



# District Laboratory Practice in Tropical Countries

**PART 2**

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has not deteriorated. A quality control chart should be prepared and the haemoglobin values of the control haemolysate entered daily on the chart as described for clinical chemistry quantitative tests on pp. 325–328 in Part 1 of the book. This will detect any drift of values upwards or downwards indicating that the results of haemoglobin tests are becoming unreliable, and there is a problem which must be investigated.

When a control haemolysate or preserved whole blood control is not available, the minimum control of haemoglobin tests using the HiCN technique must include:

- Daily use of a HiCN reference standard (as used to calibrate the colorimeter) to check instrument performance.
- Visible and photometric check of Drabkin's diluting fluid for signs of deterioration, particularly turbidity which is a common problem in tropical countries. When measured against a water blank with a yellow-green filter in place (wavelength 540 nm), Drabkin's fluid should give a zero reading. The pH of the fluid should be pH 7.0–7.4. If deterioration is indicated, the fluid should not be used. Fresh Drabkin's reagent must be prepared. During the 'hot' season, Drabkin's fluid is best stored refrigerated. It must be allowed to warm to room temperature before being used.

### DHT HAEMOGLOBINOMETER (Direct read-out Hb meter)

This modern electronic direct read-out haemoglobin meter is precalibrated by the manufacturer and therefore requires no calibration standard solutions. A glass control standard is provided for checking the performance of the meter.

#### *Suitability for use in tropical countries*

The DHT Haemoglobinmeter uses an inexpensive diluting fluid which is simple to make (no weighing of chemicals) and is stable in tropical climates. The DHT meter measures all forms of haemoglobin (HbO<sub>2</sub>, HbCO, Hi, SHb) by measuring at a wavelength of 523 nm and using a narrow band (10 nm) interference filter and green light emitting diode (LED). Haemoglobin values are digitally displayed in g/l. The measuring range of the meter is 20–300 g/l.

The DHT Haemoglobinometer is particularly easy to use. The user simply inserts the cuvette and

removes it. Placing the cuvette in the cuvette holder automatically turns on the electronic circuitry. In between measurements the meter returns automatically to a standby mode.

The meter requires very little electrical power to measure samples and to maintain the meter in its standby mode. The meter can be operated from mains electricity (220 V 50 Hz) using the 5 V AC/DC adaptor supplied or from three 1.5 V LR1 (type N) batteries (also supplied). It has been estimated that several hundred thousand measurements can be made from one set of three alkaline batteries.

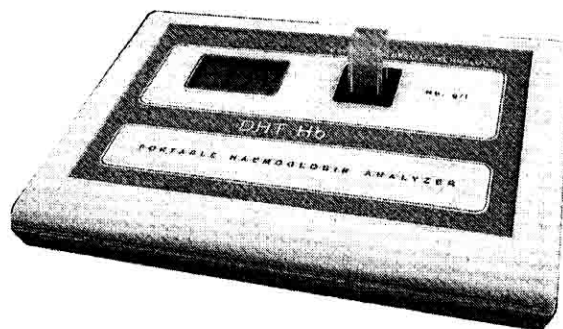


Plate 8.1 DHT Haemoglobin Meter. Courtesy of Developing Health Technology.

The cuvettes used in the meter are standard size 10 mm light-path cuvettes (glass or plastic). The dimensions of the meter are: 178 mm wide × 127 mm deep × 38 mm high. It weighs approximately 200 g (without batteries). It is a sealed unit and the cuvette opening is fitted with a shutter to prevent dust entering when the meter is not being used.

#### **Diluting fluid**

Weak 0.4 ml/l (0.04%) ammonia Reagent No. 12 water.

The reagent is stable when kept in a tightly stoppered bottle. Renew every 6 weeks.

*Note:* Weak ammonia water lyses red cells rapidly, is stable, and the ammonia solution used in its preparation is easily available and inexpensive. It does not require refrigeration. The test requires only 2 ml of the ammonia diluting fluid.

**Principle of operation**

Light emitted from the LED passes through the blood sample and then through the interference filter, restricting the wavelength to peak at 523 nm within a narrow band. Light passing through this narrow band filter falls on the photodiode (see Fig. 8.5). This converts it to an electrical signal for the control and measurement system to calculate and display directly as a haemoglobin concentration in g/l. The meter has a stated photometry precision of  $\pm 5\%$  (CV) and 2% accuracy of method. The meter must not be placed in direct sunlight and the operating environment should be within a temperature range of 10–35°C with an upper humidity limit of 80% non-condensing.

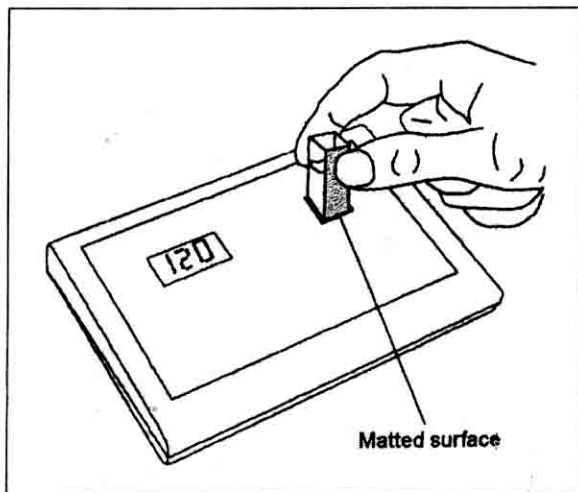
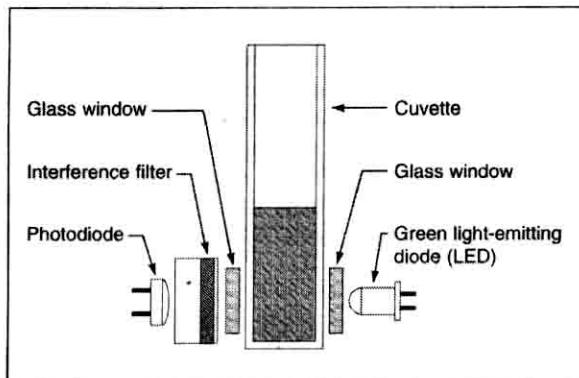


Fig 8.5 Upper: Placing a cuvette in the DHT Haemoglobin Meter. Lower: Principle of operation of the DHT Haemoglobin Meter. Courtesy of Developing Health Technology.

**Test method**

- 1 Measure carefully 20  $\mu$ l (0.02 ml, 20 cmm) of capillary blood\* or well-mixed venous blood\* and dispense it into 2 ml of the ammonia diluting fluid.

\*The collection of capillary blood and venous blood are described in subunit 8.3.

**Important:** The volume of blood used must be exactly 20  $\mu$ l.

**Accurate and safe pipetting and dispensing:** Pipettes, calibrated capillaries, and suction devices for the accurate and safe measuring and dispensing of blood and diluting fluid are described and illustrated in subunit 4.6 in Part 1 of the book.

- 2 Stopper the tube and mix. The solution can be read immediately. The colour is stable for 6–8 hours.
- 3 Check the performance of the meter by inserting the *Control Standard* glass provided in the cuvette aperture. The reading must correspond to the stated value,  $\pm 5$ .

**Note:** Inserting a cuvette starts the measuring process. There is an audible signal as the meter reads the *Control Standard* or patient's sample. Immediately the value is shown on the digital display and held in memory for 30 seconds after the cuvette is removed. The last reading can be recalled by pressing a membrane key on the instrument. The *DHT Haemoglobinometer* has automatic zeroing. In between readings the meter remains in a standby mode.

- 4 Transfer the patient's sample or control blood sample to a clean 10 mm light-path cuvette. Hold the cuvette only by its non-optical sides and ensure there are no air-bubbles in the sample.
- 5 Place the cuvette in the cuvette holder, wait for the audible signal, and read the haemoglobin value from the display.
- 6 Return the sample to its tube and allow the cuvette to drain, e.g. invert it on a paper towel.

**Availability:** The *DHT Haemoglobinometer* is available from Developing Health Technology (see Appendix 11) priced £385 (2000 y price), which includes DC/AC adaptor, set of batteries, several cuvettes, and the control glass standard.

**Interpretation of test results:** See end of this subunit.

**OXYHAEMOGLOBIN (HbO<sub>2</sub>) TECHNIQUE**

As mentioned previously, there is no stable HbO<sub>2</sub> reference standard solution available for the direct calibration of the HbO<sub>2</sub> technique. Preparation of a calibration graph for use with a filter colorimeter, requires the use of a secondary blood standard, i.e. a whole blood or haemolysate of known haemoglobin value (between 140–160 g/l) that has been