Triple Sugar Iron Agar, Granulated

Intended Use:
Triple Sugar Iron Agar, Granulated is used for the identification of gram-negative enteric bacilli on the basis of dextrose, lactose and sucrose fermentation and hydrogen sulphide production.

Composition**

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Gms / Litre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peptone</td>
<td>10.000</td>
</tr>
<tr>
<td>Tryptone</td>
<td>10.000</td>
</tr>
<tr>
<td>Yeast extract</td>
<td>3.000</td>
</tr>
<tr>
<td>HM Peptone B#</td>
<td>3.000</td>
</tr>
<tr>
<td>Lactose</td>
<td>10.000</td>
</tr>
<tr>
<td>Sucrose</td>
<td>10.000</td>
</tr>
<tr>
<td>Dextrose (Glucose)</td>
<td>1.000</td>
</tr>
<tr>
<td>Sodium chloride</td>
<td>5.000</td>
</tr>
<tr>
<td>Ferrous sulphate</td>
<td>0.200</td>
</tr>
<tr>
<td>Sodium thiosulphate</td>
<td>0.300</td>
</tr>
<tr>
<td>Phenol red</td>
<td>0.024</td>
</tr>
<tr>
<td>Agar</td>
<td>12.000</td>
</tr>
</tbody>
</table>
| Final pH ( at 25°C)     | 7.4±0.2     **Formula adjusted, standardized to suit performance parameters

# Equivalent to Beef extract

Directions
Suspend 64.52 grams in 1000 ml distilled water. Heat to boiling to dissolve the medium completely. Mix well and distribute into test tubes. Sterilize by autoclaving at 15 lbs pressure (121°C) for 15 minutes. Allow the medium to set in sloped form with a butt about 1 inch long.

Note: For better results, the medium can be sterilized by autoclaving at 10 lbs pressure (115°C) for 15 minutes.

Principle And Interpretation

Triple Sugar Iron Agar was originally proposed by Sulkin and Willett (1) and modified by Hajna (2) for identifying Enterobacteriaceae. This medium complies with the recommendation of APHA, for the examination of meat and food products (3), for the examination of milk and dairy products (4) and for microbial limit test for confirming the presence of Salmonellae (5, 6) and in the identification of gram-negative bacilli (6, 7).

Tryptone, peptone, yeast extract and HM peptone B provide nitrogenous compounds, sulphur, trace elements and vitamin B complex etc. Sodium chloride maintains osmotic equilibrium. Lactose, sucrose and dextrose are the fermentable carbohydrates. Sodium thiosulphate and ferrous ions make H2S indicator system. Phenol red is the pH indicator. Organisms that ferment glucose produce a variety of acids, turning the colour of the medium from red to yellow. More amount of acids are liberated in butt (fermentation) than in the slant (respiration). Growing bacteria also form alkaline products from the oxidative decarboxylation of peptone and these alkaline products neutralize the large amounts of acid present in the butt. Thus the appearance of an alkaline (red) slant and an acid (yellow) butt after incubation indicates that the organism is a glucose fermenter but is unable to ferment lactose and/or sucrose. Bacteria that ferment lactose or sucrose (or both), in addition to glucose, produce large amounts of acid enables no reversion of pH in that region and thus bacteria exhibit an acid slant and acid butt. Gas production (CO2) is detected by the presence of cracks or bubbles in the medium, when the accumulated gas escapes. Thiosulphate is reduced to hydrogen sulphide by several species of bacteria and HS combines with ferric ions of ferric salts to produce the insoluble black precipitate of ferrous sulphide. Reduction of thiosulphate proceeds only in an acid environment and blackening usually occurs in the butt of the tube. Triple Sugar Iron Agar should be used in parallel with Urea Agar/Broth (M112/M111) to distinguish between Salmonella and Proteus species. The reactions can be summarized as follows:
Alkaline slant / acid butt-only glucose fermented
Acid slant / acid butt-glucose and sucrose fermented or glucose and lactose fermented or all the three sugars, glucose, lactose and sucrose fermented.
Bubbles or cracks present-gas production
Black precipitate present-H₂S gas production

**Type of specimen**
Pure bacterial isolate

**Specimen Collection and Handling:**
Follow appropriate techniques for sample collection, processing as per guidelines (8,9)
After use, contaminated materials must be sterilized by autoclaving before discarding.

**Warning and Precautions:**
Read the label before opening the container. Wear protective gloves/protective clothing/eye protection/ face protection. Follow good microbiological lab practices while handling specimens and culture. Standard precautions as per established guidelines should be followed while handling clinical specimens. Safety guidelines may be referred in individual safety data sheets

**Limitations:**
1. Some members of the *Enterobacteriaceae* and H₂S producing *Salmonella* may not be H₂S positive on TSI Agar. Some bacteria may show H₂S production on Kligler Iron Agar but not on TSI Agar. This can happen because utilization of sucrose in TSI Agar suppresses the enzymic pathway that result in H₂S production.

**Performance and Evaluation**
Performance of the medium is expected when used as per the direction on the label within the expiry period when stored at recommended temperature.

**Quality Control**

**Appearance**
Light yellow to pink homogeneous garnular media

**Gelling**
Firm, comparable with 1.2% Agar gel.

**Colour and Clarity of prepared medium**
Pinkish red coloured clear to slightly opalescent gel forms in tubes as slants.

**Reaction**
Reaction of 6.45% w/v aqueous solution at 25°C. pH : 7.4±0.2

**pH**
7.20-7.60

**Cultural Response**
GM021: Cultural characteristics observed after an incubation at 35-37°C for 18-24 hours.

<table>
<thead>
<tr>
<th>Organism</th>
<th>Inoculum (CFU)</th>
<th>Growth</th>
<th>Slant</th>
<th>Butt</th>
<th>Gas</th>
<th>H₂S</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Citrobacter freundii</em> ATCC 8090</td>
<td>50-100</td>
<td>luxuriant</td>
<td>acidic reaction, yellowing of the medium</td>
<td>acidic reaction, positive reaction</td>
<td>positive, blackening of medium</td>
<td></td>
</tr>
<tr>
<td><em>Enterobacter aerogenes</em> ATCC 13048 (00175*)</td>
<td>50-100</td>
<td>luxuriant</td>
<td>acidic reaction, yellowing of the medium</td>
<td>acidic reaction, positive reaction</td>
<td>negative, no blackening of medium</td>
<td></td>
</tr>
<tr>
<td><em>Escherichia coli</em> ATCC 25922 (00013*)</td>
<td>50-100</td>
<td>luxuriant</td>
<td>acidic reaction, yellowing of the medium</td>
<td>acidic reaction, positive reaction</td>
<td>negative, no blackening of medium</td>
<td></td>
</tr>
<tr>
<td><em>Klebsiella pneumoniae</em> ATCC 13883 (00097*)</td>
<td>50-100</td>
<td>luxuriant</td>
<td>acidic reaction, yellowing of the medium</td>
<td>acidic reaction, positive reaction</td>
<td>negative, no blackening of medium</td>
<td></td>
</tr>
<tr>
<td><em>Proteus vulgaris</em> ATCC 13315</td>
<td>50-100</td>
<td>luxuriant</td>
<td>alkaline reaction, red colour of the medium</td>
<td>acidic reaction, negative reaction</td>
<td>positive, blackening of medium</td>
<td></td>
</tr>
</tbody>
</table>

Please refer disclaimer Overleaf.
Salmonella Paratyphi A  
ATCC 9150  
50-100 luxuriant alkaline reaction, red colour of the medium acidic reaction, positive yellowing of the medium reaction negative, no blackening of medium

Salmonella Typhi  
ATCC 6539  
50-100 luxuriant alkaline reaction, red colour of the medium acidic reaction, positive yellowing of the medium reaction positive, blackening of medium

Salmonella Typhimurium  
ATCC 14028 (00031*)  
50-100 luxuriant alkaline reaction, red colour of the medium acidic reaction, positive yellowing of the medium reaction positive, blackening of medium

Shigella flexneri ATCC 12022 (00126*)  
50-100 luxuriant alkaline reaction, red colour of the medium acidic reaction, negative yellowing of the medium reaction negative, no blackening of medium

Escherichia coli ATCC 8739  
50-100 luxuriant acidic reaction, yellowing of the medium acidic reaction, positive yellowing of the medium reaction negative, no blackening of medium

Escherichia coli NCTC 9002  
50-100 luxuriant acidic reaction, yellowing of the medium acidic reaction, positive yellowing of the medium reaction negative, no blackening of medium

Klebsiella pneumoniae  
ATCC 10031  
50-100 luxuriant acidic reaction, yellowing of the medium acidic reaction, positive yellowing of the medium reaction negative, no blackening of medium

Key : *Corresponding WDCM numbers.

Storage and Shelf Life
Store between 10-30°C in a tightly closed container and the prepared medium at 2-8°C. Use before expiry date on the label. On opening, product should be properly stored dry, after tightly capping the bottle inorder to prevent lump formation due to the hygroscopic nature of the product. Improper storage of the product may lead to lump formation. Store in dry ventilated area protected from extremes of temperature and sources of ignition. Seal the container tightly after use. Use before expiry date on the label.

Product performance is best if used within stated expiry period.

Disposal
User must ensure safe disposal by autoclaving and/or incineration of used or unusable preparations of this product. Follow established laboratory procedures in disposing of infectious materials and material that comes into contact with clinical sample must be decontaminated and disposed of in accordance with current laboratory techniques (8,9).

Reference

Revision : 01/ 2018

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