

Solids, Non-filterable Suspended, Total and Volatile

DOC316.53.01204

USEPA Gravimetric Method^{1, 2}

Method 8158 and Method 8164

Scope and application: For water and wastewater.

¹ USEPA accepted.

² Adapted from *Standard Methods for the Examination of Water and Wastewater*, Section 2540B.



Test preparation

Before starting

Analyze samples as soon as possible for best results.

For the best accuracy, use as much filtered sample as possible (step 11). Samples that contain more than 15 mg of solids will clog the fiber filter disc. Adjust the correct volume of the water sample to get accurate results. Some completed tests will show if adjustments are necessary.

Always use tweezers with fiber filter discs. Moisture from fingers can add moisture to the fiber filter disc and cause a weighing error.

For Volatile Non-filterable Solids (or Residue) (VNR) preheat the muffle furnace below the recommended temperature. Do not put the watch glass directly in a 550 °C (1022 °F) muffle furnace because it can break. Put the watch glass in a 100 °C (212 °F) preheated muffle furnace and then increase the temperature to 550 °C (1022 °F) for 15 minutes.

The Total Non-filterable Solids (or Residue) (TNR) are the same as the Total Suspended Solids (TSS).

Items to collect

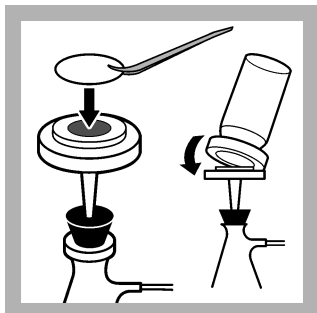
Description	Quantity
Analytical balance	1
Cylinder, graduated, 100 mL	1
Desiccator with desiccant	1
Drying oven	1
Filter flask	1
Filter holder	1
Filter, 47-mm	1
Furnace, muffle	1
Rubber policeman for 3/16 in. rod (user-supplied)	1
Tongs	1
Tweezers	1
Watch glass	1
Watch glass	1
Water, deionized	varies

Refer to [Consumables and replacement items](#) on page 5 for order information.

Sample collection and storage

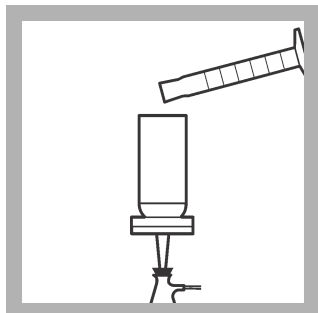
- Collect samples in clean glass or plastic bottles.
- To preserve samples for later analysis, keep the samples at or below 6 °C (43 °F) for up to 7 days.
- Let the sample temperature increase to room temperature before analysis.

Test procedure—Total Non-filterable Solids, Method 8158

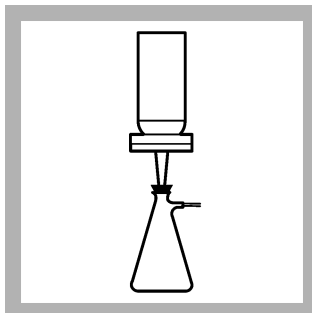


1. Use tweezers to put a fiber filter disc in the filter holder.

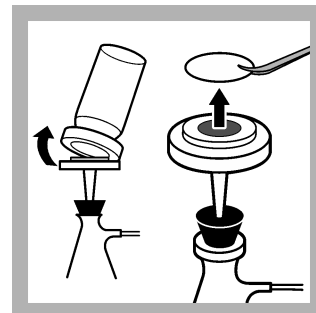
Put the filter holder assembly in the filtering flask.



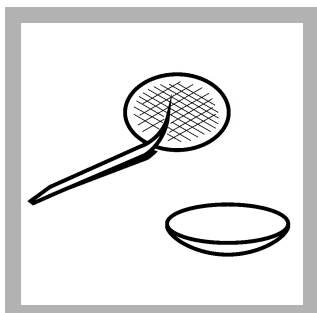
2. Use a graduated cylinder to add 100 mL of deionized water to the filtering flask.



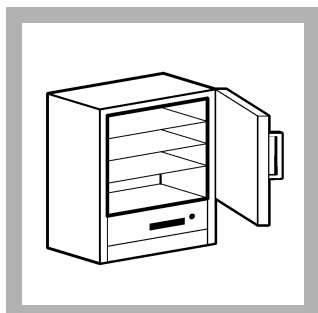
3. Apply vacuum to the flask until all of the water is pulled through the filter.



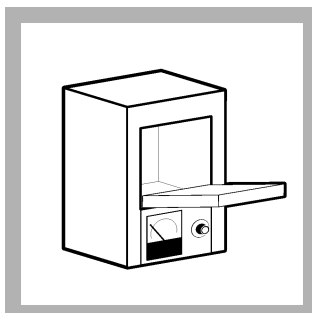
4. Slowly release the vacuum from the filtering system. Remove the fiber filter disc from the filter holder.



5. Put the fiber filter disc in a watch glass.



6. Put the watch glass with the fiber filter disc in a preheated drying oven at 103–105 °C (217–221 °F) for 1 hour.



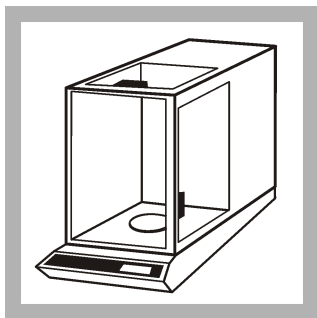
7. If Volatile Non-filterable Solids are also measured, use tongs to put the watch glass with the fiber filter disc into a preheated muffle furnace at 550 °C (1022 °F) for 15 minutes. Discard this step if Volatile Non-filterable Solids are not measured.

Note: Do not put the watch glass directly in a 550 °C (1022 °F) muffle furnace because it can break. Put the watch glass in a 100 °C (212 °F) preheated muffle furnace and then increase the temperature to 550 °C (1022 °F) for 15 minutes.



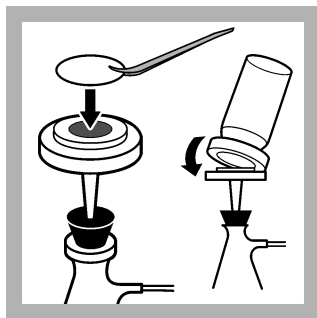
8. Use metal tongs to remove the watch glass with the fiber filter disc from the drying oven or muffle furnace and put in a desiccator. Immediately cover the desiccator. Do not seal the desiccator until the watch glass temperature has decreased a little, because pressure from the hot air inside can push the cover off.

Let the fiber filter disc and watch glass temperature decrease to room temperature.

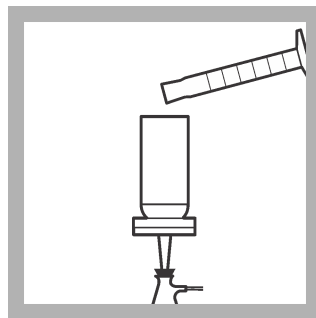


9. Remove the watch glass with the fiber filter disc from the desiccator and put it adjacent to the analytical balance.

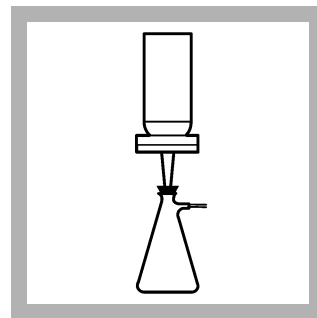
Use tweezers to remove the fiber filter disc from the watch glass. Weigh the fiber filter disc to the nearest 0.1 mg (0.0001 g). Record this mg value as B.



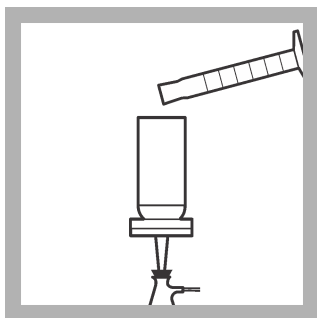
10. Put the fiber filter disc in the filter holder/filtering system again. Use deionized water to bond the fiber filter disc to the filter holder.



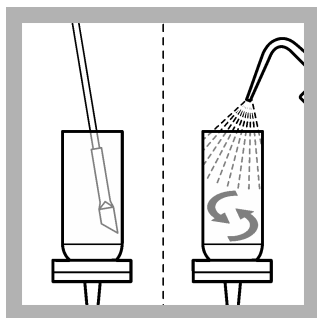
11. Use a graduated cylinder to add 100 mL (or more, if the solids content is low) of well-mixed, representative water sample.



12. Apply vacuum to the flask until all of the water is pulled through the filter.



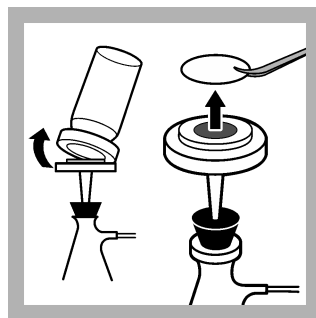
13. Add three different 10-mL aliquots of deionized water. Wait until each aliquot is pulled through the filter before the next one is added.



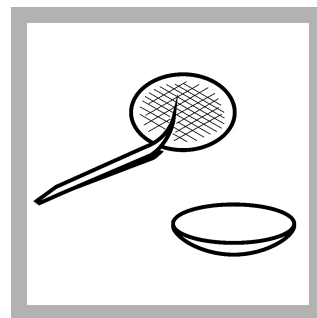
14. Move all of the remaining material that stays on the sides or bottom lip of the filter holder on the filter.

Use a rubber policeman on the end of a stirring rod as a scraper to remove the solids.

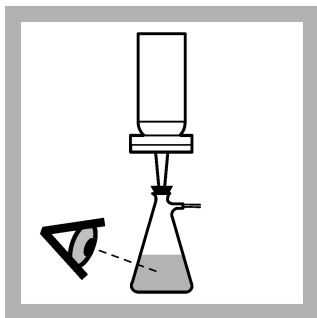
Use small amounts of deionized water to pull the solids down on the fiber filter disc.



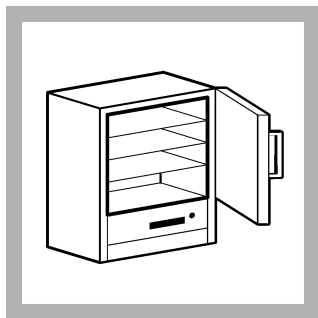
15. Slowly release the vacuum from the filtering system. Remove the fiber filter disc from the filter holder.



16. Put the fiber filter disc in a watch glass.



17. Examine the filtrate (filtered water in flask) to make sure that the solids are caught on the fiber filter disc.

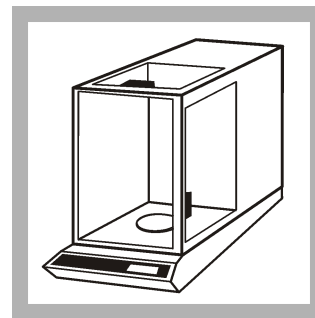


18. Put the watch glass with the fiber filter disc in a preheated drying oven at 103–105 °C (217–221 °F) for 1 hour.



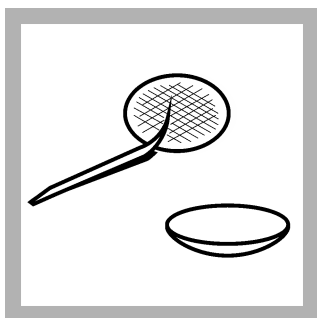
19. Use metal tongs to remove the watch glass with the fiber filter disc from the drying oven or muffle furnace and put in a desiccator. Immediately cover the desiccator. Do not seal the desiccator until the watch glass temperature has decreased a little, because pressure from the hot air inside can push the cover off.

Let the fiber filter disc and watch glass temperature decrease to room temperature.

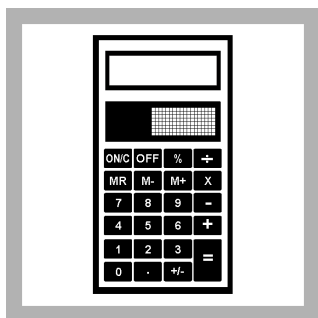


20. Remove the watch glass with the fiber filter disc from the desiccator and put it adjacent to the analytical balance.

Use tweezers to remove the fiber filter disc from the watch glass. Weigh the fiber filter disc to the nearest 0.1 mg (0.0001 g). Record this mg value as A.



21. Put the fiber filter disc back on the watch glass to measure Volatile Nonfilterable Residue. If not, discard the disc. If Volatile Nonfilterable Residue is measured, make sure to not lose any of the suspended matter on the disc.



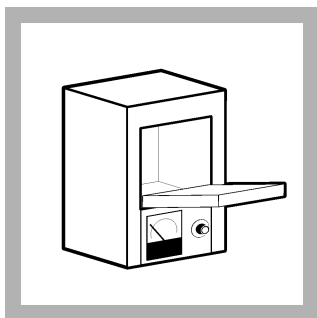
22. Calculate the test results:
 $(A - B) \div L \text{ sample} = \text{mg/L}$
 Total Non-filterable Residue (TNR)

Where:
 A = Weight (mg)¹ of fiber filter disc with solids
 B = Weight (mg) of empty fiber filter disc

Example:
 A = 95.5 mg
 B = 81.5 mg
 Volume of sample = 0.100 L
 $(95.5 \text{ mg} - 81.5 \text{ mg}) \div 0.100$
 = 140 mg/L TNR

¹ Weight in mg = grams × 1000

Test procedure—Volatile Non-filterable Solids, Method 8164



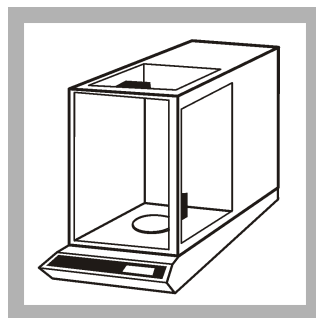
1. Put the watch glass and filter disc from the Total Non-filterable Solids procedure (step 21) in a preheated muffle furnace at 550 °C (1022 °F) for 15 minutes.

Note: Do not put the watch glass directly in a 550 °C (1022 °F) muffle furnace because it can break. Put the watch glass in a 100 °C (212 °F) preheated muffle furnace and then increase the temperature to 550 °C (1022 °F) for 15 minutes.



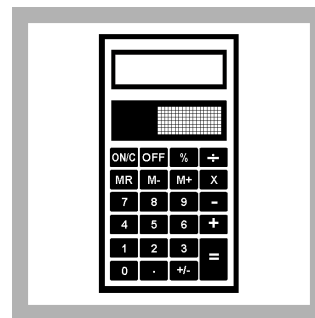
2. Use metal tongs to remove the watch glass with the fiber filter disc from the drying oven or muffle furnace and put in a desiccator. Immediately cover the desiccator. Do not seal the desiccator until the watch glass temperature has decreased a little, because pressure from the hot air inside can push the cover off.

Let the fiber filter disc and watch glass temperature decrease to room temperature.



3. Remove the watch glass with the fiber filter disc from the desiccator and put it adjacent to the analytical balance.

Use tweezers to remove the fiber filter disc from the watch glass. Weigh the fiber filter disc to the nearest 0.1 mg (0.0001 g). Record this mg value as C.



4. Calculate the test results: $(A - C) \div$ sample volume in L = mg/L Volatile Non-filterable Residue (VNR)

Where:

A = Weight (mg) of fiber filter disc with solids (step 20)

C = Weight (mg) of fiber filter disc with solids

Example:

A = 95.5 mg

C = 91.2 mg

Volume of sample = 0.100 L
 $(95.5 \text{ mg} - 91.2 \text{ mg}) \div 0.100$
 = 43 mg/L VNR

Summary of method

A glass fiber filter disc is used as a filter in a filtering flask. Deionized water is pulled with vacuum through the filter. The fiber filter disc is dried to a constant weight in an oven at 102-105 °C (217–221 °F) to determine the weight of the empty disc. A well-mixed filtered sample is dried in the same fiber filter disc to a constant weight in an oven at 102-105 °C (217–221 °F). The weight difference between the empty disc and the disc with the remaining materials shows the Total Non-filterable Solids. To measure the Volatile Non-filterable Solids, the fiber filter disc is put in a muffle furnace at 550 °C (1022 °F) to remove all of the volatile material. The weight difference between the disc and the disc with remaining materials shows the Volatile Non-filterable Solids.

Consumables and replacement items

Required reagents and apparatus

Description	Quantity/test	Unit	Item no.
Aspirator, vacuum pump	1	each	213100
Balance, analytical, 80 g x 0.1 mg, 100–240 VAC	1	each	2936701
Bottle, wash, 500 mL	1	each	62011
Cylinder, graduated, 100 mL	1	each	50842
Desiccant, indicating Drierite	1	each	2088701
Desiccator, without stopcock	1	each	1428500
Desiccator plate, ceramic	1	each	1428400
Filter discs, glass fiber, 47 mm	1	100/pkg	253000
Filter holder, 47-mm, magnetic base	1	each	1352900

Required reagents and apparatus (continued)

Description	Quantity/test	Unit	Item no.
Flask, filtering, glass, 1000 mL	1	each	54653
Furnace, muffle 240 VAC, 50/60 Hz	1	each	1429624
Furnace, muffle, 120 VAC, 50/60 Hz	1	each	1429600
Oven, laboratory, 240 VAC/50 Hz	1	each	1428902
Oven, laboratory, 120 VAC/60 Hz	1	each	1428900
Stopper, rubber, one-hole, number 8	1	6/pkg	211908
Tongs	1	each	56900
Tubing, rubber, 7.9 mm x 2.4 mm	varies	12 ft	56019
Tweezers, plastic	1	each	1428200
Watch glass, 100 mm	1	each	57870
Water, deionized	varies	4 L	27256

Optional reagents and apparatus

Description	Unit	Item No.
Ammonium Hydroxide, 58%	500 mL	10649
Sampling bottle with cap, low density polyethylene, 500-mL	12/pkg	2087079
Brush	each	68700
Pump, vacuum, hand-operated	each	1428300
Pump, vacuum, 1.2 CFM, 220 VAC	each	2824801
Pump, vacuum, 1.2 CFM 115 V	each	2824800
Stirring rod, glass	3/pkg	177001



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