AVICENNA

AviSeq™

Genomic DX

MICROBIOME

REF: AVG800016 16 TESTS
REF: AVG800048 48 TESTS

USER GUIDE

AVG800_IFU_Rev03_NOV23

CE
IVD

CONTENTS

1. AIM OF USE

Aviseq MICROBIOME is a novel NGS Medical Device for the molecular profiling of several human microbial communities. The analysis is performed with a molecular protocol based on Next Generation Sequencing (NGS) technologies.

Aviseq MICROBIOME must be used together with the following Avicenna reagents (not included in the kit) containing the specific adapters and index or barcode, and it's compatible with Illumina, Ion Torrent sequencers:

Illumina: Aviseq Index Set 16 (Ref.AVG404) or Aviseq Index Set1 (Ref. AVG411) or Aviseq Index set 384 (Ref. AVG405).

Ion Torrent: Barcode Set 1-16 (cod. AVG502) or Barcode Set 17-32 (cod. AVG503).

The kit can be used for analysis of DNA extracted from fecal, pulmonary, oral or vaginal sample.

GENE	Target regions
16s	V1-V2
	V3-V4
	V5-V6
	V7-V8-V9

Table 1: List of target regions.

2. KIT CONTENTS

The kit size is 16 or 48 tests, which can be divided respectively into a maximum of two and three analysis sessions. Dividing the kits into more analysis sessions may alter the overall performance of the kit and/or decrease the total number of tests that can be performed.

Tube	Description	Volume 16 tests	Volume 48 tests
1	Primers mix Pool	16 µl	48 µl
Taq	Hot Start Hi-Fi Taq	6.4 µl	19.2 µl
BA	BUFFER A	224 µl	672 µl
BB	BUFFER B	224 µl	672 µl
NTP	dNTPs Mix 10mM	22.4 µl	67.2 µl

Table 2: Kit contents.

3. STORAGE AND PRODUCT STABILITY

All reagents provided with our kits are ready to use and should be stored at -20°C.
The kit, intact and properly stored, will maintain high quality performance capacity until the expiry date marked on each single reagent tube and on the external jar/container.
When the reagents are thawed, they must be kept on ice throughout the process.

4. KIT FEATURES

- SPECIFICITY: >99%
- SENSITIVITY: >99%

5. REQUIRED MATERIAL NOT INCLUDED

5.1 Generic Material

- Computer with constantly updated and guaranteed secure internet connection.
- Micropipettes calibrated and periodically verified 0,2-2 µl, 2-20 µl, 20-200 µl or 100-1000 µl and filter tips.
- Vortex.
- Disposable Gloves without powder.
- Thermal cycler calibrated and periodically verified.
- Tubes and Caps or 96-wells plate, as needed, DNase and RNase free.
- Nuclease-free water.
- 1,5 ml tube magnetic separator or 96-wells plate compatible magnetic separator.
- Freshly prepared 70% ethanol.
- Illumina or Ion Torrent sequencers calibrated and periodically verified.
- For Illumina sequencers: Aviseq Index Set 16 (Ref.AVG404) or Aviseq Index Set1 (Ref. AVG411) or Aviseq Index set 384 (Ref. AVG405).
- For Ion Torrent sequencers: Barcode Set 1-16 (cod. AVG502) or Barcode Set 17-32 (cod. AVG503).

5.2 Specific Material

The material listed below has been used and validated by Avicenna:

- Qubit™ 2.0 Fluorometer (Invitrogen Cod. Q32866) or Qubit™ 3.0 Fluorometer (Invitrogen Cod. Q33216) or Qubit™ 4.0 Fluorometer (Invitrogen Cod. Q33226) calibrated and periodically verified.
- Qubit™ assay tubes (Invitrogen Cod. Q32856).
- Qubit™ dsDNA HS Assay Kit (Invitrogen, cod. Q32851).
- Magnetic beads for the purification of genomic libraries, AMPure XP (Beckman Coulter, cod. A63880) or MAGTIVIO (magSi-NGSPREP Plus, cod. MDKT00010075).

QUALITATIVE ANALYSIS OF DNA (Optional)

- Agilent 2100 Bioanalyzer system with DNA reagent kit calibrated and periodically verified.

6. IMPORTANT NOTES AND SAFETY INFORMATION

The user is required to apply the following provisions.
If the device or the results it generates, even in part, is transferred to a third party, the user must inform the end-user about the application of the specific provisions. The manufacturer is committed to constantly checking the possibilities of implementing the procedures, providing support to users.

- The kit is for professional use, it must be used by trained professionals in molecular biology.
- Do not use if package damaged.
- Biological samples and all reagents should be used in properly equipped rooms, clean and clear of potential contaminants. We suggest cleaning working areas frequently using a solution containing sodium hypochlorite 1-5%.
- Always use safety equipment such as laboratory coat, gloves and safety goggles during all steps described in the protocol.
- Check the risks and safety procedures associated with instruments, electricity, chemicals and other resources applied to the use of the device.
- Prepare ways of detecting errors in the operation of the device, evaluating after each usage the quality of the results generated; in case of doubts or anomalies found, the supplier must be promptly contacted for support.
- When the results produced are used in diagnostic or clinical processes, the user is required to consider the possible risks associated with diagnostic errors, to set up control mechanisms and to inform the medical personnel responsible for the diagnostic or clinical processes.

- To avoid contamination of reagents we recommend using DNase/RNase free tubes, filter tips and to pay particular attention to keep all instruments clean and free of contaminants.
- We suggest preparing a unidirectional workflow from the initial phase of DNA isolation following the PCR preparation phase, amplification and post-amplification phases in order to keep working areas separated for the different phases of the procedure using for each phase dedicated laboratory coats, micropipettes, tubes and filter tips.
- Used reagents and biological samples must be wasted according to legal procedures.

➢ **Stopping point**: every time is present a stopping point you can proceed with the following step or store the samples at 4°C for 24 hours or -20°C for a longer period.

7. OPERATIVE PROTOCOL

7.1 DNA SAMPLES PREPARATION

Use any commercial kit to obtain DNA from faecal, pulmonary, oral or vaginal sample. Determine the starting DNA concentration by fluorometric methods for accuracy.

7.2 TARGET ENRICHMENT

Amplification of the target regions are performed with PCR in 1 reaction tube.

Refer to the table below for the quantities of reagents required to prepare each reaction of target enrichment:

Mix x 1 reaction	
Primer Mix Pool	1 µl
Buffer A	4 µl
Buffer B	4 µl
dNTPs Mix 10 mM	0,4 µl
Hot Start Hi-Fi Taq	0,2 µl
DNA	1 ng
H_2O	Up to 20 µl
TOT	**20 µl**

Table 3: quantities of reagents for each target enrichment reaction.

Prepare MasterMIX

In a clean and appropriated work area (e.g. laminar workflow) prepare the MasterMIX.

Unfreeze Buffer A, Buffer B, dNTPs, Primer Mix Pool. Vortex and briefly centrifuge. Keep Hot Start Hi-Fi Taq in ice (do not vortex).

a) Prepare MasterMIX as described in the following table:

MasterMIX	x 1
Primer Mix Pool	1 µl
Buffer A	4 µl
Buffer B	4 µl
dNTPs Mix 10 mM	0,4 µl
Hot Start Hi-Fi Taq	0,2 µl
H2O	9,4 µl
TOTAL	**19 µl**

Table 4: MasterMIX for 1 sample.

b) For each sample, dispense 19 µl of each MasterMIX per tube, change working area then add 1 µl of DNA (1 ng). Briefly centrifuge the samples.

N.B. ***During all time keep the mixes and reagents on ice when not in use.***

Place PCR tubes in the thermocycler and then start the program according to the following thermal profile:

Stage	Temperature (°C)	Time	Ramping	Cycles
Stage 1	98	2 min	4.0°C/s	1
Stage 2	98	10 sec	4.0°C/s	30
	60	2 min	1.0°C/s	
	72	20 sec	1.0°C/s	
Stage 3	72	5 min	4.0°C/s	1
Stage 4	4	HOLD	4.0°C/s	1

Table 5: PCR thermal profile.

➢ **STOPPING POINT**

7.3 QUANTIFICATION OF PCR PRODUCTS

Analyse the obtained libraries with a fluorometer Qubit and kit Qubit dsDNA HS Assay.

7.4 QUALITATIVE AND QUANTITATIVE ANALYSIS OF LIBRARIES (OPTIONAL)

A quick estimation of DNA products size may be obtained running samples on agarose gel. However, we strongly recommend using the Agilent 2100 Bioanalyzer with DNA reagent kit; please refer to procedure of instrument.

INDEXING/BARCODING PROTOCOL

7.5 INDEXING/BARCODING PCR MIX PREPARATION

7.5.1 Defrost, quickly vortex and centrifuge the reagents supplied. Keep the Hot Start Hi-Fi Taq on ice (do not vortex).

N.B. For PCR use Buffer A, Buffer B, dNTPs and Hot Start Hi Fi Taq contained in panel kit; during all time keep the mixes and reagents on ice when not in use.

Illumina: Aviseq Index Set 16 (Ref.AVG404) or Aviseq Index Set1 (Ref. AVG411) or Aviseq Index set 384 (Ref. AVG405).
Ion Torrent: Barcode Set 1-16 (cod. AVG502) or Barcode Set 17-32 (cod. AVG503).

7.5.2 For each sample, prepare a mix according to the following scheme:

ILLUMINA	
Master Mix	**x1**
DNA (library)	100 ng
Buffer A	10 µl
Buffer B	10 µl
dNTPs Mix 10 mM	1 µl
Hot Start Hi-Fi Taq	0,2 µl
Index i7 + i5	2 µl
H_2O	Up to 50 µl

ION TORRENT	
Master Mix	**x1**
DNA (library)	100 ng
Buffer A	10 µl
Buffer B	10 µl
dNTPs Mix 10 mM	1 µl
Hot Start Hi-Fi Taq	0,2 µl
Barcode Oligo	2 µl
H_2O	Up to 50 µl

Table 6: Master mix preparation volumes.

The Reaction could be set up in 2 STEPs.

Step 1: Prepare the AmpliMIX (example for a library concentrated 10 ng/µl):

AmpliMIX	x1
Buffer A	10 µl
Buffer B	10 µl
dNTPs Mix 10 mM	1 µl
Hot Start Hi-Fi Taq	0,2 µl
H_2O	16,8 µl
TOT	**38 µl**

Table 7: PCR mix preparation volumes.

Step 2: Prepare the Master Mixes:

For Ion Torrent: assign to each sample a specific barcode and add 2 µl of the selected barcode to each sample tube.

Prepare Master Mix (Table 8):

ION TORRENT	
Master Mix	**x1**
AmpliMIX	38 µl
Barcode	2 µl
TOT	**40µl**

Table 8: Master Mix preparation.

7.5.3 In a post-PCR area, add 10 µl (100 ng of DNA) of the library (point 7.2) Please note that the total volume of the PCR should be 50 µl.

Proceed with point 7.5.4.

For Illumina: for each sample, add 2 µl of indexes to the AmpliMix from the 96-well plate.

Note: for the conversion table refer to the IFU of each index set kit.

Prepare the Master Mix (Table 9).

ILLUMINA	
Master Mix	**x1**
AmpliMIX	38 µl
Indexs	2 µl
TOT	**40 µl**

Table 9: Master Mix preparation.

7.5.3 In a post-PCR area, add 10 µl (100 ng of DNA) of the library (point 7.2). Please note that the total volume of the PCR should be 50 µl.

Proceed with point 7.5.4.

7.5.4 Briefly centrifuge the samples.

7.5.5 Keep the tubes on ice until starting the indexing step on the thermocycler.

7.5.6 Place the reaction tubes/plate in the thermal cycler and run the following PCR protocol:

Stage	Temperature (°C)	Time	Ramping	Cycles
Stage 1	98	1 min	4.0°C/s	1
Stage 2	98	10 sec	4.0°C/s	15
	54	40 sec	1.0°C/s	
	72	3 min	1.0°C/s	
Stage 3	72	2 min	4.0°C/s	1
Stage 4	10	HOLD	4.0°C/s	1

Table 11: Thermal-cycler profile.

- **STOPPING POINT**

7.6 PCR PURIFICATION

In appropriate post-PCR area, proceed with the library purification:

N.B. Fresh ethanol 70 % is required for a proper wash low molecular weight molecules. Low ethanol concentrations can lead to loss of sample.

a) For each sample, distribute 40 µl (0.8X) of magnetic beads (previously resuspended) in low binding 1,5 ml tubes.
b) Add 50 µl of each amplified library pool; pipet up and down 5 times to thoroughly mix the beads suspension with the DNA.
c) Incubate samples at room temperature for 5 minutes.
d) Place tubes on the magnetic support and incubate for 2 minutes or until the mixture appears clear; remove supernatant without touching the pellet.
e) Add 200 µl of freshly prepared ethanol 70% and rotate tubes twice to wash the beads; remove supernatant without touching the pellet.
f) Repeat the washing step for a total 2 wash.
g) Ensure that all ethanol is removed; keeping tubes on the magnetic support let the beads dry on air for 5 minutes (do not desiccate the pellet to the cracking point).
h) Remove the tubes from the magnetic support and elute the DNA in 32 µl of RNase/DNase free distilled water; pipet up and down 5 times to thoroughly mix the beads suspension with the DNA.
i) Incubate 5 minutes at room temperature.
j) Place tubes on magnetic support and incubate for 2 minutes or until the mixture appears clear; carefully collect 30 µl of the supernatant containing the desired amplicons without touching the pellet.

➢ **STOPPING POINT**

7.7 QUALITATIVE AND QUANTITATIVE EVALUATION OF PCR PRODUCTS (OPTIONAL)

A quick estimation of DNA products size may be obtained running samples on agarose gel. However, we strongly recommend using Agilent 2100 Bioanalyzer (refer to manufacturers manual for protocol).

7.8 QUANTITATIVE EVALUATION OF PCR PRODUCTS

Quantify PCR products using a fluorometer, according to the manufacturer instructions, to prepare an equimolar pool of samples for sequencing.

For Illumina: dilute each library according to the Illumina sequencer procedure.

For Ion Torrent: dilute each library according to the Ion Torrent sequencer procedure.

8. TROUBLESHOOTING

PROBLEM	POSSIBILE CAUSE	SUGGESTION
Absence of bands on agarose gel after electrophoresis	Wrong PCR thermal profile	Verify the PCR thermal profile and calibration then repeat the PCR reaction
	Mistakes in master mix preparation	Verify PCR mix components and repeat the PCR reaction
	Degraded reagents	Verify expiry date and storing conditions of the products
	Presence of inhibitors	Verify concentration and quality of DNA extracted using a spectrophotometer. If necessary, repeat DNA extraction.
	Low amount of DNA	Verify concentration and quality of DNA extracted using a spectrophotometer. If necessary, repeat DNA extraction.
Presence of fragments with low molecular weight	Primer residues and / or degradation of adapters, primers dimers, etc.	Eliminate low molecular weight fragments by purification with AMPure XP Beads

9. SYMBOLS

CE	*According to 98/79/CE Directive*	REF	*Catalogue number*
IVD	*In Vitro Diagnostic Medical Device*	LOT	*Batch code*
	Expiration date		*Temperature limitation*
	Consult instruction for use (IFU)		*Sufficient for n. tests*
	Manufacturer		*Do not use if package damaged*
EC REP	*Representative*		

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