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IMAGE IN HEALTH INNOVATION

High-performance liquid chromatography for analytical chemistry

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Abstract

High-performance liquid chromatography has replaced several spectroscopic methods and gas chromatography in the quantitative and qualitative analysis of medications in the pre-sale procedure testing done in the past ten years. This testing is done as part of the marketing of drugs and their control. During the early stages of its application, high-performance liquid chromatography (HPLC) was expected to be a procedure that would supplement gas chromatography; nevertheless, as of today, HPLC has almost entirely supplanted gas chromatography in the pharmaceutical analysis field. Compared to other methods, utilizing a liquid mobile phase that allows for the transformation of mobilized polarity during chromatography and any other mobile phase modifications that are performed according to the properties of the substance being examined is a significant benefit in the separation process. Furthermore, this instrument has clinical benefits in hospitals.

Keywords: HPLC; innovation in health; pharmacy science; laboratory analysis; healthcare technology

High-Performance Liquid Chromatography (HPLC) "Chromatography" is a technique for accelerating the separation of the chemical subject (**Figure 1**) (Petrova & Sauer, 2017). The devices are commonly used for molecular separation as columns and high-performance pumps for delivering solvent at a stable flow as the critical components of chromatography (Sebaiy, Hassan & Elhennawy, 2019). Only compounds dissolved in solvents can be evaluated using HPLC by this function. HPLC separates compounds in a liquid sample and allows quantitative and qualitative results, then describes the component of each contain (Alquadeib, 2019). HPLC can test food and beverage samples such as several additives (dyes, preservatives, flavorings, etc.), drugs, textile dyes, pesticides, lard, protein, vitamins, carbohydrates, sugars, caffeine, and plasma. This instrument will give more clinical benefits for preventing diseases and developing strategies for promoting appropriate health information in clinical and community practice.

High-performance liquid chromatography, sometimes known as HPLC, is probably best known for its application in the pharmaceutical industry. This method is applied to evaluate the purity of pharmaceuticals and other drugs to ensure that pharmaceutical products continue to meet the most stringent of requirements and, ultimately, assist people struggling with medical conditions. However, that is not the only function it serves in medicine. As you'll see in the following essay, HPLC can be utilized for research and diagnostics. When researching particular diseases and disorders, experts frequently get biological samples from patients suffering from those conditions for analysis. Why? They can check for anything out of the norm by studying those samples, which allows them to determine whether it could indicate the condition in other patients.

Because of investigations of this kind, the glycated hemoglobin HbA1c, for instance, has developed into a reliable biomarker for diagnosing diabetes. In this context, high-performance liquid chromatography (HPLC) is one of the procedures that can be utilized to separate components inside a sample, such as blood. Researchers have a better chance of finding clearer disease biomarkers if they first define and quantify the various components of a disease. This would enable earlier diagnosis and treatment for patients in the future. It can even be utilized to differentiate between diseases with similar symptoms to get a more precise diagnosis. Using high-performance liquid chromatography and mass spectrometry (HPLC/MS), researchers from Tokyo Medical University found a pre-therapeutic distinction in 2011 between large-cell neuroendocrine carcinoma (LCNEC) and small-cell lung carcinoma (SCLC). They found four protein candidates preferentially expressed in LCNEC compared to SCLC, which provides a basis for distinguishing the two types of lung cancer moving forward.



Figure 1. High-performance Liquid Chromatography (HPLC) at Universitas Muhammadiyah Magelang

The application of HPLC in clinical diagnostics is not in the distant future. After biomarkers have been located, the subsequent step is to search for them in the blood and other medical samples taken from individuals who have not yet been diagnosed. The most significant difference here is that researchers already know what they are looking for as a result of the kinds of studies discussed before. Although it may be more costly than other technologies, high-performance liquid chromatography (HPLC) is well-known for its precision and capacity to identify more complicated biomarkers. One example of this is the measurement of vitamin D, which is not done directly but rather by the concentration of a metabolite that is produced in the liver called 5-hydroxyvitamin D, which is linked to the generation of vitamin D. Both high-performance liquid chromatography (HPLC) and high-intensity liquid chromatography (HILIC) can be utilized to check for metabolites that are formed in the body; nevertheless, HPLC is the method of choice for vitamin D analysis. In addition to immunoassay and enzymatic tests, high-performance liquid chromatography (HPLC) is also one of the testing procedures that can be utilized to determine the presence of the HbA1c mentioned above in hemoglobin.

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