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TRH-3
Turbidity Meter

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I. Summary

TRH-3 scattered light turbidity meter is used for measuring the degree of light scattering generated by the insoluble grain matters suspended in water or transparent liquids.

It adopts the Formazine standard solution of turbidity specified in international standard ISO7027, and NTU as the measure unit.

II. Applications

It can be broadly applied in the measurement of turbidity in power plants, waterworks, treatment stations of domestic sewage, beverage factories, environmental protection departments, industrial water, wine and pharmaceutical industries, epidemic prevention divisions, hospitals etc.

III. Features

a) AC & DC power supply, low power consumption, handheld contour design, for field and lab use.

b) Auto power-off function and low power usage prolongs battery life.

c) Large LCD display

d) Low-drift and high-accuracy integrated circuit, with long-life light source

e) Low battery indicator

g) 0 to 2V output measured value

IV. Specifications

a Measuring principle: 90°scattered light
b Measuring range: 0~20 NTU
c Min. indicating value: 0.01 NTU
d Accuracy: ±8%（±2.5% F.S）
e Repeatability: ≤1%
f Zero drift: ≤1% F.S
g Power supply: DC 1.5V, 5 AA alkaline dry cells
AC 110V/50Hz DC7.5V 0.2A power supply adapter
h Signal output: 0~2V, impedance >100KΩ

V. Warnings

TRH-3 scattered light turbidity meter is a photoelectric fine measuring instrument. You should carefully read and comprehend the instruction manual before operation.

a) When changing batteries, observe polarity, otherwise the instrument may be damaged.

b) The measuring cell, it must be kept clean, dry, and dust free. Install light shading cover when not in use.

c) In humid conditions, readings may take longer.

d) The solution to be measured should be poured in along the test bottle wall to prevent the generation of air bubbles, which negatively affect the measuring exactness.

e) Unit must be recalibrated after changing test bottles or standard solution, or after service.

f) When the upper left corner of the screen indicates “LOBAT”, the battery should be changed.

VI. Work Conditions

a) The instrument should be placed on a level and smooth surface, avoiding direct light.

b) The instrument should be kept away from strong vibrations and strong magnetic field interference.

c) There should be no flamable dust or corrosive gas in the ambient air.

VII. Preparation for Measurement

a) Press the power switch on the left of the instrument, and allow the unit to warm up for 30 seconds;

b) Wipe the test bottle with paper towel free of oil (glass cleaner can be used if needed)

c) Prepare the water of zero turbidity for zero adjustment and Formazine standard solution of 10NTU for calibration;

d) Obtain sample with a clean container.

VIII. Measuring Procedure

a) Place test bottle filled with zero turbidity water into the sample holder and make sure that the scale line of the test bottle is aligned with the white position line on the sample holder, and then cover with the light shading cover;

b) Turn the “Zero Adjust” button after getting a stable reading, until the display reads zero

c) Load the standard solution into the sample holder adopting the same method, and turn the “Correction” button, to make it indicate the nominal value;

d) Repeat steps a), b), and c), until the zero point and standard value are reliable;

e) Load the test bottle, and note down the turbidity value of the water sample after stable.

f) The instrument will automatically shut down in 15 minutes after start-up.

IX. Calibration of Nominal Values

Calibration of nominal values must be performed after changing test bottle, damaging test bottle, invalidation of standard solution or servicing instrument.

a) Prepare 100ml standard solution of 10 NTU turbidity, and a pure water zero turbidity solution.

b) Pour the prepared standard solution of turbidity in 10 NTU into the correcting test bottle to the scale line, and then screw on the bottle lid. Make sure the lid edge is free of leaks. Wipe any water marks and fingerprints from the bottle surface. Do not touch the bottle surface directly, so as to avoid leaving fingerprint which would affect the measuring accuracy.

c) Carefully pour the zero turbidity water into the zero adjusting test bottle and the sample test bottle using the same method;

d) Start and warm up the instrument, place the zero calibrating sample bottle loaded with zero turbidity water into the sample holder and make sure that the scale line of the sample bottle is aligned with the white position line on the sample holder, and then cover with the light shading cover.

e) Turn the “Zero Adjust” button after getting a stable reading, until the display reads “0.00”;

f) Remove the 0.0 sample test bottle and load the standard solution of 10 NTU into the sample holder

g) Using the same method, and turn the “Correction” button after getting a stable reading, until it displays “10.0”.

h) Repeat steps until the zero reading and standard values are reliable.

i) Place the zero adjusting test bottle loaded with water of zero turbidity into the sample holder using the same method, and label the bottle with the value after getting a steady reading.

k) Place the correcting test bottle loaded with standard solution of 10 NTU into the sample holder adopting the same method, and write the value onto the bottle lid after getting a steady reading value.

X. Measuring Technique

Obtaining accurate turbidity readings, depends on having a quality Instrument as well as good operational skills. Be sure to use clean test bottles, avoid creating bubbles when pouring samples and follow the calibration set-up in order to obtain the best turbidity readings.

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a) Measurements should be made immediately after sampling, to avoid changes caused by temperature variation and particles settling in the water sample.

b) The test bottle must be very clean without scratches. Wash the inside and outside of the test bottle with glass cleaning agent, then rinse repeatedly with distilled water, and dry in the dust free dry-box. If the test bottle needs extra cleaning, you can soak it in diluted hydrochloric acid for 2 hours, and finally rinse repeatedly with distilled water. Take the test bottle only by its upper half, so as to avoid any fingerprints in the light path.

c) It is critical to accurately prepare the standard solution of Formazine close to the expected test value. Verify calculations for standard solution prior to mixing. Completely mix the solution and fill the test bottle to the line. Mixing low turbidity standard solutions in larger volumes will reduce preparation error.

d) When selecting standard solutions values and preparing solutions, it's better to pick turbidity values a little high than those of the sample value. Notice that, the standard solutions in low turbidity are not suitable for storage due to the short shelf life. Sufficiently mix the solution before scaling, but avoid generating any air bubbles. For the measurement of low turbidity and high accuracy you must use the same test bottle to perform any scaling. Use ultraclean water when performing zero adjustment.

d) The representative water sample will reflect the turbidity of the water source. Therefore, the water samples from all sampling points must be sufficiently blended before measuring. Also avoid water samples with sedimentation and bigger particles. Remove the air bubbles from the test bottle before taking a reading. When measuring on water samples in lower temperature, condensed water drops may occur to the bottle surface. Therefore, the bottle with water samples in must be left at room temperature until the sample is close to the ambient temperature. Be sure to clean the bottle after it is at room temperature.

e) The scale line of the bottle body should be aligned with the position line on the sample holder, and the light shading cover in place, avoiding interference from stray light. When measuring the sample, the indicated value may not completely stabilize due to movement of the particles in the water sample, the value will gradually get stabilize over time. Unsteady readings may also be caused by too many air bubbles or foreign matter in the water sample. When reading are unstable use the average between the maximum and minimum values.

g) In the wine industry uses EBC turbidity units, divide the NTU value by 4 to get the EBC turbidity value.

(1EBC turbidity = 4NTU turbidity)

XII. Parts List

1. Turbidity meter
2. Power supply adapter
3. Light shading cover
4. Test bottles (3)
5. Instruction manual

Appendix 1

Preparation of water of zero turbidity

By referring to method specified under ISO 7027, select microporous filter membranes of hole diameter of 0.1μm (or 0.2μm) to filter distillated water (or electro-dialyzed water or ion exchange water) at least two times. The filtered liquid will be water of zero turbidity for setting and calibration. The zero turbidity water should be stored in a glass bottle that has been cleaned and flushed with such water.

Water of zero turbidity is used for zero setting of turbidity meter and diluting of Formazine standard solution.

Appendix 2

Preparation of Formazine standard turbidity solution

1. The supplied Formazine standard solution is 400 (NTU, FTU) turbidity. The uncertainty is ±3% and has a one year shelf life.

Formazine standard solution of different turbidity values is obtained by diluting Formazine turbidity standard solution with water of zero turbidity that are calibrated in a certified volumetric vessel.

Formazine standard solutions above 400 NTU shall be preserved in cold room (at 4-8˚C) of the refrigerator. Standard solution that has been diluted to low turbidity value is unstable and is should be disposed of soon after being used.

2. When Formazine substandard solutions are hard to obtain. They can be prepared with method specified under ISO 7027, with strict controlled conditions and reagent dosage. The method is excerpted as following:

2.1 Instrument and reagent

Analytical balance: load 200g, precision 0.1mg, calibrated and certified.

Volumetric bottle: 100ml, Grade A, calibrated and certified.

Liquid transfer tube: 5ml, Grade A, calibrated and certified.

Hydrazine sulfate ($N_2H_6SO_4$): analytical reagent, purity shall be greater than 99%.

Hexamine ($C_6H_{12}N_4$): analytical reagent, purity shall be greater than 99%.

Thermostat (or water bath): that can hold 200ml volumetric bottle, constant temperature at 25±1˚C, can operate consecutively for 24h and above.

Water of zero turbidity: see Appendix 1.

2.2 Preparation method:

a. To weigh up accurately 1000g hydrazine sulfate accurately and to dissolve it in water of zero turbidity. Transfer solution thereof to 100ml volumetric bottle and to dilute to scale, shake up and filter for spare purpose (to be filtered with microporous filter membrane of hole diameter of 0.1μm, the same)

b. To weigh up accurately 10.00g hexamine accurately and to dissolve it in water of zero turbidity. Transfer solution thereof to 100ml volumetric bottle and to dilute to scale, shake up (to be filtered with microporous filter membrane of hole diameter of 0.1μm, the same).

c. Preparation of 4000 NTU Formazine standard solution: to transfer accurately 100ml of the said solutions and to empty them into 200ml volumetric bottle and shake up. The bottle must be placed into 25±1˚C thermostat or water bath of constant temperature for 24 hours and protected against light. Thereafter, 4000 NTU standard solution is ready.

To increase the reliability of the preparation value, several groups and bottles of Formazine standard solutions may be considered to be prepared to verify the preparation consistency. Meanwhile, turbidity change of the Formazine standard solutions shall be observed. Such solution may be used only after its stability has

been verified and its turbidity change during using process does not exceed ±3 ％ . The prepared solution shall be preserved in a dark place with temperature at 4～8℃.

Appendix 3

Diluting & Preparing List of Standard Solutions of Turbidity

Total preparing volume is 100ml

Solution Strength Demanded (NTU)	Taken Volume of Raw Liquor in 400NTU (ml)
10	2.5
50	12.5
100	25

Formula of preparation: $A = \frac{K \times B}{C}$

Where: A: Volume of raw liquor (ml)

B: Solution strength required(NTU)

C: Strength of raw liquor(NTU)

K: Total preparing volume (ml)

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