Turbidity standards – choosing and using

Turbidity standards commonly come in two basic categories –

1. formazin standards, or

2. styrene divinylbenzene (SDVB) polymer standards.

Formazin

Formazin is the “master” standard, universally accepted for most any meter or method, and can be mixed to any standard value. It tends to be economical to use, but not convenient, as dilutions must be prepared daily (preferably by trained lab personnel). Remix when particles settle out. Formazin poses a moderate health risk.

Polymer Standards

Polymer standards (SDVB) are non-hazardous, convenient, and easy-to-use. Polymer standards never settle out and never need mixing. They come pre-diluted and do not have to be prepared daily. Most customers will prefer to use polymer standards. Protect from temperature extremes. Use only with the designated meter.

The charts on the following page can help you determine which standards will work best for your application.

Primary and secondary standards

Some methods, like EPA 180.1 rev 2.0, will specify appropriate use for primary and secondary standards. A simple explanation is as follows:

- Primary standards are transferred from the storage container or volumetric flask (for formazin dilutions) into a clean, dry sample vial just before use. Primary standards are the only standards that can be used to establish a new calibration curve. Check your test method for primary standard requirements.
- Secondary standards (sometimes referred to as sealed standards) are continuously stored in the sample vial and can be used for daily calibration checks. They must be monitored against primary standards in the meter they are used with. Monitor for deterioration and replaced as required. Secondary standards can not be used to prepare a new calibration curve.

Formazin Standard[1]	SDVB Polymer Standard
Pros	**Pros**
• Acceptable as a primary calibration standard by most methods.	• Acceptable as a primary calibration standard for most methods.
• Formazin is the “master” standard[2], universally accepted for most any meter (with any light source).	• Works with the meter and the light source for which it has been specifically formulated.
• Can be diluted to any desired concentration level.	• Polymer standards are stable long term when stored in plastic - even low level polymer standards
• The 4000 NTU standard is stable long term when stored properly.	• The polymer suspension never settles out.
• The 4000 NTU standard is not known to be sensitive to temperature extremes.	• The polymer standards give consistently reproducible readings.
• Can be purchased commercially or prepared by the user.	• Polymer standards are pre-prepared. Simply pour into the sample vial and measure.
• Formazin standard is usually priced lower than polymer standards.	• Polymer standards are not considered hazardous.
	• Polymer standard is easily disposed.
Cons	**Cons**
• Dilute formazin standards have short shelf lives, e.g., low level turbidity standards are good for just 1 day or less.	• Polymer standard is formulated only for the particular meter model it is sold with - not interchangeable with a polymer standard sold for another meter model.
• Formazin standards require frequent preparation and a certain amount of laboratory expertise to do it well.	• Some methods require polymer standards to be verified against formazin standards periodically.
• The suspension settles out and must be remixed before every use.	• Polymer standards can not be prepared or diluted by the user. They are available in discreet values only.
• Due to handling (mixing and settling), formazin standard is usually not as reproducible as polymer standards.	• Polymer standards do not tolerate freezing or boiling temperatures.
• Formazin is considered a hazardous chemical and shall be handled properly.	• Polymer standards stored in glass vials may have a shortened shelf life.
• Formazin should be disposed properly.	• Polymer standards usually cost more than formazin standard.

Notes:

1 Formazin standards are available in a stabilized form from some sources. Stabilized formazin standards are like formazin standards in most ways (see above), but are purchased at discreet turbidity values and can not be diluted. They are stable long term, even at low levels, but have a more narrow temperature range tolerance than formazin or polymer standards. They still settle out like any formazin standard and must be mixed well before each use. This settling process can impact the reproducibility of the standard readings. Stabilized formazin standards have the same moderate health risk rating as formazin standard. They cost more than formazin stock standard and are priced more in line with polymer standards.

2 “Master” standard – note that a formazin standard prepared to a value of 100*, will read 100 on any properly calibrated meter with any light source and any optical geometry. It is a universal standard. By contrast, a polymer standard formulated to read 100 on a certain model of meter will not necessarily read 100 on a different model of meter. Polymer standards are not interchangeable amongst meter models. Calibrating with the wrong polymer standards can lead to erroneous results.

* See Application Note AN037 for further discussion of turbidity units of measure.

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