

# Technical Bulletin

North Carolina State Laboratory of Public Health | Laboratory Improvement Unit

## The Breakdown on Hemolyzed Specimens

### Introduction

Hemolysis occurs when red blood cells become damaged or destroyed. Red blood cells, also known as erythrocytes, contain hemoglobin molecules which are released during hemolysis. Once a whole blood specimen is hemolyzed, the hemoglobin molecules within the red blood cells are released causing the serum or plasma to have a pink to red color. A noticeable red color occurs when the released or “free” hemoglobin in the serum or plasma exceeds 20 mg/dL.<sup>3</sup>

### When does hemolysis occur?

Certain medical conditions can result in blood hemolysis such as hemolytic anemia, liver disease or a transfusion reaction. *However, most hemolysis occurs because of procedural errors during the pre-analytical phase of specimen collection, processing and transport.*

### Common pre-analytical causes of hemolysis<sup>1,3,4</sup>:

- Residual alcohol at the skin puncture site
- “Milking” of the puncture site
- Excessive and aggressive mixing of the specimen in the tube after collection
- Drawing blood through a hematoma or from a vein with a hematoma
- Using a large volume tube with a small diameter needle or in a weak vein
- Improper centrifugation time and speed

### Did You Know?

Hemolysis is far more likely to occur during collection and transportation than in the laboratory.<sup>2</sup>

### Why is hemolysis a problem in the lab?

In the clinical laboratory, many testing methods involve spectrophotometry – a method of measuring how a specimen absorbs light as a function of its color (wavelength). Therefore, visibly hemolyzed serum or plasma specimens can often interfere with test results. Excess hemoglobin can also cause a chemical interference in some clinical tests.<sup>3</sup> The standard for rejecting hemolyzed specimens is specified by the manufacturer of the laboratory test or by the testing laboratory itself.

True hemolysis that happens *in vivo* may help diagnose a clinical condition of a patient. However, hemolysis that occurs from pre-analytical errors can be detrimental to the quality of the patient specimen and test results.<sup>3</sup> Hemolysis of a blood specimen can erroneously elevate ammonia, catecholamines, creatine kinase and other enzymes, iron, magnesium, phosphate and potassium levels as well as decrease red blood cell counts.<sup>1</sup>



A depiction of a red blood cell undergoing hemolysis due to excessive force. Photo extracted from <https://phil.cdc.gov/>

## How to prevent hemolyzed samples:

Since most hemolyzed specimens are due to errors in the collection, processing or transportation of the blood, many precautions can be taken to ensure the quality of the blood specimen before it arrives in the testing laboratory!<sup>5,6</sup>

- ✓ After cleansing the venipuncture site, allow to air dry before collecting blood
- ✓ NEVER draw blood through a hematoma. If a hematoma forms during the venipuncture, promptly remove the tourniquet, tube and needle (in that order). *A new specimen might need to be collected to prevent a hemolyzed sample.*
- ✓ If using a syringe, avoid drawing the plunger back too forcibly.
- ✓ Avoid forcibly transferring the syringe's contents into the tube.
- ✓ Discontinue "sluggish" draws that can be caused by collapsed veins and/or improper needle placement.
- ✓ Avoid using large volume tubes with a small diameter needle, if possible. *Ex. Collect two 5 ml SST tubes rather than one 10 ml SST tube when using a butterfly (23-gauge) needle.*
- ✓ Use an appropriate gauge needle consistent with the size of the vein. *Ex. Use a 23-gauge (butterfly) needle on a very small, fragile hand vein.*
- ✓ Avoid tourniquet restriction for longer than one minute.
- ✓ Gently invert the blood collection tube to mix additive and specimens as recommended by the manufacturer of the tube. **Avoid vigorous mixing!**
- ✓ Gently transport the specimen to the testing laboratory to avoid shaking.
- ✓ If using a serum or plasma tube, once the blood has clotted for the appropriate time specified by the tube manufacturer, centrifuge at the recommended speed and time.
- ✓ Centrifuge the blood specimen, if necessary, within 2 hours of collecting.

### Did you know?

No evidence exists in the literature to suggest that 23-gauge needles (butterfly sets) hemolyze specimens any more than 21-gauge needles.<sup>2</sup>

## References

1. *Phlebotomy essentials, 5<sup>th</sup> edition.* McCall, R.E., & Tankersley, C.M. (2012).
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3. Hemolysis, Icterus, and Lipemia/Turbidity Indices as Indicators of Interference in Clinical Laboratory Analysis; Approved Guideline. *Clinical Laboratory Standards Institute, C56-A*
4. Procedures and Devices for the Collection of Diagnostic Capillary Blood Specimens; Approved Standard – Sixth Edition. *Clinical Laboratory Standards Institute, GP42-A6*
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