behind each liter and wonder what will become of this number given the rapidly dwindling resource in the future.

Consequently, kolb Cleaning Technology does not build or offer open loop systems. Instead the German company follows four principles to minimize water consumption constructing its cleaning equipment: 1. Innovative design with a perfect match of hardware and software, 2. ClosedLoop technology as standard in each machine, 3. optional integrated CrossLoop rinse water recycling modules and 4. external CrossLoop recycling systems.

The development of technology is oriented so that the cleaning process in itself needs less water than common processes of other conventional systems. Furthermore, each kolb fully automatic single-chamber machine is equipped with a ClosedLoop technique to include a closed internal circuit for reusing cleaning liquid and rinse water. There is also the option to equip the system with a CrossLoop water treatment module, which allows a further increased use of rinse water. With the CrossLoop batch system water is recycled and used longer. CrossLoop modules and systems run an external cross-cycle communication process with the rinse cycle of the cleaning system.

'Saving water starts before consumption' is a guiding principle of the kolb development department. Construction manager Christian Smits and his team are constantly looking for optimization of existing and new opportunities. "Our goal is always to push consumption already in the base processes below market average." With new, finest nozzle channel geometries, sophisticated pump technology and intelligent process software, a PSB400 H70



pressure spray maintenance cleaning system ((Pic 4)) for example only needs 35 liters rinse water for a process cycle in which such a machine can clean 11 large solder carriers.

The internal serial ClosedLoop filter configuration normally allows a five-fold reuse of this rinse water. With one rinse batch therefore 55 carriers can be cleaned. This corresponds to effective rinse water consumption per carrier of approximately 0.6 liters or 636 milliliters.

If the cleaning system is additionally equipped with an integrated WPCL IU CrossLoop recycling module ((Pic 5)) an additional (approximately) 35-fold recycling of rinsing water is possible and the water consumption per carrier then is only 18.2 milliliters. The installation of the fully enclosed compact modules connected to the back of the cleaning systems increases their depth by only about 400 millimeters.

If instead the cleaning system is connected to an external WPCL 100 ((cover picture)) batch recycling system, the recycling rate increases to about 70 times. The fully automatic PLC-controlled system with three storage tanks, each with 120 liter capacity and integrated water changing system can easily be connected via communication lines to any appropriate cleaning system with automatic water change. Now only 9.1 milliliters of rinse water are required per carrier. The water savings compared to an open loop system is then at an impressive 98.6 percent!

For PCB cleaning systems, the situation is not different as shown in the comparison table below. ((Pic 6 / comparison table))

With the appropriate treatment the water consumption can be reduced to an absolute minimum of one percent of the consumption of a comparable open loop system. ((Pic 7))

Also in the future kolb wants to intensively push waste water conservation in its products. Although the price of water to date in Germany has hardly any operating cost sensitivity and e.g. in the US amounts to not even half of it, it would be grossly negligent to ignore the world's rapidly depleting freshwater resources and their increasing privatization, says Pollmann. Many of kolb's advanced customers show the same mindset not only from an environmental, but also from an economic point of view. In 2014 for example the company built as a general contractor a complete wash center for SMD tools for the Siemens electronics manufacturing plant in Amberg, Germany. There at every single rinse process 1,800 liters of water are used, without producing any sewage. First the rinsing water there is regenerated inside the cleaning systems in ClosedLoop procedures. After every ten wash cycles it is vaporized externally in a special procedure and then circulated back into the cleaning process. One of the key requirements of Siemens' initial specification sheet program and perspective for kolb Cleaning Technology: Rinsing without producing sewage. Christian Ortmann: „Thinking far ahead, anticipating future demands will stay a vital part of our daily business.“

[Separate box:](#)



**ClosedLoop and CrossLoop recycling in a WPCL100 system**

In a cleaning system, the rinse water usually shows three different process states: Polluted water, which is no longer suitable for rinsing and has to be either treated for reuse or has to be discharged into the local sewage network.

Water that has been used for rinsing, but still is usable for this process because it is filtered in a closed loop inside the cleaning system and thus can be reused several times.

Fresh water or fresh recycled water which the system collects during the rinsing water exchange process either from the local water connection or from a reprocessing plant.

[Pic 8: Drawing ClosedLoop/CrossLoop](#)

**Wastewater delivery:** kolb WPCL 100 collects (CrossLoop) the wastewater through a valve into the first storage (tank 1 for used water) when it is no longer suitable for rinsing.

**Water recycling:** In the second tank (tank 2 for mixed water) and in a six-stage filtration circulation process the heavy metal content (e.g. lead, tin, silver, copper) is subsequently absorbed and organic residues are filtered out. In this process, the ion contamination is reduced to the desired  $\text{mS}$  conductance, which is determined by the preset residual ion height. This process is automatically controlled by a PLC.

**Fresh water delivery:** The processed DI- / DM-water is collected in the third storage tank (tank 3 for fresh water) ready for reuse, so that the external cleaning system constantly has suitable rinse water available.



Pic 1

BU: The only solution is to pray: Acute water shortage - common in the Australian Outback, scientists forecast the similar issues for the American Southwest in the foreseeable future.



Pic 2

BU: For appearances' sake: Californian homeowners varnish their garden lawn.



Pic 3

BU: kolb WPSD200 – able to treat wastewater of up to three cleaning systems.





Pic 4

BU: kolb PSB400 H70 PowerSpray® maintenance cleaning system for up to 11 Carrier 28" x 23" or 25" x 25"" or up to three baskets for smaller parts.



Pic 5

BU: kolb WPCL IU70 water recycling module with two-tank (70 liters each) system for reuse-preparation of rinse water in DI-quality.



Pic 6

Comparison board

Cleaning system / Capacity / Rinse water consumption per cycle	Rinse water consumption per eurocard per cycle over 70 cycles	Gesamt Eurokarten / Wasserverbrauch bei 70 Zyklen
Referenz: Conventional open loop system / 160 eurocards / 100 l	625 ml	11.200 / 7.000 l
kolb PSB500 H50 with ClosedLoop / 160 eurocards / 70 l	444 ml	11.200 / 4.900 l
kolb PSB500 H70 with ClosedLoop / 540 eurocards* / 70 l	130 ml	37.800 / 4.900 l
kolb PSB600 H70 with ClosedLoop / 540 eurocards* / 42 l	70 ml	37.800 / 2.650 l
kolb PSB500 H50 with ClosedLoop with WPCL IU Recyclingmodul / 160 eurocards / 70 l	12,5 ml	11.200 / 140 l
kolb PSB500 H50 with ClosedLoop with WPCL 100 Batch Recycling-system / 160 eurocards / 70 l	6,3 ml	11.200 / 70 l
kolb PSB600 H70 with ClosedLoop with WPCL IU Recyclingmodul / 540 eurocards* / 42 l	2,2 ml	37.800 / 84 l
kolb PSB600 H70 with ClosedLoop with WPCL 100 Batch Recycling-system / 540 eurocards* / 42 l	1,1 ml	37.800 / 42 l

\*for this capacity no reference system can be specified as kolb CLEANING TECHNOLOGY GmbH is the sole supplier of batch systems of this size.



Pic 7

BU: kolb PSB600 H70 PCB cleaning system: Rinses with recycling system WPCL100 37,800 Euro cards with only 42 liters of water.



Pic 8

Drawing ClosedLoop / CrossLoop

