APPLICATION NOTE

Sorvall MTX and MX Plus Series Micro-Ultracentrifuges
Sorvall Legend Micro 21 Microcentrifuge

Lipemia removal in serum samples by centrifugation

Sorvall Legend Micro 21 Microcentrifuge

Sorvall MTX 150 Micro-Ultracentrifuge

Background

Lipemia is an accumulation of lipoprotein particles that causes turbidity in samples. In general, lipemic samples are found to be between 0.5% and 2.5% of blood samples collected at scheduled visits [1]. Various factors cause lipemia, such as insufficient fasting before sample collection, parenteral (nonoral) administration of lipid supplements, or disease conditions such as type 2 diabetes.

The causes of lipemia contribute to the presence of lipoprotein particles of different sizes that are illustrated in Figure 1. Studies have shown that chylomicrons (70–1,000 nm), large VLDLs (60–200 nm), and medium VLDLs (35–60 nm) are the major causes of lipemia [1].

Interference in spectrophotometric measurements can be a notable cause of laboratory errors. Lipemia in blood samples, which makes them appear cloudy, is one of the main factors that interfere with downstream biochemical analyses of blood. It interferes with the measurement of biological analytes (e.g., sodium ions) by changing the absorption of light, resulting in skewed analyte values or no results at all. Therefore, lipemic blood samples must be processed to clear them prior to analyses [1].

Different methods are applied to processing of lipemic samples. Studies have shown that the use of some commercial chemical agents or dilution methods bear some risks that can affect the results [2]. Centrifugation, on the other hand, has been widely accepted as the most efficient method to clear lipemic blood samples [2,3].

The Clinical and Laboratory Standards Institute (CLSI) advocates ultracentrifugation as the gold-standard method to process lipemic samples [4]. Recent reports have found that high-speed centrifugation can also be applicable despite some drawbacks [2,3].

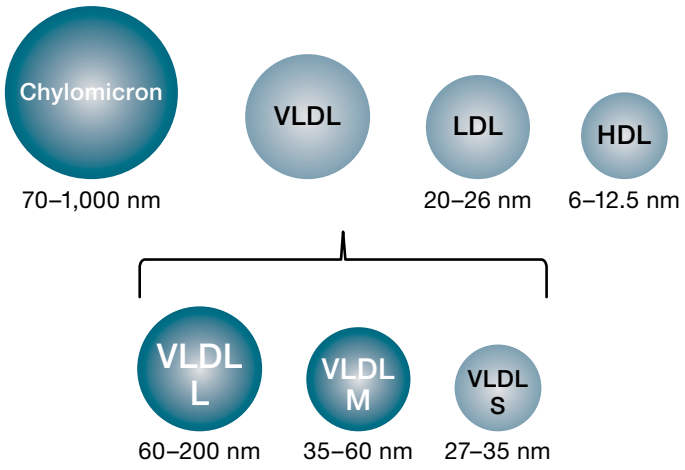

Figure 1. Lipoprotein particle sizes. Particles shown in the darker color are the main sources of turbidity in lipemic samples [1]. Figure used with permission from *Biochemia Medica*.

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Methodology

Prior to centrifugation, the serum samples must be homogenized to disrupt any lipid layer that may have formed.

Ultracentrifugation

1. Transfer 1.5 mL of samples to centrifuge tubes.
2. Centrifuge the samples for 15 min at 107,000 x *g* at room temperature [3].
3. Collect the infranatant serum with a fine-needle syringe.

High-speed centrifugation

1. Transfer 1.5 mL of samples to centrifuge tubes.
2. Centrifuge the samples for 15 min at 21,885 x *g* at room temperature [3].
3. Repeat step 3 if necessary, until clear separation is obtained.
4. Collect the infranatant serum with a fine-needle syringe.

Conclusion

While an ultracentrifuge is typically more expensive to purchase than other centrifuges, it provides the most effective solution for handling lipemic samples since most of the lipoproteins can be removed in a single separation [3]. High-speed centrifugation may prolong the turnaround time of sample handling prior to the biochemical test if the samples contain small lipids. However, high-speed centrifugation can be recommended to low-throughput laboratories in which varied turnaround times are less detrimental [3].

In conclusion, centrifugation of lipemic samples can be applied in either the ultra-speed or high-speed range. According to the CLSI, ultracentrifugation is still regarded as the most reliable technique for all types of samples regardless of lipid content.

References

1. Nikolac N (2014) Lipemia: causes, interference mechanisms, detection and management. *Biochem Med* 24(1):57–67.
2. Castro-Castro M-J, Candás-Estébanez B, Esteban-Salán M et al. (2018) Removing lipemia in serum/plasma samples: a multicenter study. *Ann Lab Med* 38(6):518–523.
3. Dimeski G, Jones BW (2011) Lipaemic samples: effective process for lipid reduction using high speed centrifugation compared with ultracentrifugation. *Biochem Med* 21(1):86–92.
4. CLSI (2012) Hemolysis, icterus, and lipemia/turbidity indices as indicators of interference in clinical and laboratory analysis; approved guideline. CLSI document C56-A. Wayne, PA: Clinical and Laboratory Standards Institute.

Recommended centrifuges

For ultra-speed protocol	For high-speed protocol
Thermo Scientific™ Sorvall™ MTX or MX Plus Series Micro-Ultracentrifuge with S55-A2 rotor (201,046 x *g*, 55,000 rpm, 12 x 1.5 mL) or S120-AT2 rotor (649,826 x *g*, 120,000 rpm, 10 x 2.0 mL)	Thermo Scientific™ Sorvall™ Legend™ Micro 21 Microcentrifuge (21,100 x *g*, 14,800 rpm, 24 x 1.5 mL)*

* Alternative models: Thermo Scientific™ Pico™ 21 Microcentrifuge, Thermo Scientific™ MicroCL 21 Microcentrifuge. Please check with your sales representative for other suitable packages for this application.

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