



## HEPATITIS A VIRUS MOLECULAR BEACON ASSAY

### **GENERAL INFORMATION**

The assay was developed for “in process” testing only and can be used with source donation plasma samples.

Primary pool samples are created using a Hamilton Star pipetting instrument which transfers an aliquot from an appropriate tube to a specific well in a deep well plate. Then the Hamilton Star transfers an aliquot from each well in the deep well plate to a reservoir creating a primary pool. Primary pools contain aliquots from 96 individual samples. The isolation is performed using the MagMax Viral RNA Isolation Kit from Applied Biosystems/Ambion and a Biomek FX from Beckman Coulter. It is an automated system which generates a 96 well plate containing each individual isolated sample.

A mastermix is prepared which contains the molecular beacons and primers for both the internal control and Hepatitis A virus (HAV). Single stranded beacons are used as indicators of specific amplified products. Their primary nucleic acid sequence is complementary to the amplified portion of the amplicons for HAV and Bovine Viral Diarrhea Virus (BVDV) (internal control). The mastermix also contains other components necessary for the amplification process. The tubes are placed in a GeneAmp PCR System 9700 thermocycler from Applied Biosystems for the amplification process.

Following amplification the samples are transferred to a fluorometric plate and read using a FLUOstar fluorometer from BMG LABTECH. The plate is read at the appropriate excitation and emission filter sets for each beacon. HAV is read at 485 and 520 nm. BVDV is read at 584 and 620 nm. The fluorescence of each sample is determined by calculating the ratio of the fluorescent reading of the sample over the fluorescence of the beacon when hybridized with the complementary target sequence oligonucleotide (maximum fluorescence).

### **SPECIMEN COLLECTION, STORAGE AND HANDLING**

- A. Blood specimens collected in plastic tubes may be used.
- B. Plasma collected in EDTA, 4% Sodium Citrate and ACD is acceptable.
- C. Plasma can be stored at temperatures  $\leq 25^{\circ}\text{C}$  for up to seven days, followed by an additional six days at  $2 - 8^{\circ}\text{C}$ . Plasma may be stored at  $\leq -18^{\circ}\text{C}$  for up to one month.
- D. No adverse affect on assay performance was observed when plasma was subjected to three freeze-thaw cycles.
- E. The user must validate other collection and storage conditions.

### **REAGENTS**

- A. Room Temperature (RT) is defined as  $15^{\circ}$  to  $30^{\circ}\text{C}$ .

- B. Do not use reagents after the expiration date.
- C. Do not refreeze the Kit Controls and External Quality Controls after the initial thaw.
- D. Consult the following table for storage information.

Reagents	Unopened Storage	Opened Storage
MB mix (Beacon/Primer Premix)	Store at $\leq -20^{\circ}\text{C}$ until the expiration date	Store at $\leq -20^{\circ}\text{C}$ for 30 days, maximum of 4 freeze- thaw cycles
HB comp	Store at $\leq -20^{\circ}\text{C}$ until the expiration date	Store at $\leq -20^{\circ}\text{C}$ until the expiration date
Internal Control	Store at $\leq -20^{\circ}\text{C}$ until the expiration date	Store at RT for 7 days once it has been added to the MagMax Lysis Buffer
Kit Controls	Store at $\leq -20^{\circ}\text{C}$ until the expiration date	Store at $2^{\circ}$ to $8^{\circ}\text{C}$ up to 24 hours
External Quality Controls (EQC)	Store at $\leq -20^{\circ}\text{C}$ until the expiration date	Store at $2^{\circ}$ to $8^{\circ}\text{C}$ up to 24 hours

- E. The premix contains the molecular beacons and primers for both the internal control and HAV.
- F. Internal control primer sequences were developed from a region of the Bovine Viral Diarrhea Virus (BVDV) genome. The primer sequences are proprietary information.
- G. The internal control molecular beacon nucleotide sequence was developed from a region of the BVDV genome. The fluorescent tag on the 5' end is CAL Fluor Red and the quencher on the 3' end is Blackhole Quencher 2. The beacon sequence is proprietary information.
- H. The HAV primer sequences were developed from a highly conserved region of the 5' non-translated region. The primer sequences are proprietary information.
- I. The HAV beacon nucleotide sequence was developed from a highly conserved region of the 5' non-translated region. The fluorescent tag on the 5' end is FAM and the quencher on the 3' end is Blackhole Quencher 1. The beacon sequence is proprietary information.

### **QUALITY CONTROL PROCEDURES / INTERPRETATION OF RESULTS**

- A. Contents of each well are read 5 times for detection of Hepatitis A Virus (HAV), and 5 times for detection of the Internal Control (IC). Readings are reported in Relative Light Units (RLUs).
- B. HAV Raw Averages of the 5 HAV RLU values are computed for each well.
- C. IC Raw Averages of the 5 IC RLU values are computed for each well.

- D. A HAV Blanks Average is calculated from the three blank wells:
- If a HAV Raw Average for a blank well is less than or equal to 13,000, it is considered qualified.
  - If there are fewer than two qualified HAV Raw Averages, all of the results on the plate will be disqualified.
  - The HAV Blanks Average is calculated by averaging the two or more qualified HAV Raw Averages and rounding to two decimal places.
- E. A IC Blanks Average is calculated from the three blank wells:
- If an IC Raw Average for a blank well is less than or equal to 16,000, it is considered qualified.
  - If there are fewer than two qualified IC Raw Averages, all of the results on the plate will be disqualified.
  - The IC Blanks Average is calculated by averaging the two or more qualified IC Raw Averages and rounding to two decimal places.
- F. If the HAV Raw Average for the Fmax well is greater than or equal to 54,000, the HAV Raw Average is considered qualified.
- G. If the IC Raw Average for the Fmax well is greater than or equal to 53,000, the IC Raw Average is considered qualified.
- H. If either the HAV Raw Average or the IC Raw Average fails to qualify, all of the results on the plate will be disqualified.
- I. Normalized HAV for each well, including the Fmax, is calculated by subtracting HAV Blanks Average from the HAV Raw Average.
- J. HAV Percentage of Fmax for each sample and control well is calculated by dividing the Normalized HAV by the Normalized HAV Fmax, multiplied by 100 and rounded to a whole number.
- K. IC Percentage of Fmax for each sample and control well is calculated by dividing the Normalized IC by the Normalized IC Fmax, multiplied by 100 and rounded to a whole number.
- L. A Positive Control is considered qualified if the HAV Percentage of Fmax for the well is greater than or equal to 7.



- M. If any of the Positive Controls are not qualified, then all of the results on the plate will be disqualified.
- N. A Negative Control is considered qualified if the HAV Percentage of Fmax for the well is less than 7 and the IC Percentage of Fmax is greater than or equal to 10.
- O. If any of the Negative Controls are not qualified, then all of the results on the plate will be disqualified.
- P. Interpret sample and External Control results:
  - a. A sample is considered positive if the HAV Percentage of Fmax is greater than or equal to 7.
  - b. A sample is considered Negative if the HAV Percentage of Fmax is less than 7 and the IC Percentage of Fmax is greater than or equal to 10.
- Q. Evaluate performance of External Controls:
  - a. If the Negative External Control is missing or is not negative, the control is considered invalid, the plate is considered Invalid and Negative sample results are disqualified, while Positive sample results are still considered Positive.
  - b. If the Positive External Control is missing or is not Positive, the control is considered invalid, the plate is considered Invalid and Negative sample results are disqualified, while Positive sample results are still considered Positive.
  - c. If both Positive and Negative External Controls are considered valid, all sample results are considered qualified.
- R. All calculations are performed as described, with standard rounding rules applied only to the products of four calculations:
  - a. The internal control blanks average and the HAV blanks average, which are both rounded to 2 decimal places after calculation.
  - b. The internal control percentage of internal control Fmax and the HAV percentage of HAV Fmax, which are both rounded to whole numbers before comparison with cutoff values and interpretation.
- S. Additional assay parameters and acceptance criteria must be validated by the user.

## **PERFORMANCE CHARACTERISTICS**

- A. **Sensitivity:** The assay has been validated to detect equal to or greater than 50 IU/ml per 96 member pool and equal to or greater than 4,800 IU/ml per individual sample.



- B. Pool Resolution: Positive pools are resolved to a single sample. The 96 sample plate is in a 8 X 12 grid with 8 rows and 12 columns. Each row from a positive plate is made into a pool containing 12 samples and then tested. The twelve samples in each positive row are then tested separately to determine the positive sample(s).
  
- C. Potentially Interfering Substances: The assay demonstrated the ability to detect HAV RNA in the presence of potentially interfering substances including anticoagulants (ACD, 4% Sodium Citrate), and other viruses (HCV, BVDV, HBV, Parvo B19 and HIV-1). The assay also detected HAV RNA in lipemic and hemolytic plasma samples.
  
- D. Repeatability and Reproducibility (Intra and Inter Run Validity): The repeatability and reproducibility of the assay was determined by using three different lots of reagents and two different technicians. Each technician tested a panel of samples using each lot three different times.
  
- E. Genotypes: The assay has been shown to detect genotypes IA, IB, and III.