ProzessAnalysenInstrumente GmbH

PAI

Process Analysers

Organic X Monitor *LC*

Continuous determination of inorganic and organic impurities in

- Condensates
- Boiler feed water
- Ultra pure water

ProzessAnalysenInstrumente GmbH

(주)엠씨마스터스
MC Masters
Measurement & Control

Grüner Ring 6
D-27432 Hipstedt

Tel.: (+49) 04768-922100
Fax: (+49) 04768-922101

email: info@p-a-i.de
web: www.p-a-i.de

Detection of Impurities in Condensates and Ultrapure water

One precondition for a continuous trouble free boiler operation is an almost perfect protective coating on both sides of the heat exchangers. The quality of these passivation layers is a function of the conductivity in the water - steam cycle, i. e. the concentration of ionic species.

Inorganic and organic ionic species are removed by ion exchange resins, and don´t pose any thread to the protective layers. Neutral organic compounds are not removed and they are decomposed to organic and inorganic acids under conditions found in modern boilers. This yields to an increase in conductivity, higher corrosion and reduced maintenance intervals.

An analytical method that detects traces of organic impurities in feed water is therefore mandatory.

The Organic X value gives better information than the DOC-value

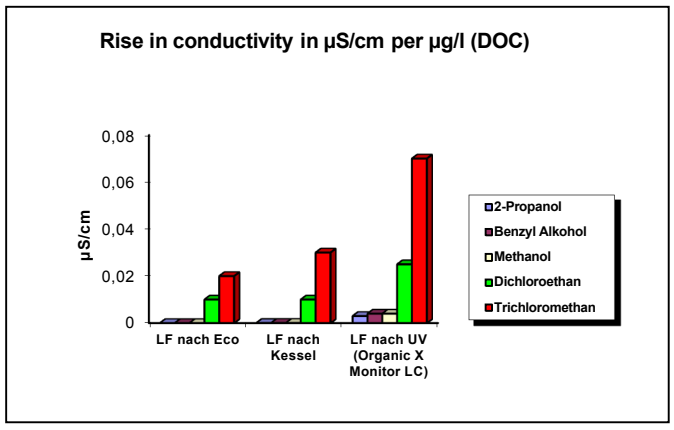
DOC-Value

Most instruments for the determination of the DOC (Dissolved Organic Carbon) decompose the organic compounds and measure the amount of carbon dioxide formed (DIN 38 409). In most cases there is no correlation between the DOC and the conductivity increase due to the decomposition of these compounds in the boiler!

Organic X Value

The **Organic X Monitor *LC*** also decomposes the organic impurities but detects all ionic products (HCO_3^-, Cl^-, F^-, SO_4^{2-}, etc.) by their conductivity.

By simulating the decomposition process that takes place in the boiler the **Organic X Monitor *LC*** is able to determine the quality of boiler feed water unambiguously.



The following figure illustrates results from experiments that had been performed in a power plant be injecting small quantities of organic compounds into the boiler feed water. The different behaviour of various organic compounds in boiler and in the process of UV-treatment as performed by the **Organic X Monitor *LC*** is presented in the following figure. As can be seen the increase in conductivity for halogenated compounds is much higher than for halogen-free

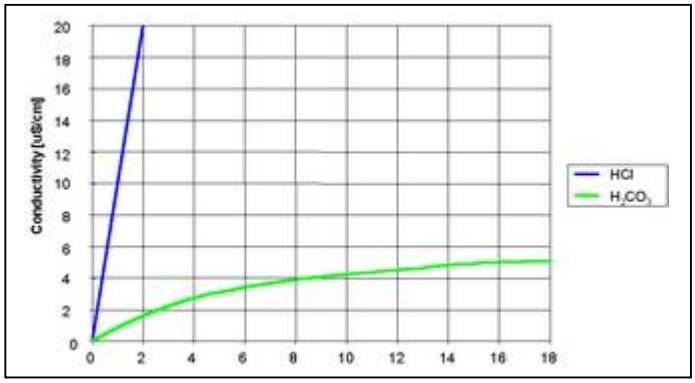
ProzessAnalysenInstrumente GmbH

Grüner Ring 6
D-27432 Hipstedt

Tel.: (+049) 04768-922100
Fax: (+049) 04768-922101

email: info@p-a-i.de
Web.: www.p-a-i.de

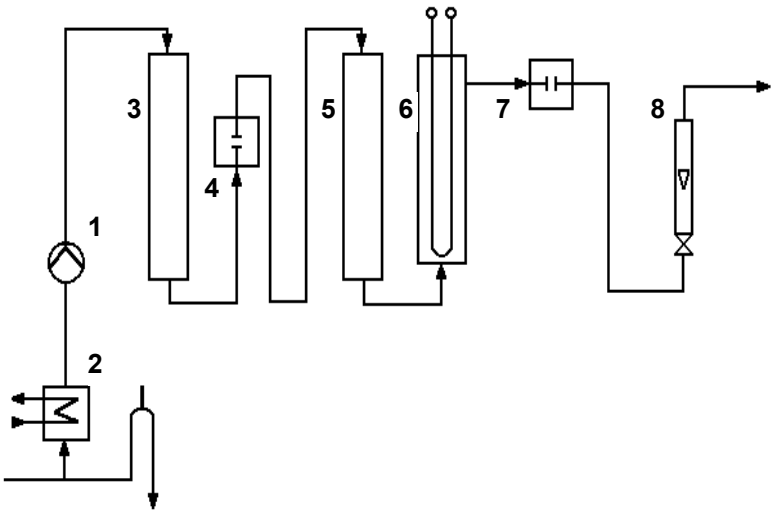
compounds. Furthermore decomposition of halogenated compounds starts at lower temperatures. Even during pre-heating at 270°C some decomposition of chlorinated compounds occurred. This indicates that even in older power stations with moderate steam temperatures some decomposition may happen.



The higher increase in conductivity for chlorinated compounds is explained by the fact that Hydrochloric Acid is a much stronger acid than Carbonic Acid as illustrated by the following graph.

Operational Principle

Inorganic impurities like HCO_3^- and conditioners like NH_4^+ are removed by a mixed-bed exchanger in the first step. Then the sample is treated with ultra violet light (< 200nm) to decompose the organic impurities. The ionic reaction products are than detected by their conductivity. The configuration shown in the following figure can be changed to meet the local requirements (see scheme description).



1 Sample pump

2 Sample cooler

3 cation exchanger

4 conductivity cell I

5 mixed-bed exchanger (optional)

6 UV - reactor

7 conductivity cell II

8 flow meter

ProzessAnalysenInstrumente GmbH

Grüner Ring 6
D-27432 Hipstedt

Tel.: (+049) 04768-922100
Fax: (+049) 04768-922101

email: info@p-a-i.de
Web.: www.p-a-i.de

The calculation of the concentration of the organic impurities from this conductivity value is not useful in most cases. Experience shows that it is the best to use the conductivity after UV irradiation directly as a measure for boiler feed water quality. This is in accordance to official guidelines like VGB, VdTÜV, TRD, etc.

Scheme description

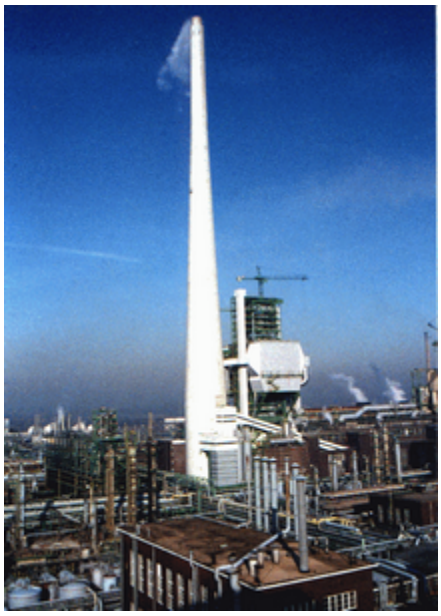
For the **Organic X Monitor *LC*** several versions are possible dependant on the feed water quality or the measuring tasks.

a)		**cell I**		**UV**	**cell II**	DI-water (conductivity < 0,2 µS/cm) sample conductivity is measured without sample pre-treatment.
b)		**cell I**	**MB**	**UV**	**cell II**	like a) with higher sample conductivity (≤ 30 µS/cm)
c)	**CA**	**cell I**	**MB**	**UV**	**cell II**	sample conductivity (≤ 30 µS/cm) with conductivity measurement after high acidic cation exchanger
d)	**CA**	**cell I**		**UV**	**cell II**	for feed water conditioned with NH_3 with conductivity measurement after high acidic cation exchanger

CA	=	high acidic cation exchanger
MB	=	mixed-bed exchanger (high acidic cation exchanger / high alkaline anion exchanger)
cell I	=	conductivity cell I
cell II	=	conductivity cell II

Grüner Ring 6
D-27432 Hipstedt
Tel.: (+049) 04768-922100
Fax: (+049) 04768-922101
email: info@p-a-i.de
Web.: www.p-a-i.de

Performance



At a major chemical production site in Germany with more than 1000 potentially contaminating organic substances more than 50 million tons of condensate have been returned in the past since the introduction of the **Organic X Monitors**. Because of the very short response time of less than 60sec the Organic X Monitors directly monitor and decide which condensate is good and can be re-used as boiler feed water and which condensate has to be rejected due to contamination. Since all power stations are run at very high temperatures and pressures – one station is run even over-critically - the quality requirements for the feed water are extremely high. 3000 times condensate returns were rejected automatically because of organic contamination but in no case an increase of conductivity occurred in one of the boiler or in the steam produced.

User interface

A colour touch-panel is installed for visualisation of results and parameter setting.

Log-files

Measurement results and error codes are stored in two separate log-files. The files can be downloaded we a standard LAN-cable and internet browser.

Maintenance

The UV-lamp has to be replaced every 3000h. A maintenance message appears on the display and an (optional) maintenance output is triggered.
The replacement takes only a few minutes and no special tools are required.
Depending of the condensate quality the ion-exchangers have to be replaced if installed.
If a new column is at hand the replacement is done in less than a minute.

ProzessAnalysenInstrumente GmbH

Grüner Ring 6
D-27432 Hipstedt

Tel.: (+049) 04768-922100
Fax: (+049) 04768-922101

email: info@p-a-i.de
Web.: www.p-a-i.de

Outputs

Analog outputs
2x 4 – 20mA (0 – 20mA option).

Fault contact
Is triggered if a malfunction of the analyser occurs.

Maintenance contact (optional)
Is triggered in case of maintenance request.

Threshold contacts (optional)
Is triggered if an user adjustable threshold is exceeded.

Multiplexer (optional)

A multiplexer can be installed for up to 8 channels. In this case 8 separate analog outputs are installed.

ATEX-Version

For installations in hazardous areas an explosion proof version of the **Organic X Monitor *LC*** is available.

ProzessAnalysenInstrumente GmbH

Grüner Ring 6
D-27432 Hipstedt

Tel.: (+049) 04768-922100
Fax: (+049) 04768-922101

email: info@p-a-i.de
Web.: www.p-a-i.de

Specifications:

Principle of operation:		Conductivity after UV-digestion
Range:		0,01 – 1mg-C/l
T_{90}:		> 1 Min. < 3 Min.
Detection limit:		10µg/l, lower for some compounds
Measuring channels:		Max. 8 (option)
Sample:		Condensate, ultra pure water, cond. < 20µS/cm
	Pressure:	No pressure
	Flow rate:	2l/h
	Temperature:	> 0 - 30 °C (higher temperatures with optional sample cooler)
Alarms:		System fault, NC/NO Threshold, NC/NO (option) Maintenance request, NC/NO (option)
Analog outputs:	*Max.8*	(0)4 – 20mA, galvanically isolated, max. 500 Ohms
Display:		4”-colour-touch panel
Communication:		Ethernet, Profibus (optional), Modbus (optional)
Environmental cond.:		Indoor installation
	Rel. humidity:	5 – 95% (not condensing)
	Temperature:	10 – 40 °C
Housing:		Wall mounting, stainless steel and plastic
	Dimensions:	Width: ±400 mm x depth: ±270 mm x highth: ±910 mm
	Weight:	±30 kg
Infrastructure:	*Mains:*	220/240 VAC, 50/60 Hz
	Instrument air:	Dry and oil free ISA-S7.0.01-1996 (optional for air purge)
	Waste:	Atmospheric open sink

Errors and omissions accepted! Technical data are subject to change!
Vers. 2016

ProzessAnalysenInstrumente GmbH

(주)엠씨마스터스 MC Masters Measurement & Control

Grüner Ring 6
D-27432 Hipstedt

Tel.: (+049) 04768-922100
Fax: (+049) 04768-922101

email: info@p-a-i.de
Web.: www.p-a-i.de