

# MacConkey Broth

## Intended Use

MacConkey Broth is used for the detection of coliform organisms in milk and water.

Meets *United States Pharmacopeia (USP)*, *European Pharmacopoeia (EP)* and *Japanese Pharmacopoeia (JP)*<sup>1-3</sup> performance specifications, where applicable.

## Summary and Explanation

MacConkey Broth is a modification of the original bile salt broth recommended by MacConkey<sup>4</sup> that contained 0.5% sodium taurocholate and litmus as an indicator. In later publications,<sup>5,6</sup> MacConkey suggested variations of this formulation using neutral red indicator instead of litmus. Childs and Allen<sup>7</sup> demonstrated the inhibitory effect of neutral red and substituted the less inhibitory bromcresol purple. Oxgall in the medium

replaces the original sodium taurocholate to inhibit growth of gram-positive organisms.

MacConkey Broth is used for cultivating gram-negative, lactose-fermenting bacilli and as a presumptive test for coliform organisms. It has been used to analyze food,<sup>8</sup> milk<sup>9,10</sup> and water samples<sup>10-13</sup> for coliforms. In addition, this medium has also been used in the rapid detection of shiga-toxin producing *E. coli* in fecal samples.<sup>14</sup> MacConkey Broth is recommended in the *USP* as a test medium for *E. coli* in the microbiological examination of nonsterile products.<sup>1</sup>

## Principles of the Procedure

Peptone provides amino acids and other growth factors. Lactose is a carbon energy source for gram-negative lactose-fermenting bacilli. Oxgall inhibits the growth of gram-positive organisms. Bromcresol purple is the indicator.

## User Quality Control

NOTE: Differences in the Identity Specifications and Cultural Response testing for media offered as both **Difco™** and **BBL™** brands may reflect differences in the development and testing of media for industrial and clinical applications, per the referenced publications.

### Identity Specifications

#### Difco™ MacConkey Broth

Dehydrated Appearance: Light beige, free-flowing, homogeneous.  
 Solution: 3.5% solution, soluble in purified water. Solution is purple, clear.  
 Prepared Appearance: Purple, clear.  
 Reaction of 3.5% Solution at 25°C: pH 7.3 ± 0.1

#### BBL™ MacConkey Broth (prepared)

Appearance: Purple and clear.  
 Reaction at 25°C: pH 7.3 ± 0.2

### Cultural Response

#### Difco™ MacConkey Broth

Prepare the medium per label directions. Inoculate and incubate at 35 ± 2°C for 18-24 hours. For *E. coli* ATCC 8739 and *S. aureus* ATCC 6538, inoculate 100 mL bottles and incubate at 43-44°C for 18-48 hours.

| ORGANISM  | ATCC™ | INOCULUM CFU    | RECOVERY                      | ACID | GAS |
|---|-------|-----------------|-------------------------------|------|-----|
| <i>Enterococcus faecalis</i>  | 29212 | 10 <sup>3</sup> | Marked to complete inhibition | -    | -   |
| <i>Escherichia coli</i>   | 25922 | 30-300          | Good                          | +    | +   |
| <i>Salmonella enterica</i> subsp. <i>enterica</i> serotype Choleraesuis var. Kunzendorf | 12011 | 30-300          | Good                          | -    | -   |
| <i>Escherichia coli</i>   | 8739  | <100            | Growth (at 24 hours)          | N/A  | N/A |
| <i>Staphylococcus aureus</i>  | 6538  | >100            | No growth (at 48 hours)       | N/A  | N/A |

KEY: + = positive, yellow for acid, gas  
 - = negative, no change for no acid, no gas

#### BBL™ MacConkey Broth (prepared)

Inoculate and incubate at 42-44°C for 18-48 hours.

| ORGANISM                     | ATCC™ | INOCULUM CFU | RECOVERY  | ACID |
|------------------------------|-------|--------------|-----------|------|
| <i>Escherichia coli</i>      | 8739  | 10 - 100     | Growth    | +    |
| <i>Escherichia coli</i>      | 25922 | 10 - 100     | Growth    | +    |
| <i>Staphylococcus aureus</i> | 6538  | >100         | No growth | -    |

KEY: + = positive, yellow for acid  
 - = negative, no change for no acid



## Formula

### Difco™ MacConkey Broth

| Approximate Formula* Per Liter     |        |
|------------------------------------|--------|
| Oxgall .....                       | 5.0 g  |
| Pancreatic Digest of Gelatin ..... | 20.0 g |
| Lactose .....                      | 10.0 g |
| Bromcresol Purple .....            | 0.01 g |

\*Adjusted and/or supplemented as required to meet performance criteria.

## Directions for Preparation from Dehydrated Product

1. Dissolve 35 g of the powder in 1 L of purified water. For testing 10 mL samples, prepare double strength.
2. Dispense in test tubes containing Durham tubes.
3. Autoclave at 121°C for 15 minutes.
4. Test samples of the finished product for performance using stable, typical control cultures.

## Sample Collection and Handling

For milk or food samples, follow appropriate standard methods for details on sample collection and preparation according to sample type and geographic location.<sup>8-10</sup>

For water samples, follow appropriate standard methods for details on sample collection and preparation according to sample type and geographic location.<sup>10-13</sup>

For pharmaceutical samples, follow appropriate standard methods for details on sample collection and preparation according to sample type and geographic location.<sup>1</sup>

## Procedure

Refer to appropriate references for details on test methods using MacConkey Broth.<sup>8-13</sup>

Inoculate tubes with the test sample. Incubate tubes at 35 ± 2°C for 18-24 hours in an aerobic atmosphere, or as instructed in appropriate reference.<sup>8-13</sup>

## Expected Results

Lactose-fermenting organisms grow very well in MacConkey Broth and produce acid, causing the medium to turn yellow. Gas is also produced, which collects in the Durham tubes. Nonfermenting organisms produce good growth but will not produce acid or gas.

## References

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2. European Directorate for the Quality of Medicines and Healthcare. 2008. The European pharmacopoeia, 6th ed., Supp. 1, 4-1-2008, online. European Directorate for the Quality of Medicines and Healthcare, Council of Europe, 226 Avenue de Colmar BP907, F-67029 Strasbourg Cedex 1, France.
3. Japanese Ministry of Health, Labour and Welfare. 2006. The Japanese pharmacopoeia, 15th ed., online. Japanese Ministry of Health, Labour and Welfare.
4. MacConkey. 1901. Zentralbl. Bakteriell. 29:740.
5. MacConkey. 1905. J. Hyg. 5:333.
6. MacConkey. 1908. J. Hyg. 8:322.
7. Childs and Allen. 1953. J. Hyg. Camb. 51:468.
8. Qadri, Buckle and Edwards. 1974. J. Appl. Bact. 37:7-14.
9. Adeleke, Adeniyi and Akinrinmisi. 2000. Afr. J. Biomed. Res. 3:89-92.
10. Hsu and Tsen. 2001. Int. J. Food Microbiol. 64:1-11.
11. World Health Organization. 4 Sept 2008. European standards for drinking water, 2nd ed., online. <www.who.int/water\_sanitation\_health/dwq/eurostand2/en/index.html>.
12. Alivisatos and Papadakis. 1975. J. Appl. Bact. 39:287-293.
13. International Organization for Standardization. 1990. Water quality – Detection and enumeration of coliform organisms, thermotolerant coliform organisms and presumptive *Escherichia coli* – Part 2: Multiple tube (most probable number) method. ISO 9308-2, First ed., 1990-10-01. International Organization for Standardization, Geneva, Switzerland.
14. Teel, Daly, Jerris, Maul, Svanas, O'Brien and Park. 2007. J. Clin. Microbiol. 45:3377-3380.

## Availability

### Difco™ MacConkey Broth

EP ISO JP USP

Cat. No. 220100 Dehydrated – 500 g<sup>†</sup>

### BBL™ MacConkey Broth

EP ISO JP USP

Cat. No. 215177 Prepared Bottles, 100 mL – Pkg. of 10<sup>†</sup>

Europe

Cat. No. 254957 Prepared Bottles, 100 mL – Ctn. of 25<sup>†</sup>

<sup>†</sup> QC testing performed according to USP/EP/JP performance specifications.