

Sample Preparation (SP) is a broad technique that encompasses any modification to a collected sample before its qualitative or quantitative analysis. Not only does sample preparation remove interfering contaminants and particulates, but it can also be used to concentrate the sample further and switch the samples solvent to one optimal for the analytical technique that will be used. The removal of particulates, proteins, phospholipids, and salt can help increase concentration of the samples target analytes. In addition to allowing lower levels of detection to be obtained, sample preparation has the added benefit of increasing the lifetime of a column as well. Phenomenex is well equipped to help every laboratory need when it comes to Sample Preparation.

Solid Phase Extraction

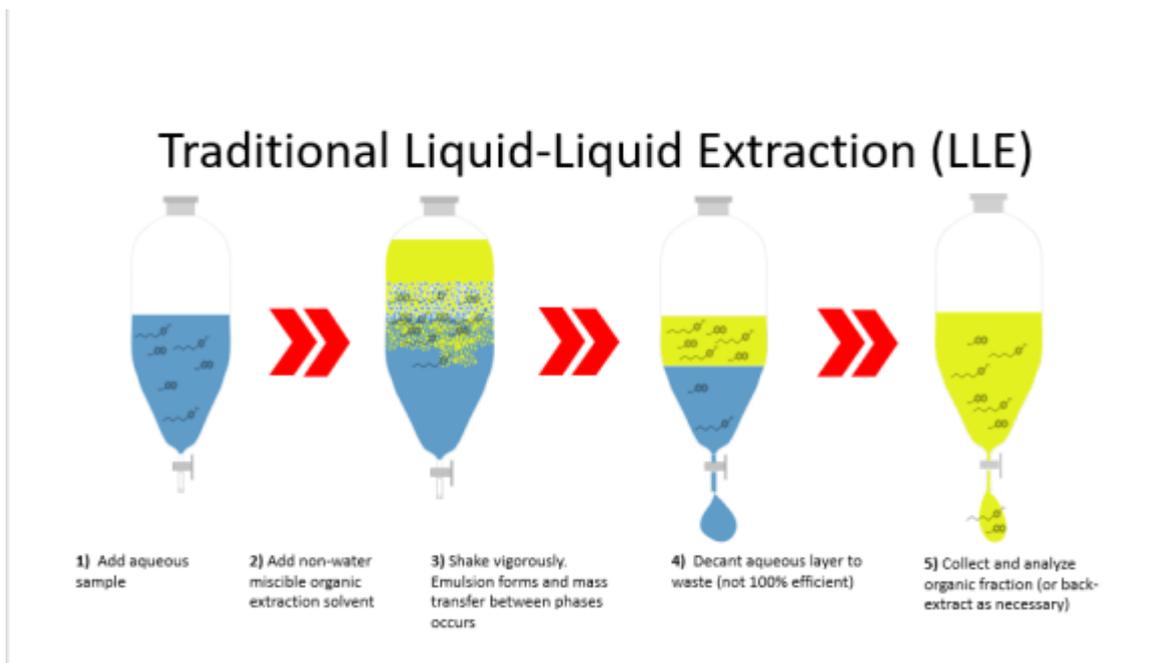
Solid Phase Extraction (SPE) is a type of sample preparation technique where compounds that are dissolved or suspended in a liquid matrix can be extracted by their chemical and physical properties from their matrix. In SPE, the chemical properties of the targeted analytes are used to create a physical or chemical interaction to a solid stationary phase media. Once the analytes in question are held onto the solid media, all other components of the matrix can be flushed from the solid media by a series of solvent washes. The analytes in question can then be eluted by using a specific solvent in where the chemical or physical connection to the solid media is disrupted or broken.



Liquid Liquid Extraction

Liquid Liquid Extraction (LLE) is a sample preparation technique where analytes can be separated from the sample's matrix by their specific solubilities using immiscible solvents. LLE is a labor-intensive process, where the two immiscible solvents must be shaken vigorously in a separatory funnel or other vessel to ensure the organic solvent will be in contact with the analytes for as much time as possible to have the analytes be separated into other solvents. LLE technique is time consuming, labor intensive, difficult to automate, and tends to have poorer analyte recovery compared to other sample preparation techniques due to emulsions that can form. It is also difficult to run multiple analytes in a row due to the samples having to be run in a pre-set sequence. The technique is also not as

targeted as you are separating analytes from their matrix based on their solubility towards one liquid to another and many of the contaminants/interferences might share the same solubilities.



Supported Liquid Extraction

Supported Liquid Extraction (SLE) is a technique similar to LLE, where the sample is immobilized on an inert solid support media in which the liquid extraction takes place. The matrix must be aqueous-based to allow absorption into the solid support. An immiscible organic solvent is run through the media and the target analyte elutes based on its increased affinity towards the new solvent leaving all the aqueous based contaminants and impurities behind on the solid support.



All over the world, companies have been using SPE, SLE, and LLE for decades. They choose a technique based on what they need to separate and how clean they need the sample to be. There are some differences between the three techniques. These differences usually relate to their time requirements:

- Condition, Equilibrate, and Load Sample (2-5 minutes)
- Wash (2-5 minutes)
- Elute and Dilute (~10 minutes)

For SPE, the entire process takes about 20 minutes since there is no need to add buffers or

solvents, which take between 5-20 minutes. For LLE and SLE, the entire process takes about 40 to 60 minutes, respectively. SPE and SLE both are more accurate and faster than LLE, which results in higher yields and producing more reproducible and higher throughput values.

The second major difference is the amount of manual labor involved. LLE is more labor-intensive compared to SLE and SPE because solvents must be vigorously shaken to achieve a clean separation. Meanwhile, there is gradually less labor involved in SLE and SPE.

In addition to being the fastest, SPE is also the cleanest. Studies have shown that SPE (Strata-X) % RSD values are higher than LLE, and SPE is more precise and reproducible for the extraction of pharmaceutical compounds. (1)

In **Figure 1**, you can see where some of these differences lie.

LLE Vs. SPE Figure 1.

Protocol Compounds	Traditional LLE Method	SPE (Strata-X)
Throughput (Samples/Day)	20	30-35
Solvent Usage (mL/Sample)	>360	41
Glassware	~ 100 pieces (large)	<100 Test Tubes (disposable)
Data Quality	Sufficient	Improved
Manual Labor	High	Very Low
Procedural Steps	Dozens	6

The choice ultimately comes down to what you can do in your laboratory settings. Phenomenex has products and capabilities to make your lab grow, regardless of its size. Whether it's a small business lab or a large industrial facility, there's something for everyone at Phenomenex.

If you have any questions or are seeking technical assistance with your work, Phenomenex offers a free, 24/7, online Technical Support service - **Chat Now**.

References

1. Phenomenex. 2017 Using Liquid-Liquid Extraction (LLE)? There's a Cleaner Way!

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