Bilirubin (TOTAL AND DIRECT)
DMSO, Colorimetric

REF: 225 001  60 Test
R1 Direct Bilirubin  1x90 ml
R2 Total Bilirubin  1x90 ml
R3 Nitrite  1x 7 ml

Intended Use
Spectrum Diagnostics bilirubin reagent is intended for the in-vitro quantitative, diagnostic determination of bilirubin in human serum on both automated and manual systems.

Background
The average level of the bilirubin produced in humans from different sources ranges between 250 to 300 mg/day, of which 85% is derived from the hemoglobin of the haemoglobin released from senescent erythrocytes that are destroyed in the reticuloendothelial system. The remaining 15 % is produced from erythrocytes destroyed in the bone marrow and from catabolism of other heme containing proteins such as cytochromes and myoglobin.

After it is produced in the peripheral tissues, bilirubin is transported to the liver in association with albumin. In the liver, bilirubin is conjugated with glucuronic acid for solubilization and subsequent transport through the bile duct and elimination via the digestive tract. Disease or conditions which, through hemolytic processes, produce bilirubin faster than the liver can metabolize it, cause the levels of unconjugated (indirect) bilirubin to increase in the circulation. Bile duct obstruction or damage to hepatocellular structure causes increases in the levels of both conjugated (direct) and unconjugated (indirect) bilirubin in the circulation.

Method
DMSO. Colorimetric method.

Assay Principle
Bilirubin is converted to colored diazotized sulfanilic acid and measured photometrically. Of the two fractions presents in serum, bilirubin glucuronide and free bilirubin loosely bound to albumin, only the former reacts directly in aqueous solution (bilirubin direct), while free bilirubin requires solubilization with dimethylsulfoxide (DMSO) to react (bilirubin indirect). In the determination of indirect bilirubin the direct is also determined, the results correspond to total bilirubin.

Reagents
Reagent 1 (R1) D- Bilirubin
Sulfanilic acid  30 mmol/l
HCL  150 mmol/l
Reagent 2 (R2) T- Bilirubin
Sulfanilic acid  30 mmol/l
HCL  150 mmol/l
Dimethylsulfoxide(DMSO)  7 mol/l
Reagent 3 (R3)
Sodium Nitrite  29 mmol/l

Precautions and Warnings
Do not ingest or inhale. In case of contact with eyes or skin; rinse immediately with plenty of soap and water. In case of severe injuries; seek medical advice immediately.

Reagent Preparation, Storage and Stability
Spectrum bilirubin reagents are supplied ready-to-use and stable up to the expiry date labeled on the bottles when stored at 2 - 8 °C

Deterioration
Do not use the Spectrum bilirubin reagents if precipitate forms. Failure to recover control values within the assigned range may be an indication of reagent deterioration.

Specimen Collection and Preservation
Avoide exposure of the specimen to light. If plasma is used, only heparin and oxalate plasma are suitable. Other anticoagulants should not be used. The average half-life of total bilirubin and direct bilirubin in serum is 17 days and few hours respectively.

Stability:

<table>
<thead>
<tr>
<th></th>
<th>-20 °C</th>
<th>4 – 8 °C</th>
<th>20 – 25 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Direct</td>
<td>6 months</td>
<td>7 days</td>
<td>1 day</td>
</tr>
<tr>
<td>Direct</td>
<td>6 months</td>
<td>7 days</td>
<td>2 days</td>
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</tbody>
</table>

Procedure

Direct Bilirubin

<table>
<thead>
<tr>
<th>Sample blank</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reagent 1 (D)</td>
<td>1.5 ml</td>
</tr>
<tr>
<td>Reagent 3</td>
<td>1.5 ml</td>
</tr>
<tr>
<td>Sample</td>
<td>100 μl</td>
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</tbody>
</table>

Mix and incubate for 5 minutes at 20 – 25 °C. Measure absorbance of sample (ASample) against sample blank at 546 nm(530 - 580 nm)

Total Bilirubin

<table>
<thead>
<tr>
<th>Sample blank</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reagent 2 (T)</td>
<td>1.5 ml</td>
</tr>
<tr>
<td>Reagent 3</td>
<td>1.5 ml</td>
</tr>
<tr>
<td>Sample</td>
<td>50 μl</td>
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</tbody>
</table>

Mix and incubate for exactly 5 minutes at 20 – 25 °C. Measure absorbance of sample (ASample) against sample blank at 546 nm (530 - 580 nm).

Calculation

\[(A\text{-Sample} - (A\text{ Sample blank}) \times \text{Factor} = \text{mg/dl}\]

*Theoretical Factor

Direct bilirubin = 14

Total bilirubin = 19.1

Conversion Factor = mg/dl x 17.1 = μmol/l

Note
For bilirubin determination in newborns, pippete 50 μl of sample. Multiply the result by 2.

Quality Control
Normal & abnormal commercial control serum of known concentrations should be analyzed with each run.
Performance Characteristics

Precision
Within run (Repeatability)

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Direct</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Mean (mg/dL)</td>
<td>0.79</td>
<td>0.299</td>
</tr>
<tr>
<td>SD</td>
<td>0.016</td>
<td>0.016</td>
</tr>
<tr>
<td>CV%</td>
<td>2.13</td>
<td>5.41</td>
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</table>

Run to run (Reproducibility)

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Direct</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Mean (mg/dL)</td>
<td>0.82</td>
<td>0.32</td>
</tr>
<tr>
<td>SD</td>
<td>0.02</td>
<td>0.023</td>
</tr>
<tr>
<td>CV%</td>
<td>2.24</td>
<td>5.57</td>
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</table>

Methods Comparison

A comparison between Spectrum Diagnostics Bilirubin and a commercial reagent of the same methodology was performed on 20 human sera. A correlation of 0.975 was obtained.

Sensitivity
When run as recommended, the sensitivity of this assay is 0.1 mg/dL (1.7 μmol/L) for total and 0.04 mg/dL (0.68 μmol/L) for direct bilirubin.

Linearity
The reaction is linear up to a total bilirubin concentration of 18 mg/dL (308 μmol/L) and a direct bilirubin concentration of 18 mg/dL (308 μmol/L). Specimens showing higher concentration should be diluted 1+4 with physiological saline and repeat the assay (result×5).

Interfering substances

Serum, plasma

Haemolysis
Avoid haemolysis since it interferes with the test.

Lipemia
Lipemic specimens interfere with the test.

Drugs
Theophyllin and propranolol may cause artificially low total bilirubin levels.

Expected Values

Total Bilirubin
Adults and infants >1 month < 0.2-1.1 mg/dL (3.4-17 μmol/l)
Newborns premature (3-5 d) 10-14 mg/dL (171-239 μmol/l)

Newborns:
(3-5 d) 4.0 - 8.0 mg/dL (68-137 μmol/l)
(<48 h) 6.0 - 10.0 mg/dL (103-171 μmol/l)
(<24 h) 2.0-6.0 mg/dL (34-103 μmol/l)

Direct Bilirubin
0 - 0.3 mg/dL (0 - 51 μmol/L)

Spectrum Diagnostics does not interpret the results of a clinical laboratory procedure; interpretation of the results is considered the responsibility of qualified medical personnel. All indications of clinical significance are supported by literature references.

Analytical Range
Total bilirubin: 0.1 - 18 mg/dL (1.7 - 308 μmol/L)
Direct bilirubin: 0.04 - 18 mg/dL (0.68 - 308 μmol/L)

Waste Disposal
This product is made to be used in professional laboratories. Please consult local regulations for a correct waste disposal.

SS6: dispose of this material and its container at hazardous or special waste collection point.

S57: use appropriate container to avoid environmental contamination.

S51: avoid release in environment. Refer to special instructions/safety data sheets.

References

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>CATALOG NO.</th>
<th>QUANTITY</th>
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<td>60 test</td>
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