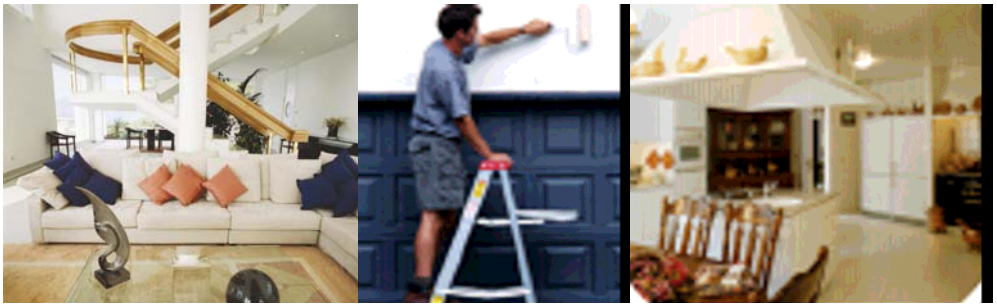
Formaldehyde Analyzer



YOUNG LIN INSTRUMENT

1. Product

Young Lin Formaldehyde Analyzer

2. Purpose

The Young Lin Formaldehyde Analyzer offers a perfect solution for accurate, efficient, and ease of operation process for the quantitative measurement of airborne aldehyde compounds by providing sampling procedures and detailed sample preparation protocols.

Volatile organic compounds are known to cause sick building syndrome, which can lead to respiratory illnesses. Formaldehyde is one of the major irritants of the respiratory tract, which necessitates the monitoring of work space environments for its presence.

The Young Lin Formaldehyde Analyzer represents the best solution for the analysis of formaldehyde derivatives by providing the most appropriate system configuration to monitor indoor air quality.

Refer to the emission rate regulation for Aldehyde compounds located on the last page of this presentation for current limits of formaldehyde levels established for indoor air quality.

3. Principle of Analysis

The procedures for the measurement of Formaldehyde levels in indoor air is categorized by sample collection, sample preparation and analysis.

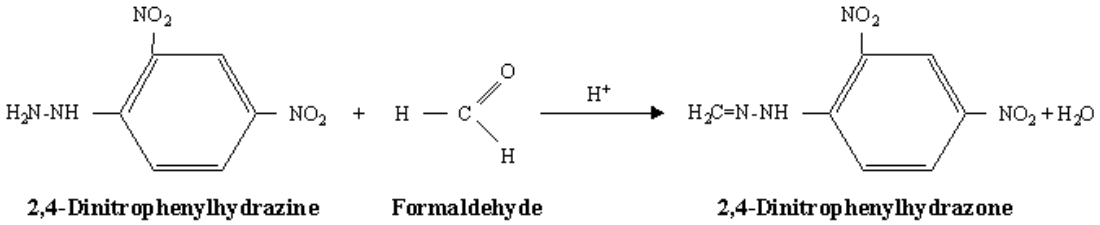
1) Sample collection

Collect an indoor air sample using the silica gel cartridge coated by 2,4-dinitrophenylhydrazine (DNPH). For sampling, the system consists of an Ozone Scrubber, a LpDNPH Cartridge, a flow meter with a pump and a Teflon tube.

Generally, if the ambient indoor air temperature is higher than 20^{o}C, the volume of the

collected sample will approximate 15-30 L at a 200-1000 ml/min flow rate of the sampling pump. Once a sample of the targeted indoor air has been collected, any formaldehyde present immediately reacts with the DNPH to form the derivative 2,4-Dinitrophenylhydrazone.

The derivative 2,4-Dinitrophenylhydrazone is detected by UV/VIS absorbance at the 360nm wavelength. Quantify the Formaldehyde level in the indoor air sample by chromatogram's peak's height or area.



[Fig.1.] Reaction of Formaldehyde with 2,4-Dinitrophenylhydrazine to form the derivative 2,4-dinitrophenylhydrazone

2) Sample Preparation

Collected indoor air sample by the silica gel cartridge should be immediately wrapped with aluminum foil to block the light. Store the sample in a cold and dark place of less than 4°C. The sample should be analyzed as soon as possible.

Prior to injecting the sample in the Formaldehyde Analyzer, add 5 ml of Acetonitrile into the cartridge for extract.

3) Sample Analysis

Before injecting the collected indoor air sample into the Formaldehyde Analyzer, the system must be stabilized. Prepare an eluant, and run the Formaldehyde Analyzer at a flow rate of 1.0 ml/min for 20-30min to stabilize the system. To verify system stabilization, check whether the signal emitting from the Formaldehyde Analyzer data system reaches equilibrium.

Inject the collected indoor air sample into the injector valve of Formaldehyde Analyzer with a Micro-syringe for Formaldehyde Analyzer or Autosampler.

When all DNPH-Formaldehyde derivatives or Carbonyl compounds are extracted and completed the analysis, prepare additional samples for analysis following the above procedures.

However if the detection limits of the Formaldehyde Analyzer are exceeded, dilute the sample or decrease the amount of sample.

In addition, if the retention time of the targeted constituent is different from the initial analytical condition (within ±5 % in the detection time of targeted constituents), control the retention time by adjusting the mixing ratio of Acetonitrile and water.

4. Configuration (P/N: YLAN-0300)

- Solvent delivery module
- 4 channel vacuum degasser & mixer
- Manual Sample Injector with switch
- UV/Vis detector
- Data system
- Accessories
  - performance Kit
    - Solvent Clarification kit, 220V
    - 100ul syringe
    - C18 column for analysis of Aldehydes
    - LpDNPH Cartridge
    - LpDNPH Cartridge adaptor
    - Ozone Scrubber
    - DNPH-Aldehydes standard solutions
    - Mail Luer fitting
    - Rack(vacuum) for extraction
    - Sampling pump

- Option: Autosampler (MIDAS)

5. Features and Advantages

Features	Advantages
An easy and straightforward analysis for Aldehyde compounds	An accurate, efficient, and user friendly system for the analyses of Aldehyde compounds
Minimal maintenance costs	An economical system that reliably operates with minimal maintenance costs
Only minute indoor air samples are needed for accurate analyses	Consistently accurate and reliable results
Results are presented in real time by use of a precise solvent delivery and dual wavelength detector systems	Results are consistently reproducible and reliable
Control of the system by the installed software	Operation of system is easy and convenient.

6. Reference

1) Analytical Method: Young Lin Formaldehyde Analyzer

Factors	Condition
Column	C-18Column - 250mm x 4.6mm
Eluant	Acetonitrile/Water = 60/40 (v/v) or Other appropriate solvents for separation
UV/Vis Detector	360nm
Flow Rate	1.0mL/min
Injection Vol.	20μL

2) Calculations

$C_A = (A_s - A_b) \times V \div Q$

C_A : Concentration level of formaldehyde in indoor air

A_s :Value of sample analysis in indoor air (㎍/mL)

A_b : Value of blank DNPH cartridge ㎍/mL

V : Acetonitrile extract volume (mL)

Q_i : Total sampling amount (㎥)

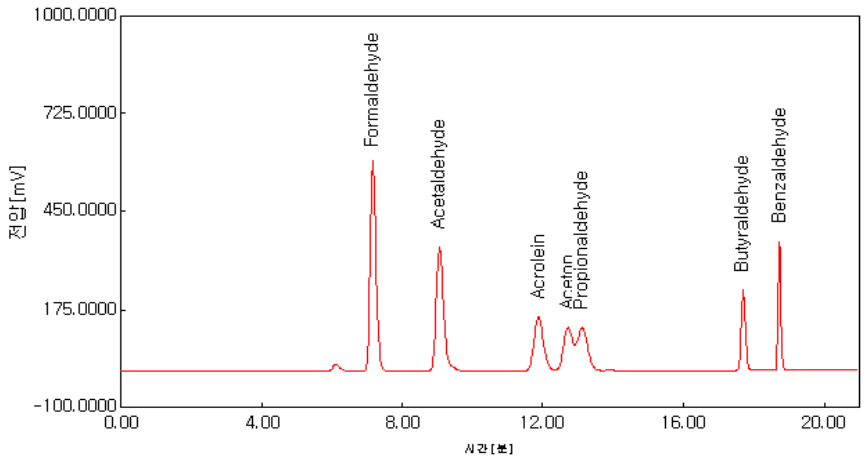
※ To convert concentration values from ㎍/㎥ to ppb first adjust the results derived as ㎍/㎥ to their corrected values at 1.0 psi at 20°C.

3) Results and Discussion

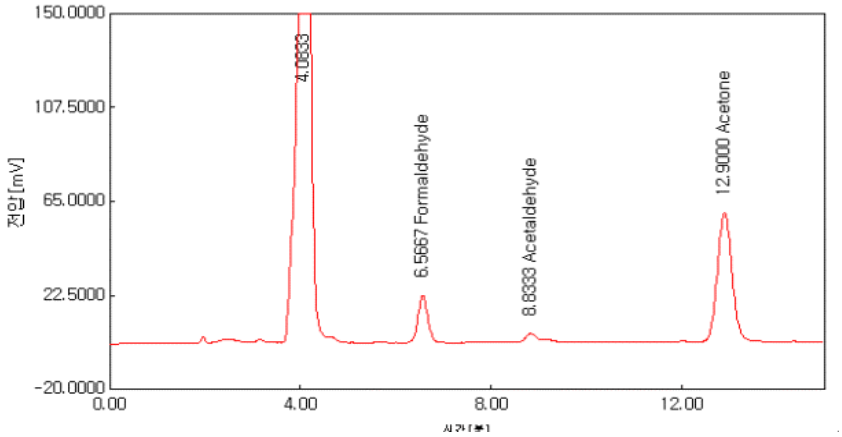
Such results for air samples collected from indoor living and working environments can be compared with existing limits of airborne

Formaldehyde samples collected from indoor living and working environments are analyzed by the derivatization with 2,4- dinitrophenylhydrazine.
In general, the ratio of Acetonitrile to purified water is 60:40 which is regulated by the Department of Environment. Then the ratio of Acetonitrile increases if an elution time is long, or vice versa.

The Young Lin Formaldehyde Analyzer represents the best solution for the analysis of formaldehyde under U.S. EPA regulations for indoor air quality, which have been adopted by the Korean Ministry of the Environment.



[Fig. 2] Chromatogram of Aldehyde Standards



[Fig. 3] Chromatogram derived from an indoor air sample analysis conducted using the Young Lin Formaldehyde Analyzer.

7. Applications

- Analysis of Formaldehyde or Aldehydes in indoor air
- Analysis of Aldehydes included in the odor
- Analysis of Formaldehyde or Aldehydes included in building materials
- Analysis of other Aldehydes

8. Regulation of Aldehyde compounds

1) Regulation of indoor air quality (Korea) - Formaldehyde

Classification	Items	Method	Standards
Building	HCHO	2,4-DNPH Derivatization Analysis	120ug/m3
House	HCHO	2,4-DNPH Derivatization Analysis	-
Building Materials	HCHO	2,4-DNPH Derivatization Analysis	Glue: mg/m^2*hr General Materials: 1.25 mg/m^2*hr

2) Aldehydes Compounds related to the odor (Korea)

Compounds	Regulation of Concentration (ppm)	Industrial Area (ppm)	Others (ppm)	Executed Time
Acealdehyde	0.05-0.1	0.05	0.1	From Feb.10 2005
Propionaldehyde	0.05-0.1	0.05	0.1	
butyraldehyde	0.029-0.1	0.029	0.1	
n-valeraldehyde	0.009-0.02	0.009	0.02	
i-valderaldehyde	0.003-0.006	0.003	0.006	

3) Aldehyde compounds related to the odor (Japan)

Compounds	Regulation of Concentration (ppm)	Smell	Major Sources
Acealdehyde	0.005-0.5	Pungent odor and smell of burning,	Paints manufacturer Printing Ink manufacturer Glue manufacturer Wood and Furniture manufacturer
Propionaldehyde	0.05-0.5		
n-butyraldehyde	0.009-0.08		
i-butyraldehyde	0.02-0.2		
n-valeraldehyde	0.009-0.05		
i-valderaldehyde	0.003-0.01		