510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION
DECISION SUMMARY
ASSAY ONLY TEMPLATE

A. 510(k) Number: k123903

B. Purpose for Submission:

To obtain a substantial equivalent determination for a premarket notification for the BD BACTEC Lytic/10 Anaerobic/F (plastic) blood culture medium

C. Measurand:

Anaerobic microorganisms from blood

D. Type of Test:

Liquid culture medium for recovery of microorganisms from blood using fluorescent technology to detect the increased CO_2 produced by the growth of microorganisms

E. Applicant:

Becton, Dickinson and Company

F. Proprietary and Established Names:

BD BACTEC Lytic/10 Anaerobic/F (plastic)

G. Regulatory Information:

1. Regulation section:

   21 CFR 866.2560

2. Classification:

   Class I

3. Product code:

   MDB

4. Panel

   83 Microbiology

H. Intended Use

1. Intended use:

   BD BACTEC™ Lytic/10 Anaerobic/F culture vials (prereduced enriched Soybean-Casein Digest broth with CO_2) are for anaerobic blood cultures. Principal use is with the BACTEC fluorescent series instruments for the qualitative culture and recovery of anaerobic microorganisms from blood.

2. Indications for use:

   BD BACTEC™ Lytic/10 Anaerobic/F culture vials (prereduced enriched Soybean-Casein Digest broth with CO_2) are for anaerobic blood cultures. Principal use is with the BACTEC fluorescent series instruments for the qualitative culture and recovery of anaerobic microorganisms from blood.

3. Special conditions for use statement(s):

   Prescription use

4. Special instrument requirements:

   BACTEC fluorescent series instruments: BACTEC FX, BACTEC 9240, and BACTEC 9050

I. Device Description:

The blood sample to be tested is inoculated into one or more vials which are inserted into the BACTEC fluorescent series instrument for incubation and periodic reading. Each vial contains a chemical sensor which can detect increases in CO_2 produced by the growth of microorganisms. The sensor is monitored by the instrument every ten minutes for an increase in its fluorescence, which is proportional to the amount of CO_2 present. A positive reading indicates the presumptive presence of viable microorganisms in the vial. Detection is limited to microorganisms that will grow in a particular type of medium.

J. Substantial Equivalence Information:

1. Predicate device name(s):

   BD BACTEC Lytic/10 Anaerobic/F medium (glass)

2. Predicate k number(s):

   k954925

3. Comparison with predicate:

Similarities		
Item	Device	Predicate
Intended Use	Qualitative anaerobic culture and recovery of microorganisms from blood, with the BD BACTEC fluorescent series instrument	Same
Specimen type	Human blood	Same
Maximum blood to broth ratio	1:5	Same
Instrumentation	BD BACTEC fluorescent series using the same incubation, agitation parameters and detection algorithms	Same
Detection Technology	Continuous monitoring; incorporate sensor for detection of CO_2 increases produced by organism growth	Same
Active ingredients in growth medium	40 mL of enriched soybean casein digest broth	Same
Incubation	35ºC (± 1.5ºC) up to 120 hours	Same

Differences		
Item	Device	Predicate
Vial	Plastic	Glass
Vial weight	Lighter than glass	-
Vial height	5.0 inches	5.6 inches
Vial sensor	Adjusted to obtain equivalent performance to that of the glass vial	-

K. Standard/Guidance Document Referenced (if applicable):

Not applicable

L. Test Principle:

The BD BACTEC Lytic/10 Anaerobic/F blood culture medium is an enriched soybean-casein digest broth, with each vial containing 40 mL of broth. Sodium polyanetholesulfonate (SPS) is added to the medium as an anticoagulant that inhibits bacteriocidal activities in the blood. The concentration of SPS has been optimized to accommodate blood volumes of up to 10mL per vial.

Each BD BACTEC Lytic/10 Anaerobic/F blood culture medium vial contains a chemical sensor in a silicon rubber base that can detect increases in CO_2 produced by the growth of microorganisms. Three to 10mL of blood is inoculated into the BD BACTEC Lytic/10 Anaerobic/F blood culture medium vial, which is inserted into the BD BACTEC Fluorescent Series instrument for incubation, agitation and periodic measurement. When microorganisms are present in the blood sample, they metabolize nutrients in the culture medium, releasing CO_2 into the medium. A dye in the sensor reacts with the CO_2, modulating the amount of light that is absorbed by the fluorescent material in the sensor. The instrument's photo detectors monitor the sensor every 10 minutes and measure the level of fluorescence, which is proportional to the amount of CO_2 present in the vial. Positivity of a vial is determined by algorithms resident in the instrument rack's microprocessor. The algorithms use the rate of CO_2 production as well as the absolute increase in CO_2 to interpret the data.

Culture vials flagged as presumptively positive are removed from the instrument for subculture and Gram stain in order to identify the microorganisms for further evaluation and proposed patient treatment. Culture vials that are not flagged as positive remain in the instrument until the test protocol has been completed and negative vials are discarded (after 120 hours).

M. Performance Characteristics (if/when applicable):

1. Analytical performance:

   a. Precision/Reproducibility

   A comparison across three lots study was evaluated in the Percent Recovery study. The lots were manufactured individually with varying key components. Three hundred forty two paired sets (114 paired sets x 3 lots) at the 10 to 100 CFU per vial inoculum level yielded 100% (95% CI: 98.9%, 100%) recovery.

   b. Linearity/assay reportable range:

   Not applicable

   c. Traceability, Stability, Expected values (controls, calibrators, or methods):

An internal validation study was conducted to evaluate the range of time-to-detection in hours was ≤72 hours for each of the organisms listed below. The study was conducted across three lots.

Clostridium perfringens ATCC 13124
Bacteroides vulgatus ATCC 8482
Escherichia coli ATCC 25922
Clostridium histolyticum ATCC 19401
*Bacteroides fragilis** ATCC 25285
Streptococcus pneumoniae ATCC 6305
Staphylococcus aureus ATCC 25923

*CLSI Strain

The time-to-detection study results were acceptable.

d. Detection limit:

Microbial Detection Limit

The microbial detection limit study included 13 organisms (six anaerobes and seven aerobes) tested at blood volumes of 3 and 10 mL, each at inoculum levels of 0-1and 1-10 CFU/vial over three lots with BACTEC FX and BACTEC9240. The performance was demonstrated below:

		Glass Vial		
		Detected	Not detected	
Plastic Vial	Detected	191	48**	
	Not detected	29*	44***	
				312

*27 were from 0 to 1 CFU; 2 were from 1 to 10 CFU
**44 from 0 to 1 CFU; 4 from 1 to 10 CFU
***44 from 0 to 1 CFU

There were 29 recovery failures in the plastic vials, 27 of which were at the 0-1 CFU. The two recovery failures at the 1-10 CFU inoculum levels were *Clostridium perfringens, Prophyromonas asaccharolytica* (formerly *Bacteroides melaninogenicus* subsp. *asaccharolyticus*) with plate count of 0 and 4 CFU respectively.

An additional recovery study was evaluated at the inoculum of 10- 100 CFU/vial, with no recovery failures. The study included 19 organisms tested at two blood volumes, over three lots on the BACTEC FX, BACTEC 9050, and BACTEC 9240 instruments.

The microbial detection limit study results were acceptable.

e. Analytical specificity:

Not applicable

f. Assay cut-off:

Not applicable

2. Comparison studies:

Performance of the BD BACTEC Lytic/10 Anaerobic/F (plastic) blood culture vials was evaluated in internal analytical studies to demonstrate comparable performance to the predicate device, the BD BACTEC Lytic/10 Anaerobic/F medium in glass vials. Method comparison results were acceptable.

a. Method comparison with predicate device:

Instrument Time to Detection (TTD) study

The data included 342 paired sets at the 10-100 CFU per vial inoculum level across two blood volume of 3 and 10 mL; they were evaluated in both the new and the predicate devices with 100% recovery. The observed median TTD difference between the paired sets was 10 minutes faster for the BD BACTEC Lytic/10 Anaerobic/F medium contained in a plastic vial. Ninety-five percent of the TTD differences between the paired sets were between -1.68 hours faster for the glass vial and 3 hours faster for the plastic vial.

There were 191 paired sets at the 0-1 and 1-10 CFU per vial inoculum levels that were positive in both the new and predicate devices.

Percent Recovery Study

A total of 342 paired sets at 10 to 100 CFU per vial were evaluated in the Percent Recovery comparison. The study included 19 organisms (10 anaerobes and 9 aerobes) on three lots with two blood volumes on the BACTEC FX, BACTEC 9050, and BACTEC 9240. All were positive in both the new plastic and the predicate devices. The analysis at the 10-100 CFU per vial inoculum level supports substantial equivalence.

An additional study included a subset of organisms, *Finegoldia magna* (formerly *Peptostreptococcus magnus*) and *Peptoniphilus asaccharolyticus* (formerly *Peptostreptococcus asaccharolyticus)* were evaluated on the BD BACTEC FX instrument at 10 to 100 CFU per vial and demonstrated 100% recovery in both the BD

BACTEC Lytic/10 Anaerobic/F medium contained in a plastic vial and the BD BACTEC Lytic/10 Anaerobic/F medium contained in a glass vial.

False Positive Rate

False positivity was assessed with vials inoculated with freshly drawn human blood (i.e. 2, 4, 6, 8 and 10 mL). No organisms were added to the vial. There were 240 pair sets across three lots using BACTEC FX and BACTEC 9240. No positive results were observed.

False Negative Study

Vials that were instrument negative at 120 hours and found to be terminal subculture positive were classified as false negative vials.

The data for this study was generated from the Instrument Time to Detection, Percent Recovery (Sensitivity), and Microbial Detection Limit studies. Vials expected to be positive (i.e., those inoculated with viable organisms) formed the dataset for the False Negative Rate.

A total of 121 pair sets were evaluated by terminal subculture to determine if the results were false negative. All anaerobes were subcultured onto CDC anaerobe 5% Sheep Blood Agar, incubated anaerobically for five days for determination of no growth, with the results listed below:

Detected in predicate device only	29
Detected in new device only	48
Detected in neither devices (Negatives)	44 paired sets

Of the 29 both instrument and terminal subculture negative from the new plastic vials (i.e. detected in glass vials only), there were 27 that were at the low inoculum level of 0- 1 CFU/mL, six of which had initial plate count of 1-2 CFU: two recovery failures each from *Bacteroides vulgatus* (initial plate count was 2 CFU), *Veilonella parvula* (initial plate count was 1 CFU), and *Staphylococcus aureus* (initial plate count was 1 CFU).

There were 48 instrument and subculture negative results from the glass vials (i.e. detected in plastic vials only); 44 were from the low inoculum level of 0- 1 CFU/mL and nine of which had initial plate count of 1-2 CFU. There were five recovery failures for anaerobes: two for *Bacteroides vulgatus,* one *Fusobacterium nucleatum,* and two for *Veilonella parvula.*

There were no false negative results observed in either the new plastic or the glass vials, indicating that the low inoculum might not have been inoculated into the vials.

BACTEC Instrument Compatibility

A total of 114 paired sets (new and predicate devices) were tested in each the BACTEC FX, BACTEC 9240 and BACTEC 9050 fluorescent-series blood culture instruments at the 10-100 CFU per vial inoculum level. A recovery comparison of the new device versus the predicate device results demonstrated that all 114 paired sets were positive in both the new and the predicate devices in each of the BACTEC fluorescent series blood culture instruments.

All comparison studies results were acceptable.

b. Matrix comparison:

BD BACTEC Lytic/10 Anaerobic/F medium, human blood volume, common bloodstream pathogens (anaerobes and aerobes)

3. Clinical studies:

Not applicable; seeded analytical studies to compare the new plastic blood culture vials to the glass blood culture vials (predicate).

a. Clinical Sensitivity:

Not applicable

b. Clinical Specificity:

Not applicable

c. Other clinical supportive data (when a. and b. are not applicable):

Not applicable

4. Clinical cut-off:

Not applicable

5. Expected values/Reference range:

Seeded analytical studies demonstrated equivalent performance of the BD BACTEC Lytic/10 Anaerobic/F (plastic) blood culture medium when compared to the BD BACTEC Lytic/10 Anaerobic/F (glass) blood culture medium.

N. Proposed Labeling:

The labeling is sufficient and it satisfies the requirements of 21 CFR Part 809.10.

O. Conclusion

The submitted information in this premarket notification is complete and supports a substantial equivalence decision.