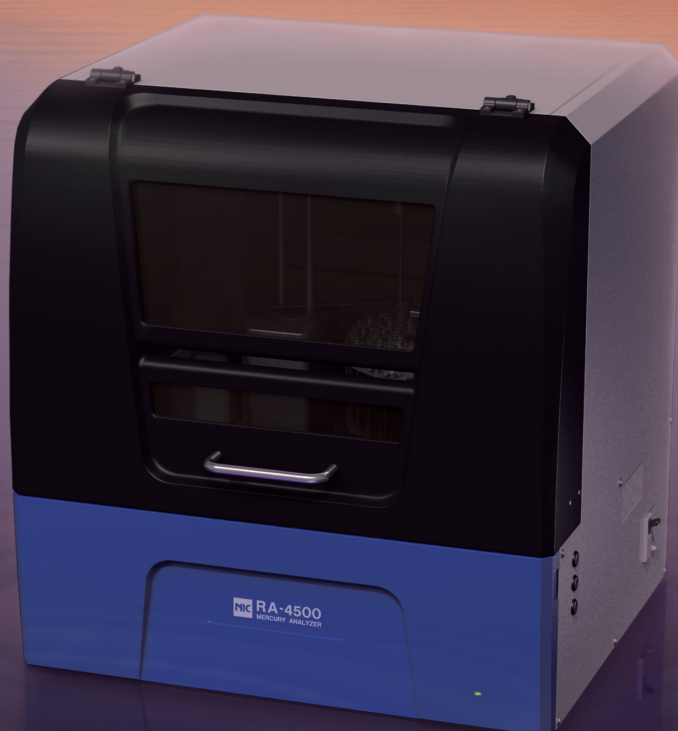# Innovation Beyond The Horizon

Revolutionizing Mercury Analysis by Cold Vapor Atomic Absorption to Include Fully Automated Sample Digestion and Analysis.
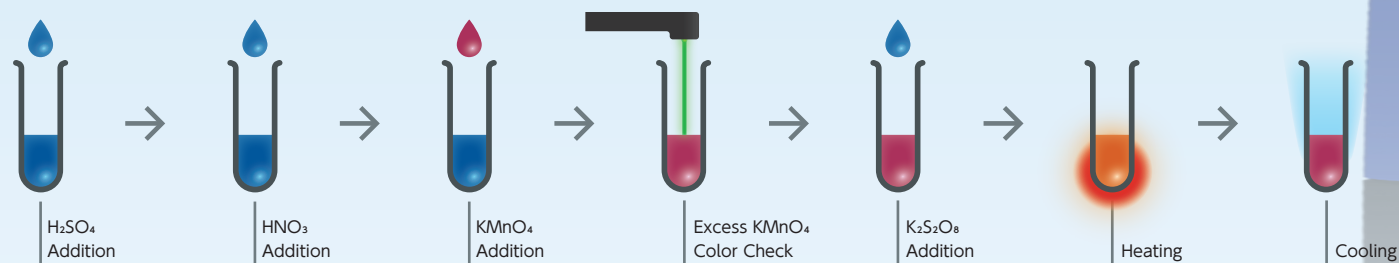
Model RA-4500 : Fully Automated Sample D
for Mercury···Seamless Automation from St

Mercury is released into our atmosphere through a combination of natural and man-made events on a daily basis. Once in the atmosphere, mercury finds its way into our water sources, where bacteria and other mechanisms convert the mercury to various organo-mercury species that are more bio-available and also more toxic to humans. Mercury also bioaccumulates in many fish species that are eaten by humans, making the detection and monitoring of mercury in our lakes, rivers, seawater, and even wastewaters highly important.

Since mercury is present in both organic and inorganic species, it is necessary to be able to accurately measure it in all its forms. This is accomplished by the acid/oxidant digestion process, which converts all forms of mercury in the samples to the oxidized and water-soluble inorganic species ($Hg2+$), which is then analyzed by CVAAS. The NIC Model RA-4500 accurately and precisely adds all necessary acids and oxidants to each sample, verifies the inclusion of excess oxidant, heats and cools all samples, quenches the excess oxidant, and then performs mercury analysis by CVAAS in one fully automated, seamless, and unattended operation. The operator only needs to add samples and press START···the RA-4500 will take care of the rest.

The RA-4500 is fully compliant with traditional mercury analysis methods, such as US EPA Methods 245.1, 245.2, & 7470A, JIS K0102, APHA 3112, EN 1483, and more.

Mercury Analysis in Aqueous Matrices is Accomplished in Ten Fully Automated Steps

| H_2SO_4 Addition | HNO$_3$ Addition | KMnO$_4$ Addition | Excess KMnO$_4$ Color Check | $K_2S_2O_8$ Addition | Heating | Cooling |

## Effective Acid Digestion is Achieved with Precise Thermal Control

The turntable style autosampler tray is also used as the heating block for samples through the use of innovative infrared heating technology, which provides rapid and precise temperature control. The heating block is equipped with an over-temp circuit for safety and also includes a NIST-traceable calibration protocol to ensure regulatory compliance.
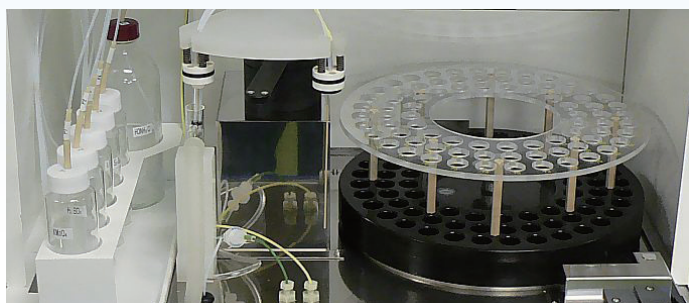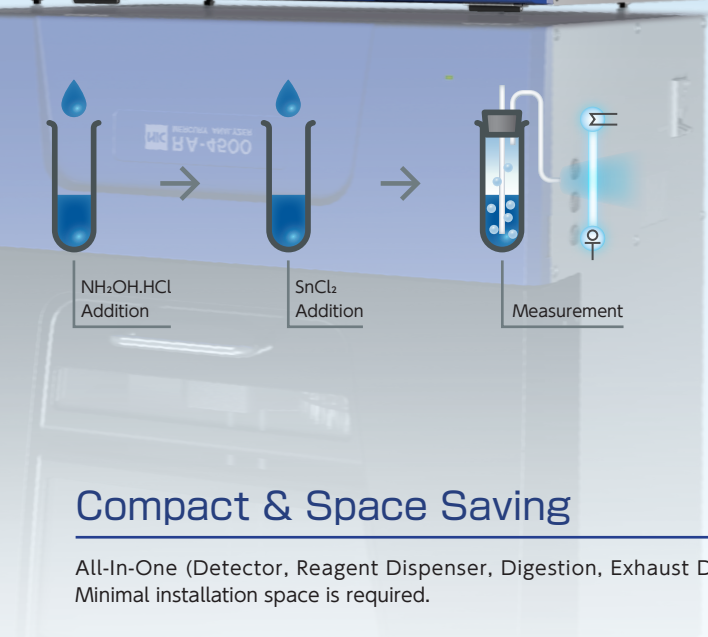
Excellent Precision and Repeatability

Advanced detector design significantly reduces noise levels, allowing for accurate and precise measurements down to 1 part-per-trillion (ppt), or less.
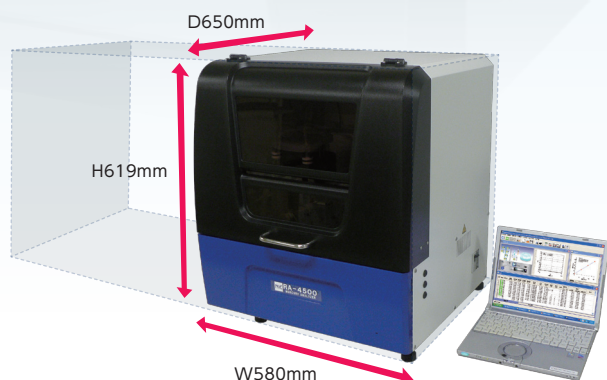
RA-4500 Profile

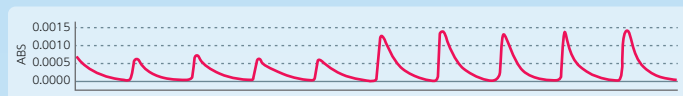0.5ppt   1.0ppt
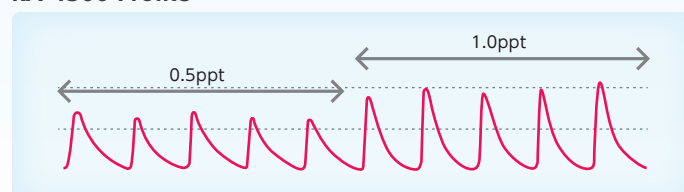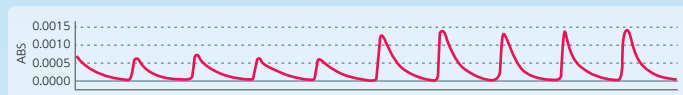
Digestion and CVAAS Start to Finish

Proven Recovery with Precision

RA-4500 provides full recovery of organic and inorganic mercury, even at low concentrations.

HgCl₂

Sample name	N	Average	C.V.
0.02µg/L STD solution	5	0.020 µg/L	0.5%
0.05µg/L STD solution	5	0.050 µg/L	0.7%

MeHgCl

Sample name	N	Average	C.V.
0.02µg/L STD solution	5	0.020 µg/L	1.1%
0.05µg/L STD solution	5	0.051 µg/L	0.3%

| Sample name	N	Average	CV	Recovery
Sea water	5	0.0058 µg/L	11%	- - -
Sea water + 0.02µg/L HgCl₂	5	0.0250 µg/L	3.1%	96%
Sea water + 0.02µg/L MeHgCl	5	0.0254 µg/L	4.3%	98%
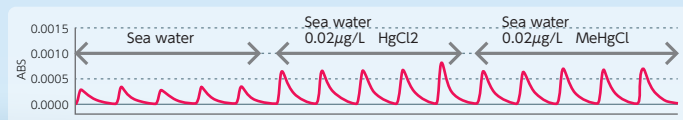
Non-contact LED Color Light Sensor

Newly designed LED color sensor does not contact the sample in any way while verifying the permanganate oxidant strength in each sample. The acids/oxidants are also located on a separate injection head from the reductants. These features virtually eliminate any possible cross-contamination from sample to sample.

Compact & Space Saving

All-In-One (Detector, Reagent Dispenser, Digestion, Exhaust Duct). Minimal installation space is required.

NH₂OH.HCl Addition → SnCl₂ Addition → Measurement
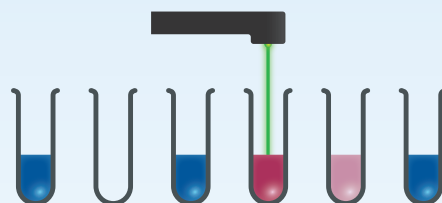
Easy to Use / User Friendly Software

RA-4500 Win software is specifically designed for quick learning and easy operation. The software includes animated graphics that illustrate real-time system operations, spreadsheet-style sequence tables, and data verifying proper operations such as color checks, heating temperatures, etc. The software also includes an automatic "System Self-Check" that tests the critical components of the system automatically and returns a report of results.
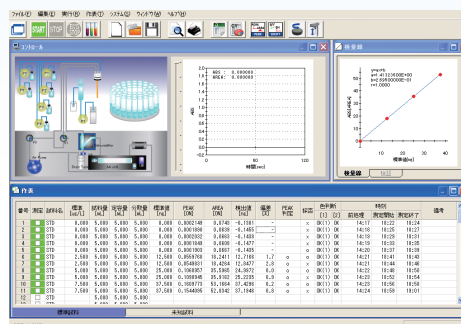
SCHEMATIC DIAGRAM
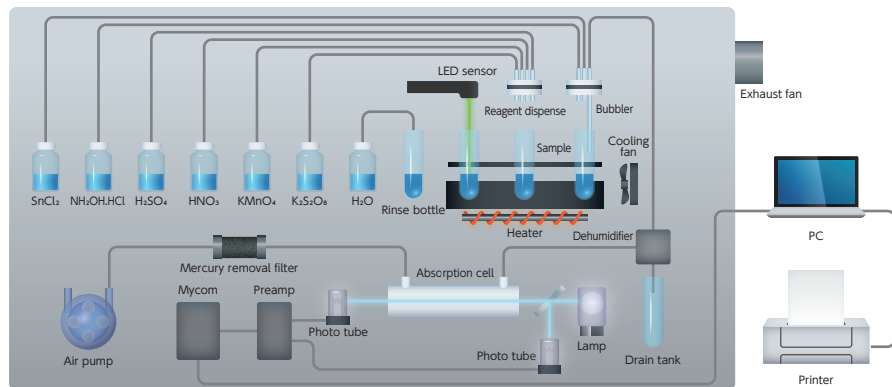
APPLICATIONS

The RA-4500 measurement technique is suitable for a wide variety of aqueous samples, including drinking waters, industrial wastewaters, river waters, lake waters, seawaters, rain-runoff, and more.

SPECIFICATIONS

Sample treatment section	Number of sample	80
	Drive system	Turn table system
	Heating method	Infra-red radiation heater
	Sample tray	Acid-resistant Aluminum
	Heating temperature	95±5℃ (within 90min)
	Cooling method	Cooling fan (Room temperature-10℃)
	Stirring method	Magnetic stirrer
	Sensor for "with /without sample and KmnO4 color"	Photo sensor
	Sample container	Glass (50pcs) ※Disposable tube is also available
	Bubbler	Reagent-resistance resin bubbler
Reagent dispenser section	Dispensing	Delivered with a tube pump
	Dispensing volume	Adjustable
	Dispensed reagents	Sulfuric acid, Nitric acid, Potassium permanganate solution, Peroxide potassium disulfate solution, Hydroxylamine hydrochloride solution, Tin (II) chloride solution, Distilled water
Mercury detecting section	Measurement principle	Non-dispersive double-beam cold vapor atomic absorption
	Measurement method	Reducing vaporization with open air-supply (Peak height measuring and integration measuring selectable)
	Light source	Low pressure mercury discharge lamp
	Wave length	253.7nm
	Detector	Photo-tube
	Detection limit	0.0025ng/5mL (0.5ppt) ※5ppt in case of including chemical treatment
	Maximum range	500ng/5mL (100 ppb)
	Measuring time	120sec〜300sec
	Mercury removal	Absorption by activated carbon
Body case	Safety system	Lock system (Running)
	Exhaust capacity	1.6〜1.8m3/min (Sirocco fan)
Data processing system (PC-Win/RA-4500)	OS	Windows 7
	Communication	Ethernet (One-to-one for RA-4500, not for in-house LAN)
	Display	Peak wave shape, Calibration curve, Measuring time and Measuring result
	Control software	Start/stop measuring : Controllable Pretreatment conditions : Heating conditions setup (Heating temperature, heating time), Reagent dispensing volume setup
	Data processing software	Selectable from 6 formulas (3 linear and 3 3rd Order fits), Correlation coefficient is automatically calculated. Statistic calculation : Mean value, Standard deviation, Coefficient of variation (All values are automatically calculated.)
	Print	Measuring conditions, Calibration curve, Measured values, Statistical calculations, Peak wave shape and Measuring time
	Quality control	Check standard, Avoid abnormally high mercury etc.
Installation requirements	Installation dimensions	580W × 650D × 619H (mm)
	Weight	42kg
Power supply	(1) AC 100, 220〜240V 50/60Hz (2) Voltage variation : within ±5% (3) Power capacity : 1.5kVA (Excluding PC and printer) (4) Power quality : Non surging, no high-frequency waves, and noiseless. (5) Distance from power supply : 2m or less (6) Ground-fault circuit interrupter : 15mA (7) Grounding : Grounding terminal with ground resistance of 100Ω or less	

ACCESSORIES

Duct hoseφ75 (flexible: 2m-5m) [Q'ty 1] / Duct hose adaptorφ75 [Q'ty 2] / Hose band [Q'ty 2] / Power cable 2m [Q'ty 1] / Plug adaptor [Q'ty 1] / Sample container [Q'ty 50] / Stirrer [Q'ty 50] / Bubbler (for spare) [Q'ty 1] / Mist catcherφ25 (for spare) [Q'ty 2] / Screw driver [Q'ty 1] / L-cysteine 1g [Q'ty 1] / Waste bottle 2L [Q'ty 1] / LAN cable 2m [Q'ty 1] / CD-ROM for Window soft [Q'ty 1] / Instruction manual [Q'ty 1] / Simplified instruction manual [Q'ty 1]

CE

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