remel

McFARLAND EQUIVALENCE TURBIDITY STANDARDS

INTENDED USE
Remel McFarland Equivalence Turbidity Standards are used as standards in adjusting densities of bacterial suspensions.

SUMMARY AND EXPLANATION
Original McFarland standards were prepared by adding $BaCl_2$ to H_2SO_4, resulting in $BaSO_4$ precipitation.[1] The McFarland Equivalence Turbidity Standards are prepared from suspensions of uniform polystyrene microparticles with absorbance values similar to the original $BaSO_4$ standards. Stability of suspensions, shelf life, and ease of comparison have been improved with the McFarland Equivalence Turbidity Standards.

PRINCIPLE
Polystyrene microparticles are suspended in a special buffer and adjusted to an acceptable absorbance range using a spectrophotometer with a 1 cm light path set at 600 nm or 625 nm, depending on the standard used.[2,3] Adjusting a bacterial suspension turbidity to the McFarland Equivalence Turbidity Standard produces bacterial counts in an expected range.

REAGENTS*
Electrically charged polystyrene microparticles suspended in a special buffer.
*Adjusted as required to meet performance standards.

PRECAUTIONS
This product is for Laboratory Use only and should be used by properly trained individuals. Directions should be read and followed carefully.

STORAGE
This product is ready for use and no further preparation is necessary. Store product in its original container at room temperature (20-25°C). Do not freeze or overheat.

PRODUCT DETERIORATION
This product should not be used if (1) there is evidence of dehydration, (2) the product is contaminated, (3) the color has changed, (4) the expiration date has passed, or (5) there are other signs of deterioration.

MATERIALS REQUIRED BUT NOT SUPPLIED
(1) Loop sterilization device, (2) Inoculating loops, swabs, or transfer pipettes, (3) Sterile tube, (4) Saline or broth, (5) Light source.

PROCEDURE
1. Invert the McFarland Equivalence Turbidity Standard gently to fully suspend the polystyrene microparticles.
2. Visually compare the turbidity of an actively growing broth culture or a bacterial suspension prepared from an 18-24 hour culture to the appropriate McFarland Standard. (**Note:** The bacterial suspension tubes should be of similar diameter as the McFarland Equivalence Turbidity Standard).
3. For visual comparison, use adequate light and read the tubes against the white card with contrasting black lines.
4. Equal obliteration or distortion of black lines indicates a turbidity match.

INTERPRETATION
Bacterial suspensions are standardized when distortion of black lines is equal to that of the corresponding McFarland Equivalence Turbidity Standard.

QUALITY CONTROL
All lot numbers of McFarland Equivalence Turbidity Standards have been tested spectrophotometrically and found to be acceptable.

LIMITATIONS

1. The use of broth media which is dark yellow, orange, or brown in color may result in bacterial suspensions of incorrect densities. Trial comparisons should be performed. Use adequate light to read the Standard and test broth against a white card with contrasting black lines.[2]
2. Visually comparing McFarland Equivalence Turbidity Standards and bacterial suspensions by use of backlight illumination could result in bacterial suspensions of incorrect densities.
3. Bacterial densities may be too heavy when colonies of *Haemophilus influenzae* ≤ 24 hours old are used to prepare suspensions.[3]
4. McFarland Equivalence Turbidity Standards are recommended when performing visual comparisons or when using a spectrophotometer adjusted to the proper setting.[4] Use with instruments which use alternative light sources, such as scattered light, has not been validated.

EXPECTED VALUES

Standard No.	0.5	1.0	2.0	3.0	4.0	5.0
Approximate Cell Density (x 10^8/ml)	1.5	3.0	6.0	9.0	12.0	15.0

PERFORMANCE CHARACTERISTICS

A study comparing McFarland Equivalence Turbidity Standards to barium sulfate standards resulted in agreement between the two methods.

BIBLIOGRAPHY

1. McFarland, J. 1907. JAMA. 14:1176-1178.
2. Clinical and Laboratory Standards Institute (CLSI). 2009. Performance Standards for Antimicrobial Disk Susceptibility Tests; Approved Standard, 10th ed. M2-A10. CLSI, Wayne, PA.
3. Doern, G.V. and R.N. Jones. 1988. Antimicrob. Agents Chemother. 32:1747-1753.
4. Lorian, V. 1986. Antibiotics in Laboratory Medicine, 2nd ed. Williams & Wilkins, Baltimore, MD.

PACKAGING

Each standard is packaged in a plastic case with a visual comparison card. Tube size is 15 x 103 mm and fits most spectrophotometers.

REF R20410, McFarland Equivalence Turbidity Standard 0.5.....Each
REF R20411, McFarland Equivalence Turbidity Standard 1.0.....Each
REF R20412, McFarland Equivalence Turbidity Standard 2.0.....Each
REF R20413, McFarland Equivalence Turbidity Standard 3.0.....Each
REF R20414, McFarland Equivalence Turbidity Standard 4.0.....Each
REF R20415, McFarland Equivalence Turbidity Standard 5.0.....Each
REF R20421, McFarland Equivalence Turbidity Standard Set .....Set*

*Contains 1 each of 0.5, 1.0, 2.0, 3.0, and 4.0 standards

Symbol Legend

REF	Catalog Number
IVD	In Vitro Diagnostic Medical Device
LAB	For Laboratory Use
	Consult Instructions for Use (IFU)
	Temperature Limitation (Storage Temp.)
LOT	Batch Code (Lot Number)
	Use By (Expiration Date)

IFU 20410, Revised May 21, 2009 Printed in U.S.A.

12076 Santa Fe Drive, Lenexa, KS 66215, USA
General Information: (800) 255-6730 Website: www.remel.com Email: remel@remel.com
Local/International Phone: (913) 888-0939 International Fax: (913) 895-4128