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Siemens Healthcare Diagnostics Inc.

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Handling and Storing Samples

Blood Gas Systems

This document provides updated information and instructions about handling and storing patient samples on all Siemens Healthcare Diagnostics blood gas analyzers.

Collecting Patient Samples

This section describes sample requirements, collection procedures, and handling techniques for pH and blood gas. The sample collection and handling guidelines described here are also suitable for CO-ox analysis.[1]

System performance — both fluidics and sensor performance — is based on the use of properly heparinized samples. Use of blood samples without anticoagulant will result in clots and fluidic errors, and has also been shown to cause sensor performance issues.

Select a site and perform the collection procedure under proper medical supervision. Use sterile technique at all times to avoid infecting the sample site.

Immediately expel any bubbles that occurred during sample collection. Cap the sample device immediately after you collect the sample to avoid room air contamination. When you collect samples with a capillary tube, fill the capillary tube completely, cap it securely, and mix the sample thoroughly.

CAUTION

Never use mineral oil or mercury in syringes because these substances may alter sample values and damage the system. Collect blood in heparinized syringes that satisfy requirements for blood gas analysis. Use capillary tubes that contain the appropriate balanced heparin.

NOTE: To prevent hemolysis and maintain sample integrity, use capillary tubes that do not contain mixing beads.

Using Anticoagulants

For human whole blood samples, use sample devices containing only calcium-titrated (balanced) heparin or lithium heparin as the anticoagulant.

[1] For more information about collecting and handling patient samples, refer to Clinical and Laboratory Standards Institute. Blood Gas and pH analysis and Related Measurements: Approved Guideline. *CLSI Document C46-A.* 2001; 21(14)

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NOTE: Other anticoagulants, such as EDTA, citrate, oxalate, and fluoride significantly affect blood pH, sodium, potassium, chloride, ionized calcium results, and CO-ox results. For more information about substances that interfere with analyte measurement, refer to your system's Performance Characteristics.

If you are analyzing samples for ionized calcium, you can use a maximum of 15 units of lithium heparin for each 1.0 mL of sample. If you are not analyzing samples for ionized calcium, you can use up to 50 units of lithium heparin for each 1.0 mL of sample.

Avoiding Erroneous Results

The following conditions can cause erroneous results, even when samples are collected correctly:

- Metabolic activity in the sample that occurs between sampling and completion of analyses
- Contamination of the sample by room air
- Incorrect mixing of the sample before analysis

To minimize the errors these conditions can cause, use correct storage and handling techniques. You can minimize errors caused by metabolic changes by analyzing samples as soon as possible after collection. This is particularly important for pO_2, glucose, and lactate values, because the sample consumes oxygen and glucose, and lactate is rapidly formed during storage.

Lactate is produced by glycolysis and increases while the sample is stored. Glycolysis is temperature dependent. Lactate increases approximately 0.1 mM/hour at 4°C and 1.0 mM/hour at 37°C.[2]

The rate of oxygen consumption depends on several factors:

- Storage temperature
- White blood cell count
- Reticulocyte count

Using Sample Handling and Storage Techniques

Use the following sample-handling and storage steps when you obtain human whole blood samples:[3]

- Analyze the sample as soon as possible to minimize oxygen consumption.
- Blood collected for special studies, such as A-a O_2 gradients or shunt studies, should be analyzed within 5 minutes of collection.
- Plastic syringes should not be iced, but kept at room temperature as long as the blood is analyzed within 30 minutes of collection.
- Oxygen and carbon dioxide levels in blood kept at room temperature for 30 minutes or less are minimally affected except in the presence of an elevated leukocyte or platelet count.

[2] Wandrup. *Clinical Chemistry* 1989;35(8):1741

[3] Blood Gas and pH analysis and Related Measurements: Approved Guideline. *CLSI Document C46-A.* 2001; 21(14);.

- If a prolonged time delay of more than 30 minutes before analysis is anticipated, the use of glass syringes and storage in iced water are recommended.

  Syringes stored in iced water should not be used for electrolyte determinations, as room temperature effects on diffusion in and out of the red blood cells can cause unreliable potassium results. Storage in iced water is applicable to blood gas measurements.

  You can store a sample collected in a glass syringe in the iced water for up to 2 hours without significant change in values for pH and pCO_2; however, this affects the K^+ and lactate values. Samples with elevated white blood cell or reticulocyte counts deteriorate more rapidly, and you should analyze them immediately.
- Before you analyze the sample, roll the syringe or the capillary tube between your palms and gently invert it several times to mix the sample thoroughly.

  Blood cells settle during storage. If you do not mix the sample well before analysis, the total hemoglobin results obtained can be falsely decreased or increased. Mix all samples using a consistent technique.
- If the sample is chilled or has been stored for more than 10 minutes, increase the mixing time to ensure that the sample is thoroughly mixed.
- Position any labels toward the top of the syringe barrel, near the plunger, so that the label does not inhibit your ability to insert the syringe into the system, or cause the syringe to fall off after it is inserted.
- Dispose of used sample devices according to your institution's infection control policy.
- Avoid using sample collection devices containing fluoride/oxalate anticoagulants (gray-topped tubes). These anticoagulants have a significant affect on glucose and lactate.

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