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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by Japan Analytical Instruments Manufacturers' Association (JAIMA)/Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently **JIS K 0126**:2001 is replaced with this Standard.

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General rules for flow analysis

1 Scope

This Japanese Industrial Standard specifies the common matters in the case of carrying out the quantitative analysis of inorganic matter and organic matter by using the flow analyzer. The flow analysis indicates mainly the flow injection method, continuous flow method and sequential injection method, however this Standard applies to the flow injection method and continuous flow method.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS K 0050 *General rules for chemical analysis*

JIS K 0211 *Technical terms for analytical chemistry (General part)*

JIS K 0212 *Technical terms for analytical chemistry (optical part)*

JIS K 0213 *Technical terms for analytical chemistry (Electrochemistry part)*

JIS K 0214 *Technical terms for analytical chemistry (Chromatography part)*

JIS K 0215 *Technical terms for analytical chemistry (analytical instrument part)*

JIS K 0557 *Water used for industrial water and wastewater analysis*

3 Terms and definitions

For the purposes of this Standard, the terms and definitions specified in **JIS K 0050**, **JIS K 0211**, **JIS K 0212**, **JIS K 0213**, **JIS K 0214** and **JIS K 0215** and the following apply.

3.1 flow analysis

the analytical method to detect and determine continuously the component produced by the reaction of sample with reagent in the flow

3.2 flow analyzer

the quantitative analyzer by utilizing flow analysis

3.3 flow injection method

the analytical method in which sample or reagent is introduced respectively in the flow of reagent or sample in a tube, reaction operation, etc. are carried out, and then the analytical component is detected at the detection part provided downstream and determined

3.4 flow injection analysis (FIA in brief)

the quantitative analysis by using flow injection method

3.5 continuous flow method

the analytical method in which gas is introduced in the flow of reagent or sample in a tube and segmented, after reaction operation, etc. are carried out by introducing sample

or reagent respectively, analytical component is detected at the detection part provided downstream and determined

3.6 continuous flow analysis (CFA in brief)

the quantitative analysis by using continuous flow method

3.7 flow system, manifold

a flow system of fluid flowing in the instrument connected with a tube in a flow analyzer

3.8 flow injection titration method

the method to obtain the concentration from the width of response curve obtained after introducing the sample into flow of reagent, dispersing and reacting them sufficiently by mixer

In the case of using various buffer solutions as reagent, the degree of dispersion shall be less than medium by using no mixer and the peak height of response curve shall be used for determination.

3.9 merging zone method

the method of introducing the sample and/or reagent respectively in the flow of two carriers and merging

3.10 double injection method

the method to introduce the sample with changing the concentration or amount with separating into two places in the flow

3.11 sandwich injection method

the method to introduce the sample and reagent at the same time from the plural injectors provided at the same place in the flow system

3.12 stopped flow method

the method to stop temporarily the flow of carrier

There are two methods such as the method to observe the change of reaction time by stopping in the flow cell of detector and the method to prolong the reaction time by stopping in the mixer and restraining dispersion.

3.13 segment

the divided layer (band) generated when gas, sample, reagent, organic solvent or the like is introduced into the fluid in a tube

3.14 merging point

the place where two or more flow passages join to one

3.15 response curve

a profile obtained by recording signals from the detection part

3.16 carrier

the fluid to carry sample or reagent in a tube

3.17 pump

an instrument to send fluid

3.18 tube

a tube to compose the flow passage of fluid

3.19 injector

a device to introduce sample or reagent into the fluid in a tube

3.20 debubbler

a device to remove the bubbles introduced in a tube

3.21 mixer

parts or a device to mix sample and reagent

3.22 reactor

parts or a device to react sample and reagent

3.23 extractor

parts or a device to extract a specific component in the sample

3.24 phase separator

a device to separate water phase and organic phase

3.25 gas separator

a device to separate gas segment and liquid segment or to separate dissolved gas from the liquid

3.26 concentrator

a device to separate and concentrate a specific component in the sample

3.27 divider

a device to divide one flow passage to plural flow passages

3.28 dialyzer

a device to separate the specific component in the sample by using semipermeable membrane, etc.

3.29 distillater

a device to separate and purify the specific component in the sample by distillation operation

3.30 reaction part

the part where the treatment of sample or the various kinds of reaction are carried out

3.31 sequential injection method

the analytical method in which the sample and reagent are successively introduced in non-continuous flow, the reaction, etc. are carried out and then the analytical component is detected at the detection part provided downstream and determined

3.32 sequential injection analysis (SIA in brief)

the quantitative analysis by using sequential injection method

4 Instruments

4.1 Flow injection method

4.1.1 General

This is the method in which the sample or reagent is introduced in the flow of reagent or sample not segmented by gas in a tube respectively, the reaction operation, etc. are carried out and then the analytical component is detected at the detector provided downstream and determined.

4.1.2 Composition of instrument

The flow injection analyzer is composed of liquid-feed part, sample introducing part, reaction part, detection part, tube and indicating/recording part. An example of the basic composition is shown in figure 1. The sample, reagent and carrier form a continuous-flow system in a tube.

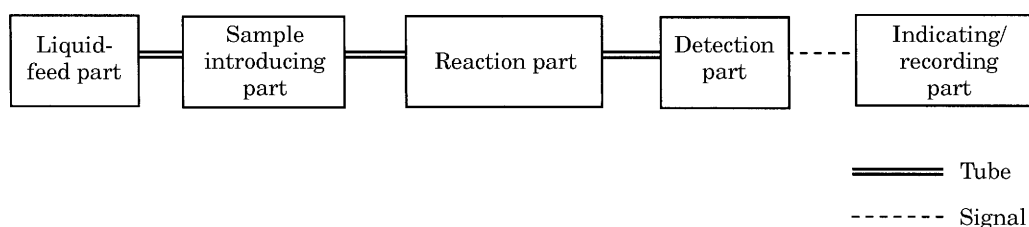


Figure 1 Flow injection analyzer (an example)

a) **Tube** The tube composing flow passage of liquid shall satisfy the following conditions:

- 1) That is excellent in chemical resistance.
- 2) That resists the working pressure.
- 3) That has a uniform inside diameter.
- 4) That is less sensitive to temperature.

NOTE 1 For the tube, usually the fluororesin, polyethylene, polypropylene, stainless steel pipe, etc. of 0.25 mm to 1.5 mm in inside diameter and 0.8 mm to 3.0 mm outside diameter are used in many cases.

NOTE 2 For the connection of tube, the various type connectors of plastics are used in many cases.

b) **Liquid-feed part** The liquid-feed part is the part to feed liquid of sample, reagent and/or carriers, which is composed of pump, damper, etc. and satisfies the following conditions.

- 1) Accuracy of constant flow rate is high.
- 2) Pulsating flow is small.
- 3) Material of part in contact with the solution is excellent in chemical resistance and corrosion resistance.

c) **Sample introducing part** That is the part to introduce the sample into the instrument, and as follows.

- 1) That is able to make segment by introducing the sample into the flow in a tube by using the introducing device, confluence type of flow passage, etc.

NOTE : In same cases, the segment is formed by introducing the reagent into the flow of sample or carrier.

- 2) By using plural flow passages, that is able to be so arranged that the sample and reagent are joined in flow.

d) **Reaction part** There are the part to carry out division and dilution and the part to carry out the reaction with reagent, extraction, concentration, gas separator, etc. in the reaction part. That is capable of carrying out the treatment and reaction of sample by the combination of tube and the following devices.

- 1) **Divider** That is used so that the flow passage is divided, and connected to different multiple reactors or introduced to multiple analytical systems.
- 2) **Mixer** That is used for mixing carrier or reagent solution and sample. Usually, the mixing coil of tube wound in coil or 8-shaped is used. In addition, the column packed with chemically inert matter such as glass beads, polymerbeads or small mixing chamber (inside capacity 100 μ L to 1 000 μ L) is used in some cases.

NOTE : The mixer is also used for the reactor.

- 3) **Reactor** That is used for reacting chemically sample and reagent. Usually the same one as the mixer is used. In addition, the column packed with ion exchange resin, reducing agent, enzyme, catalyst, etc. and the inner wall of tube with enzyme immobilized are also used. There is the one provided with temperature control function for maintaining the reactor at a definite temperature.
- 4) **Extractor** That is used for extracting only the object component mainly by utilizing partition function. The extractor consists of the segmentor, extracting coil and phase separator.
 - 4.1) The segmentor joins the water phase and organic phase at this part and forms the regular segment of each phase.
 - 4.2) The extracting coil is used so that the object component is extracted from water phase to organic phase or from organic phase to water phase.
 - 4.3) The phase separator is to divide the segment of water phase and organic phase into the flow of each phase.

NOTE : The extraction efficiency is influenced by the geometrical arrangement of separator, the flow rate of both phases, etc.

- 5) **Concentration** That is used for the concentration of object component. The column packed with ion exchange resin, chelate resin, hydrophobic resin, etc. is mainly used.
- 6) **Gas separator** That is used separating the gas component from the inside of flow. The analytical component in sample is made to gas by evaporation or reaction and absorbed in absorbing solution through gas permeable membrane (pipe wall).