Pointe Total Bilirubin Reagent Set

HORIBA Instruments Incorporated
5449 Research Drive, Canton, MI 48188
Phone: 734-487-8300; (800) 445-9853

Intended Use

For the quantitative determination of total bilirubin in serum using the Yumizen C230 and Yumizen C240 analyzers. For *in vitro* diagnostic use only. **Rx Only.**

Method History

Since the introduction of the diazo method for bilirubin determination by Ehrlich in 1883[1], several modifications have been proposed to enhance the reaction. The Malloy and Evelyn method[2] employs methanol to catalyze the azo-coupling reaction of the indirect bilirubin, as well as to keep the azobilirubin in solution. A serious disadvantage of this method lies in the fact that protein may be precipitated by the methanol solution to yield falsely lowered results.

In 1938, Jendrassik and Grof.[3] presented an assay that gave reliable results. The method is, however, cumbersome and involves several pipetting steps.

The method presented here was developed by Wahlefeld et al.[4] A detergent is used to accelerate the reaction and to avoid protein precipitation. The diazo reagent is 2,5-dichlorophenyldiazonium tetrafluoroborate (DPD) that reacts very rapidly in coupling with blirubin under acidic conditions. The resulting procedure is simple, yet exhibits good correlation when compared with the method of Jendrassik and Grof.

Principle

Total bilirubin is coupled with a diazonium salt (DPD) in a strongly acid medium (pH 1 – 2).

Bilirubin + DPD ---(Acid, surfactant)---> Azobilirubin

The intensity of the color of the azobilirubin produced is proportional to the total bilirubin concentration and can be measured photometrically.

Reagents

1. Total bilirubin R1 reagent: acid buffer 50 mmol/L, Surfactant.
2. Total bilirubin R2 reagent: acid buffer >30 mmol/L, >2.0 mmol/L DPD and stabilizers.

Reagent Preparation

Reagents provided as ready to use liquids.

Reagent Storage

1. Packaged reagents are stored at 2-8°C. The reagents are stable until the expiration date appearing on the label when stored as directed.
2. Do not freeze reagents.
3. Avoid exposure to direct sunlight.

Reagent Deterioration

1. Do not use if reagents show evidence of contamination (turbidity)
2. The R2 may develop very slight precipitation that does not affect performance and will re-dissolve if the R2 is warmed gently.
3. R2 reagent containing a precipitate that does not re-dissolve and results in product discoloration should not be used.
4. Do not use if reagent fails to achieve assigned assay values of fresh control sera.

Precautions

1. Reagents are toxic and corrosive. Do not pipette by mouth. Avoid contact with skin and clothing.
2. This reagent is for *in vitro* diagnostic use only.

Specimen Collection and Storage

1. Fresh, unhemolyzed serum is recommended.
2. Samples should be analyzed within two hours of collection if kept at room temperature in the dark and within twelve hours if kept refrigerated (2-8°C) and protected from light.[5]
3. Bilirubin in serum is stable for three months when stored frozen (-20°C) and protected from light.[5]
4. Direct sunlight may cause up to a 50% decrease in bilirubin within one hour.[6]
5. Specimen collection should be carried out in accordance with NCCLS M29-T2. No method can offer complete assurance that human blood samples will not transmit infection. Therefore, all blood samples should be considered potentially infectious.

Interferences

1. All interference studies were performed according to the procedures recommended in NCCLS guideline No. EP7-P for interference testing in clinical chemistry.[7]
2. Serum hemoglobin levels up to 500 mg/dl do not interfere with results.
3. Serum Triglycerides up to 1000 mg/dl do not interfere with results.
4. A number of drugs and substances affect bilirubin results. See Young, et al.[8]

Materials Provided

1. Total Bilirubin R1 reagent
2. Total Bilirubin R2 reagent

Materials Required but not Provided

1. Yumizen C230 / Yumizen C240 Analyzer
2. Yumizen C230 / Yumizen C240 Operation manual
3. Pointe Chemistry Calibrator, catalog number C7506-50
4. Pointe Chemistry control, catalog number C7592-100

Test Parameters

Test:	TBIL	Chemistry:	Total Bilirubin
Chemistry No.:	207	Print Name:	Total Bilirubin
Reaction Type:	Endpoint	Reaction Direction:	Positive
Pri. Wave:	546 nm	Sec. Wave:	630 nm
Decimal.:	0.1	Samp. Type:	Serum
Blank Time:	-2 -1	Reaction Time:	18 19
Unit:	mg/dL	Incubation Time:	3

	Sample Vol.	Aspirated	Diluent		Reagent Vol.	Diluent	
Standard;	3	uL	uL	uL	180	uL	uL
Decreased;		uL	uL	uL	47	uL	uL
Increased;		uL	uL	uL			

Linearity Range (Standard);	0.1-30		Linearity Limit:	
Linearity Range (Decreased):			Substrate Depletion:	
Linearity Range (Increased):			Mixed Blank Abs.:	- 40000 40000
R1 Blank Abs.:	- 40000	40000	On-board Stability:	30 Day (s)
Blank Response	- 40000	40000	Reagent Alarm Limit:	5
Twin Chemistry:				

Prozone Check:		
Q1:	Q2:	Q3:
Q4:	PC:	ABS:

Use Qualitative Result:		
	Range:	Flag:

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Slope Offset:			
	Slope	Offset	Unit
	1	0	mg/dL

Pretreatment:			
Pretreat Sample Vol.:	uL	Pretreat Reagent Vol.:	uL

Ref. Range:					
Sample Type:	Gender:	Age Range:	Ref. Range:	Critical Range:	Unit:

Calibration Setup Parameters

Chem: T. Bili
Calibration Setting
Math Model: Two-Point Linear
Factor: Replicates: 2
Acceptance Limits
Cal Time: 168 hr.
Slope Diff: SD:
Sensitivity: Repeatability: * User Defined
Deter Coeff:
Auto Calib.
□ Cal Time

Calibrator	Conc.	Pos	Lot No.
Water	0.0	W	
Chem Cal	*	*	

Calibration
Use an NIST-traceable serum calibrator. Follow instrument application instructions for calibration. Refer to instrument manual instructions for calibration procedures and frequency. It is recommended that each laboratory determine its own frequency of calibration.

Calculations (Example)
Abs. = Absorbance
Unk. = Unknown
Cal. = Calibrator

$$\frac{\text{Abs. Unk.} - \text{Abs. Unk. Blank}}{\text{Abs. Cal.} - \text{Abs. Cal. Blank}} \times \text{Conc. of Cal. (mg/dl)} = \text{Total Bilirubin (mg/dl)}$$

Sample: If Abs. of Unknown = 0.35, Abs. of Unknown Blank = 0.01, Abs. of Calibrator = 0.25, Abs. of Calibrator Blank = 0.01, Concentration of Calibrator = 5.0 mg/dl

Then: $\frac{0.35 - 0.01}{0.25 - 0.01} \times 5 = \frac{0.34}{0.24} \times 5 = 7.1$ mg/dl

Quality Control
The validity of the reaction should be monitored by use of the control sera with known normal and abnormal total bilirubin values. These controls should be run at least with every working shift in which total bilirubin assays are performed. It is recommended that each laboratory establish its own frequency of control determination. Quality control requirements should be performed in conformance with local, state, and/or Federal regulations or accreditation requirements.

Limitations
1. Samples with values above 30 mg/dl must be diluted 1:1 with isotonic saline, re-assayed and the final answer multiplied by two.
2. Serum hemoglobin levels of up to 500 mg/dl and triglycerides up to 1000 mg/dl do not interfere with results.

Performance
1. Linearity: 30.0 mg/dl
2. Limit of Detection (Sensitivity): 0.15 mg/dl
3. Comparison: A study was performed between the Yumizen 200 series analyzers and a similar analyzer using this method, resulting in a correlation coefficient of 0.999 with a regression equation of y=0.902x + 0.02.
4. Precision: Precision studies were performed using the Yumizen 200 series analyzers following a modification of the guidelines which are contained in NCCLS document EP5-T2.[9]

Within Day			Day to Day		
Mean	S.D.	C.V.%	Mean	S.D.	C.V.%
0.84	0.08	10.1	0.67	0.04	6.0
5.99	0.14	2.4	5.98	0.25	4.2

Expected Values[10]
Total: Adults and infants older than 1 month: 0.2 –1.0 mg/dl
Infants: Full Term Newborn
Up to 24hrs: 2.0-6.0 mg/dl
Up to 48hrs: 6.0-10.0 mg/dl
Days 3-5: 4.0-8.0 mg/dl

References

1. Ehrlich, P., Charite Ann. 8:140 (1883).
2. Malloy, H.T., Evelyn, K.A., J. Biol. Chem. 119:481 (1937).
3. Jendrassik, L., Grof, P., Biochem. Zeitschr. 297:81 (1938).
4. Wahlefeld AW, et al. Scand J Clin Lab Invest. 29 Supplement 126(1972).
5. Martinek, R.G., Clin. Chim. Acta 13:161 (1966).
6. Tietz, N.W., Fundamentals of Clinical Chemistry, Philadelphia, W.B. Saunders, p.1028 (1976).
7. NCCLS document, "National Evaluation Protocols for Interference Testing", Evaluation Protocol Number 7, Vol. 4, No. 8, (June 1984).
8. Young, D.S., Effects of Preanalytical Variables on Clinical Laboratory Tests, Washington DC, AACC Press, (1997)
9. NCCLS document "Evaluation of Precision Performance of Clinical Chemistry Devices", 2nd Ed. (1992).
10. Tietz, Textbook of Clinical Chemistry, Philadelphia, W.B. Saunders, 3rd Ed., p. 1170 (1999)

Symbol Key

Use by (YYYY-MM-DD)	LOT Lot and batch code
REF Catalog number	Manufacturer
IVD *In vitro* diagnostic medical device	Temperature limitation
Consult instructions for use	**Rx Only:** Prescription Use Only
CE mark	EC REP Authorized representative in the European Community

REF 12-HB979-192

Manufactured by
HORIBA Instruments Incorporated - Pointe Brand
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IVD

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5449 Research Drive, Canton, MI 48188

European Authorized Representative:
Obelis s.a.
Boulevard Général Wahis 53
1030 Brussels, BELGIUM
Tel: (32)2.732.59.54 Fax:(32)2.732.60.03 email: mail@obelis.net

Certified to Perform Reagents
The Pointe reagents are certified to be manufactured according to specified parameters. Any Pointe reagent product not meeting specifications through its listed expiration date will be remedied immediately without charge.