Preparation of HumM2 Assay Reagents and Standards for qPCR Analysis

1. INTRODUCTION

1.1 This quantitative Polymerase Chain Reaction (qPCR) assay targets a single copy chromosomal gene in *Bacteroides-like microorganisms* for the detection of human fecal contamination. A gBlock® fragment containing a 333 bp HumM2 qPCR target sequence serves as the standard in the HumM2 assay, which is used to generate a standard curve for determination of performance characteristics of the qPCR assay.

1.2 Extraction control and third well spike: The extraction control contains a known concentration of gBlock DNA that is extracted and analyzed along with environmental samples. The third well spike also contains a known concentration of gBlock DNA and is added as a third replicate well to each environmental sample during reaction plate setup. Both extraction control and third well spikes are used as positive controls for the HumM2 target sequence and qPCR assay.

2. EQUIPMENT AND SUPPLIES

2.1. Gloves, latex or nitriles

2.2. Tube racks

2.3. Centrifuge tubes, 0.5, 1.5, and 2.0 mL

2.4. Brady FreezerBondz Laboratory Labels (Cat#19-140-586)

2.5. Micropipettes with sterile PCR grade filter tips

2.5.1 Calibrate and use per SOP PCR-2.4.

2.6. CBS Optimizer PCR Workstation #1 (S/N 007631)

2.7. CBS Optimizer PCR Workstation #2 (S/N 007632)

2.8. Fisher Mini Vortexer

2.9. Fisher Minicentrifuge

2.10. Eppendorf Centrifuge Model 5418 (S/N 5418AG715992)

2.11. Qubit 2.0 Fluorometer (S/N 1301008411)

2.11.1 Calibrate and use per SOP PCR-2.0

2.12. PCR#9, Thermo Refrigerator Isotemp (S/N TR1562211012), maintained at 4ºC ± 2ºC, Room B246A

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2.13. PCR#2, Thermo Freezer (S/N 0121174101121218), maintained at -20ºC ± 10ºC, Room B246A

2.14. PCR#4, Thermo Freezer (S/N 0121174201121218), maintained at -20ºC ± 10ºC, Room B246B

2.15. PCR#8, Thermo Revco Freezer (S/N 127018801220603), maintained at -80ºC ± 10ºC, Room B246

2.16. Incubating mini shaker (S/N 150747)

2.17. Autoclave Steris Amsco Model 250 LS (S/N 031761851)

3. REAGENTS AND CHEMICALS

3.1 Molecular Biology grade water. Corning Molecular Biology Grade Water tested to USP Sterile Water (Cat.#MT46000CV).

3.2 Bleach solution, 10% (v/v)

3.3 Ethanol 80% (v/v)

3.3 TE Buffer

4. HUMM2 PRIMER/PROBE STOCK

4.1 Always purchase primer/ probes together as a set. Primers should be dry, salt free, and at a 1 µmol scale. The probe should be dry, HPLC purified and at a 1 µmol scale. The probe should be ordered with the 5' 6-FAM dye and 3' Zen-Iowa Black FQ quencher from Integrated DNA Technologies (IDT). Keep stored at -20°C.

4.1.1. Forward Primer HumM2For: 5'- CGT CAG GTT TGT TTC GGT ATT G - 3'

4.1.2. Reverse Primer HumM2Rev: 5'- TCA TCA CGT AAC TTA TTT ATA TGC ATT AGC - 3'

4.1.3. Taqman® Probe HumM2Probe: 5'-/56-FAM/TAT CGA AAA /ZEN/ TCT CAC GGA TTA ACT CTT GTG TAC GC/3IABkFQ/ -3'

4.2. Each order includes an Oligonucleotide Data Sheet. Record received date and review the sequences for correctness. Scan the data sheet into the folder: ..\..\Certificates of Analysis\Oligo Data Sheet

4.3. Record each preparation in Laboratory Information Management System (LIMS) Standard Preparation Tracker module (**Laboratory/Technical/Standard Preparation Tracker**).

4.3.1. In LIMS select **Laboratory/Technical/Standard Preparation Tracker** from the menu. Choose **BIO-PCR** from the "Group" drop down list.

4.3.2. Select **Purchased/New Reagent/Material** from the menu. If a similar reagent exists, select **Purchased/Duplicate Reagent/Material** from the menu and choose the reagent to duplicate from the list.

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4.3.3. In the "Purchased Material" pop-up window, enter the following information:

4.3.3.1. For HumM2 Forward Primer: Identity: = HumM2For; Description = HumM2 Assay Forward Primer; Entered by: = Analyst Name; Type: = Powder; Grade: = blank; Purity: = Salt-free; Received: = Date of receipt; Expires: = 1 year from receive date; Manufacturer: = Integrated DNA Technologies (IDT); Lot # = Barcode ID from data sheet; Storage Location: = B246A; Storage Temperature: = Freezer at <-10 degC; Container Size: = weight in mg; Units: = mg;

4.3.3.2. For HumM2 Reverse Primer: Identity = HumM2Rev; Description = HumM2 Assay Reverse Primer; Entered by = Analyst Name; Type = Powder; Grade = blank; Purity = Salt-free; Received: = Date of receipt; Expires: = 1 year from receive date; Manufacturer = Integrated DNA Technologies (IDT); Lot # = Barcode ID from data sheet; Storage Location = B246A; Storage Temperature = Freezer at <-10 degC; Container Size = weight in mg; Units = mg;

4.3.3.3. For HumM2 Probe: Identity = HumM2Probe; Description = HumM2 Assay Probe; Entered by = Analyst Name; Type = Powder; Grade = HPLC Grade; Purity = HPLC; Received: = Date of receipt; Expires: = 1 year from receive date; Manufacturer = Integrated DNA Technologies (IDT); Lot # = Barcode ID from data sheet; Storage Location = B246A; Storage Temperature = Freezer at <-10 degC; Container Size = weight in mg; Units = mg;

4.3.3.4. Select "Yes" for the "Has Certificate of Analysis" drop down list.

4.3.4. If a component is not already in the components list, click **Add**, and "Identity" name will self-populate in the "Components" table.

4.3.5. Double click the component and add the concentration of the reagent. Use the concentration in nmol from the data sheet. The **Add** or **Remove** buttons can be used to add or remove components.

4.3.6. Click **OK** to save the entry and receive a serial number. Open the LabelMark6 software and create labels (see SOP PCR-5.0 for details). Print labels with the reagent name, serial number, and expiration date and affix labels to the side of each tube. The top label should include the reagent name. Place labels on all aliquoted tubes. Place the label on the Oligonucleotide Data Sheet, before scanning it (from Step 4.2).

4.3.7. The concentration of primer/probe will vary with each order. This is listed in the "nmol" column of the data sheet. The data sheet will list how much TE buffer is needed to reconstitute the primer/probe to a 100 µM concentration in the "Add X µL for 100 µM" column. For a 500 µM concentration, divide this number by 5.

4.4. All primer/ probe mixing and pipetting must be completed in PCR Workstation #1 (DNA free) using sterile, DNA free supplies. Use only aerosol barrier tips for micropipettes. Before opening the dry oligonucleotide tube, pulse centrifuge to ensure everything is at the bottom of the tube and help prevent a spill. Oligos are shipped by

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the manufacturer as dried content and appear either as a translucent film or a white powder in the centrifuge tube.

4.5. For each primer, pipette appropriate amount of TE buffer into the tube containing the dried primer to make a 500 µM concentration. Dissolve by tapping the tube. Allow the solution to equilibrate for 5 minutes. Mix again and pulse centrifuge to coalesce droplets. Aliquot 10 µL volumes into purple 0.5 mL centrifuge tubes. Label clearly (as in 4.8.5), and affix labels to the top and side of each tube.

4.6. For the probe, pipette appropriate amount of TE buffer into the tube containing the dried probe to make a 100 µM concentration. Dissolve by tapping the tube. Allow the solution to equilibrate for 5 minutes. Mix again and pulse centrifuge to coalesce droplets. Aliquot 10 µL volumes into purple 0.5 mL centrifuge tubes. Label clearly (as in 4.8.5), and affix labels to the top and side of each tube.

4.7. Group in sets of forward primer, reverse primer, and probe in a freezer box and store at -20°C.

4.8. Record each primer/probe preparation in Laboratory Information Management System (LIMS) Standard Preparation Tracker module (**Laboratory/Technical/Standard Preparation Tracker**).

4.8.1. In LIMS select **Laboratory/Technical/Standard Preparation Tracker** from the menu. Choose **BIO-PCR** from the "Group" drop down list.

4.8.2. Select **Prepared/New Reagent** from the menu. If a similar reagent exists, select **Prepared/Duplicate Reagent** from the menu and choose the reagent to duplicate from the list.

4.8.3. In the "Prepared Reagent" pop-up window, enter the following information:

4.8.3.1. <u>For HumM2 Forward Primer</u>: Identity: = HumM2For; Type: = Working Reagent; Entered by: = Analyst Name; Holding Time: = 365 Days; Prepared = Date/Time of preparation and Analyst; SOP: = PCR-3.8; See Also: = leave blank; Location: = B246A; Description = HumM2 Assay Forward Primer 500 µM concentration; Storage Temperature = Freezer at <-10 degC; Additional Information: = TE Buffer S#; Solvent Used: = AE Buffer; Final Volume: = final total volume of preparation in µL; Units: = µL;

4.8.3.2. <u>For HumM2 Reverse Primer</u>: Identity = HumM2Rev; Type: = Working Reagent; Entered by: = Analyst Name; Holding Time: = 365 Days; Prepared = Date/Time of preparation and Analyst; SOP: = PCR-3.8; See Also: = leave blank; Location: = B246A; Description = HumM2 Assay Reverse Primer 500 µM concentration; Storage Temperature = Freezer at <-10 degC; Additional Information: = TE Buffer S#; Solvent Used: = AE Buffer; Final Volume: = final total volume of preparation in µL; Units: = µL;

4.8.3.3. <u>For HumM2 Probe</u>: Identity = HumM2Probe; Type: = Working Reagent; Entered by: = Analyst Name; Holding Time: = 365 Days; Prepared = Date/Time of preparation and Analyst; SOP: = PCR-3.8; See Also: = leave

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blank; Location: = B246A; Description = HumM2 Probe 100 µM concentration; Storage Temperature = Freezer at <-10 degC; Additional Information: = TE Buffer S#; Solvent Used: = AE Buffer; Final Volume: = final total volume of preparation in µL; Units: = µL;

4.8.4. Click **Add**. Choose the **Purchased Materials** radio button in the "Select Source:" section. In the "Enter Serial #" pop up window, choose the primer/probe that was used to make the preparation being entered from the list, or enter its serial number in the text box. In the "Enter Amount & Units for.." pop up window, enter weight of the primer/probe added in µg and choose "µg" from the "Added Units:" drop down list. Click **OK**.

4.9. Click **OK** to save the entry and receive a serial number. Open the LabelMark6 software and create labels (see SOP PCR-5.0 for details). Print labels with the reagent name (HumM2For, HumM2Rev, or HumM2Probe), serial number, and expiration date and affix labels to the side of each tube. The top label should include the reagent name and serial number. Place labels on all aliquoted tubes before storage at -20° C.

5. GBLOCK STANDARD

5.1. A gBlock gene fragment containing the target sequence for the HumM2 assay is ordered from Integrated DNA Technologies (IDT) and is used as a standard for the HumM2 assay. The 333 bp fragment is below (bold sequences show location of primer binding):

5' –
ATCGCTCACACCGA**CGTCAGGTTTGTTTCGGTATTG**AGTATCGAAAATCT
CACGGATTAACTCTTGTGTACGCTCTCGAGGACCA**GCTAATGCATATAAAT**
AAGTTACGTGATGAGACCGGCGCACGGGTGAGTAACACGTATCCAACCTG
CCGTCTACTCTTGGCCAGCCTTCTGAAAGGAAGATTAATCCAGGATGGGAT
CATGAGTTCACATGTCCGCATGATTAAAGGTATTTTCCGGTAGACGATGGG
GATGCGTTCCATTAGCTCGAGATAGTAGGCGGGGTAACGGCCCACCTAGTC
AACGATGGATAGGGGTTCTGAGAGGAAGG – 3'

5.2 This sequence is combined with the target sequence for the CowM2 assay to generate a standard that can be used for both assays. This gBlock fragment is named C2H2 gBlock and is a 449 bp fragment:

5' –
ATCGCTCACACCGAATCGCGGCCAAATACTCCTGATCGTACTCGAGATAGG
CACCTATGTCCTTTACCTCATCAACTACAGACAAAATTATCTCAAGGAACG
CAACAAGCATCGCCTCTAATGGAAAATGCGTCAGGTTTGTTTCGGTATTGA
GTATCGAAAATCTCACGGATTAACTCTTGTGTACGCTCTCGAGGACCAGCT
AATGCATATAAATAAGTTACGTGATGAGACCGGCGCACGGGTGAGTAACA
CGTATCCAACCTGCCGTCTACTCTTGGCCAGCCTTCTGAAAGGAAGATTAA
TCCAGGATGGGATCATGAGTTCACATGTCCGCATGATTAAAGGTATTTTCC
GGTAGACGATGGGGATGCGTTCCATTAGCTCGAGATAGTAGGCGGGGTAA
CGGCCCACCTAGTCAACGATGGATAGGGGTTCTGAGAGGAAGG – 3'

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5.3 There are no modifications or purifications needed, and 250 ng of the gBlock arrives dried and appears as either a translucent film or a white powder in a centrifuge tube. Record the gBlock in LIMS Standard Preparation Tracker module (Laboratory/Technical/Standard Preparation Tracker).In LIMS select **Laboratory/Technical/Standard Preparation Tracker** from the menu. Choose **BIO-PCR** from the "Group" drop down list.

5.3.2 Select **Purchased/New Standard** from the menu. If a similar standard exists, select **Prepared/Duplicate Standard** from the menu and choose the standard to duplicate from the list.

5.3.3 In the "Purchased Standard" pop up window enter the following information:

5.3.3.1 For C2H2 gBlock: Identity: = C2H2 gBlock; Description: = gBlock standard for CowM2 and HumM2 assays; Entered by: = Analyst Name; Received: = Date received; Expires: = 365 days; Type: = purchased powder; Has certificate of Analysis: = YES; Manufacturer: = Integrated DNA Technologies; Lot #: = (list number on tube); Storage Location: = B246; Storage Temperature: = Freezer <10 degC; Additional information: = Use with SOP PCR-3.8.

5.4 To resuspend, centrifuge the tube briefly then add TE to reach a final concentration of 10 ng/µL. For 250 ng, add 25 µL TE. Vortex briefly, then incubate at 50°C for 20 minutes in benchtop incubator. Briefly vortex and centrifuge.

6. STOCK DNA AND WORKING STANDARDS

6.1 Dilute the resuspended gBlock in TE buffer to measure on the Qubit. Gently mix each dilution and pulse centrifuge to coalesce droplets.

6.1.1 Mix 10 µL of resuspended C2H2 gBlock with 90 µL of TE buffer to make a 1:10 dilution.

6.1.2 Mix 50 µL of the 1:10 dilution with 450 µL of TE buffer to make a 1:100 dilution.

6.2 Analyze the 1:10 and 1:100 in triplicate on the Qubit fluorometer per SOP PCR-2.0 to determine the concentration. Use 10 µL as the sample volume. The 1:10 dilution should be 10X greater than the 1:100 dilution. If this is not the case, use a more concentrated or dilute sample as needed.

6.3 Determine the concentration of stock C2H2 gBlock in ng/mL.

6.3.1 For each dilution, multiply the stock concentration (from Qubit data file) measured on the Qubit by the dilution factor (10X for 1:10, 100X for 1:100). Use the average of these as the concentration of the stock C2H2 gBlock.

6.3.2 Compare this value to the expected concentration of 10 ng/µL. If calculated value differs greatly, recheck measurements.

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6.4 Determine the concentration of the stock DNA in TSC/5 µL using the following equation with the conversion factor of 1 ng of C2H2 double-stranded gBlock = 2.06 X 10^9 copies of C2H2 target sequence.

$$\frac{TSC\ C2H2}{5\ uL} = (Stock\ Conc.\ in\ ng/mL)(\frac{1\ mL}{1000uL})(\frac{2.06\ X\ 10^9\ TSC}{1\ ng})(5)$$

6.4.1 If developing a new gBlock, please refer to SOP PCR-5.4 Section 2.3.3 to determine the number of copies per nanogram.

6.5 Determine the concentrations of the dilutions in TSC/5 µL and continue the serial dilution down to a concentration of 10^7 in 1000 µL volumes. This will be used as the working standard.

6.6 Using green 0.5 mL tubes, aliquot the 10^7 dilution in 50 µL volume for the standards and 16 µL volume for the extraction control spikes. Print labels (see 6.7.5) and affix to the top and sides of the tubes. Store the 10^7 tubes at -80°C.

6.6.1 The 10^7 standards will be diluted further to 10^6, 10^5, 10^4, and 10^3 when setting up the reaction plate to make a standard curve for the HumM2 assay and as a third well spike at a concentration of 10^5.

6.7 Record the stock DNA and dilutions in LIMS Standard Preparation Tracker module (**Laboratory/Technical/Standard Preparation Tracker**).

6.7.1 In LIMS select **Laboratory/Technical/Standard Preparation Tracker** from the menu. Choose **BIO-PCR** from the "Group" drop down list.

6.7.2 Select **Prepared/New Standard** from the menu. If a similar standard exists, select **Prepared/Duplicate Standard** from the menu and choose the standard to duplicate from the list.

6.7.3 In the "Standard Solution" pop up window, enter the following information:

6.7.3.1 <u>For Stock C2H2 gBlock DNA</u>: Identity: = x.xxEx C2H2 gBlock (use measured concentration in TSC/5µL); Type:= Stock Standard; Holding Time: = 365 days; Entered by: = Analyst Name; Location: = B246; Prepared = Date/time of preparation and analyst; SOP: = PCR-3.8; See Also: = leave blank; Description: = C2H2 gBlock reconstituted at 10 ng/µL in TE buffer for CowM2 and HumM2 assays; Additional Information = TE Buffer S#; Storage Temperature: = Freezer at <-10 degC; Solvent Used: = AE Buffer; Final Volume: = 50.00; Units: = µL;

<u>Note</u>: The stock gBlock DNA will be used to make working standards and the original tube will be stored at -80°C.

6.7.3.2 <u>For working C2H2 gBlock Standards</u>: Identity: = x.xxEx C2H2 gBlock (use measured concentration in TSC/5 µl); Type: = Working Standard; Holding Time = 365 days; Entered by: = Analyst Name; Location: = B246; Prepared = Date/time of preparation and analyst; SOP: = PCR-3.8; See Also: = leave blank; Description: = resuspended gBlock used as standard for CowM2 and HumM2 assays; Additional Information = TE

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Buffer S#; Storage Temperature: = Freezer at <-10 degC; Solvent Used: = AE Buffer; Final Volume: = 1000.00; Units: = µL;

6.7.4 Click **Add**. In the "Enter Serial #" pop up window, choose the standard that was used to make the standard being entered from the list, or enter its serial number in the text box. For C2H2 gBlock stock, the standard is in the **Purchased Materials** "Select Source:" list. For the other working standards, choose **Existing Standards** for the source list. In the "Enter Amount & Units from.." pop up window, enter the amount of standard added in µL and "Final Conc. Units:" should be entered as "ng/mL". Click **OK**.

6.7.5 Click **OK** in the "Standard Solution" pop up window to save the entry and receive a serial number. Open the LabelMark6 software and create labels. The side label should include the serial number, name (_.__E7 C2H2 STD or _.__E7 C2H2 SPK), and expiration date. The top label should include E7 C2H2 STD or E7 C2H2 SPK. Print labels and affix to the top and sides of the tubes. Store at -80°C.

7. HUMM2 ASSAY STANDARD CURVES AND THIRD WELL SPIKE

7.1 A set of 10^7, 10^6, 10^5, 10^4, and 10^3 TSC/5µL of C2H2 gBlock standards should be run on every HumM2 plate. The third well spike is run at a concentration of 10^5 TSC/5µL.

7.2 HumM2 standards and third well spike will be diluted before each run from 10^7 concentration. To make the 10^6 standard, dilute by mixing 10 µL of the 10^7 dilution with 90 µL of TE buffer. 10^5, 10^4, and 10^3 will be made similarly by serially diluting.

7.3 Record the third well spike standard in LIMS Standard Preparation Tracker module (**Laboratory/Technical/Standard Preparation Tracker**) as a working standard per Step 6.7.3.2, except add SPIKE to the end of the Identity name.

7.4 When new standards are needed, dilute the original gBlock stock and measure as described in Section 6. Reorder as needed.

8. HUMM2 EXTRACTION CONTROL

8.1 The extraction control (EC) has a concentration of 10^7 TSC/5 uL of C2H2 gBlock.

8.2. Use the 10^8 C2H2 gBlock stock standard to make the 10^7 EC dilution by mixing 50 µL of the 10^8 dilution with 450 µL of TE buffer.

8.3. Aliquot the EC spike into green 0.5 mL tubes in 16 µL volumes and keep frozen at -80°C in B246.

8.4. Record the standards in LIMS Standard Preparation Tracker module (**Laboratory/Technical/Standard Preparation Tracker**) as a working standard per Step 6.7.3.2, except add SPIKE to the end of the Identity name.

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9. QUALITY CONTROL

9.1 Maintain control charts of C2H2 extraction controls. If recoveries show a decreasing trend, DNA standards may be deteriorating and should be remade.

9.2 When new standard curve sets are made, analyze alongside an older set for comparison. New standards should perform similarly to older standards. If older standards are not available, compare to the control chart information.

10. REFERENCES

10.1 DEP Quality Manual

10.2 Health and Safety Plan

10.3 DEP SOP PCR-2.0 *Calibration, Use and Maintenance of Qubit 2.0 Fluorometer*

10.4 DEP SOP PCR-2.4 *Calibration and Use of Mechanical Pipettes using PCS® Pipette Calibration System and Artel® Pipette Tracker™*

10.5 DEP SOP PCR-5.0 *Sample Custody, Labels and Worksheet Instructions for Molecular Biology Samples*

10.6 DEP SOP PCR-5.4 *Determining Optimal Running Conditions for qPCR Markers*

Appendix of Changes

01/05/2021 Updated the gBlock information to the combined C2H2 gBlock.

12/28/2022 Updated new fridge and freezer information in Equipment and Supplies.

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