



## Comparative Analytical Procedure Based On Protic The Solvents For The Extraction Of Antidiabetic Drug Allium Sativum

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### ABSTRACT

One of the most prevalent non-communicable diseases in the world, diabetes mellitus (DM) lowers quality of life in people of all ages. The illness is now a worldwide public health issue that has an impact on a person's socioeconomic standing. The most important factor in obtaining active phytoconstituents from medicinal plants is selecting the right extraction technique. Variations in extraction methods impact the biological activity and production of phytocomponents. In this research work, we observed the comparative analytical procedure based on protic solvents such as ethanol and water for the extraction of antidiabetic drugs Allium sativum. The extraction yields a much higher phenolic, saponin, and tannin content in addition to a much higher overall extract yield.

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**Keywords:** Protic solvents, Extraction Methods, Allium Sativum

### INTRODUCTION :

A kind of long-term metabolic illness known as diabetes mellitus is defined by insufficient insulin secretion or activity. A deficiency in the anabolic hormone insulin can lead to abnormalities in the metabolism of proteins, carbs, and fats. Low insulin levels, insulin resistance in target tissues, insulin receptor levels, mainly in skeletal muscles and adipose tissue, and, to a lesser extent, in the liver, signal transduction system, effector enzymes or genes, and/or signal transduction pathway, are the causes of these abnormalities in metabolism. One of the most common metabolic illnesses in the world, diabetes has already reached an epidemic proportion never seen before. Even though diabetes is not a communicable disease, it is regarded as one of the top five morbidities globally<sup>[1]</sup>.

Allium sativum most commonly used for diabetes in India. This is also a common ingredient in a lot of natural diabetes remedies. Blood glucose levels are lowered by the antihyperglycemic effects of methanolic extract, and aqueous extract<sup>[1]</sup>.

The most important factor in obtaining active phytoconstituents from medicinal plants is selecting the right extraction technique. Variations in extraction methods impact the biological activity and production of phytocomponents. In this research work, we observed the comparative analytical procedure based on protic solvents such as ethanol and water for the extraction of antidiabetic drugs Allium sativum. The extraction yields a much higher phenolic, saponin, and tannin content in addition to a much higher overall extract yield<sup>[2]</sup>.

### DIABETES<sup>[3]</sup>:

Hyperglycemia, a metabolic illness associated with diabetes, is characterized by elevated blood sugar levels (fig 1). Normal meal digestion results in the release of glucose into the bloodstream, where it serves as the body's

fuel. Insulin, a hormone that the pancreas generates, aids in transferring blood glucose into the liver, muscle, and fat so that it can be used as fuel. There are two main reasons why diabetics are unable to remove this sugar from their bloodstream: either their pancreas does not create enough insulin, or their cells exhibit insulin resistance, which is the inability of their cells to respond to insulin. This explains why blood sugar levels are elevated in diabetics.

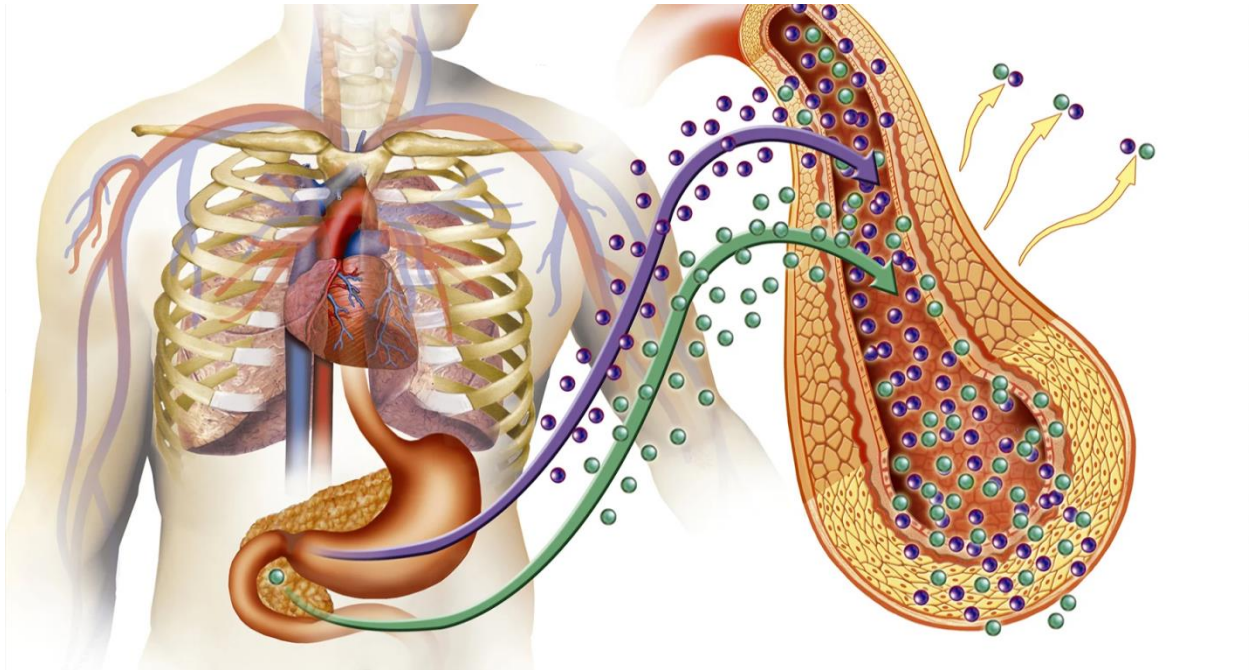


Fig 1 :Hyperglycemia<sup>[4]</sup>

### Types of diabetes:

1) **Type 1 diabetes/ Juvenile diabetes/ Insulin dependent diabetes:** It is a disease that can strike anyone at any age. It is caused by a loss of pancreatic beta cells or by the inactivity of these cells, which inhibit the pancreas from making insulin (figure 2). The affected people require daily insulin injections to keep their blood glucose levels within normal ranges. Though the exact origins of Type 1 diabetes are unknown, researchers think that both hereditary and environmental factors play a role.

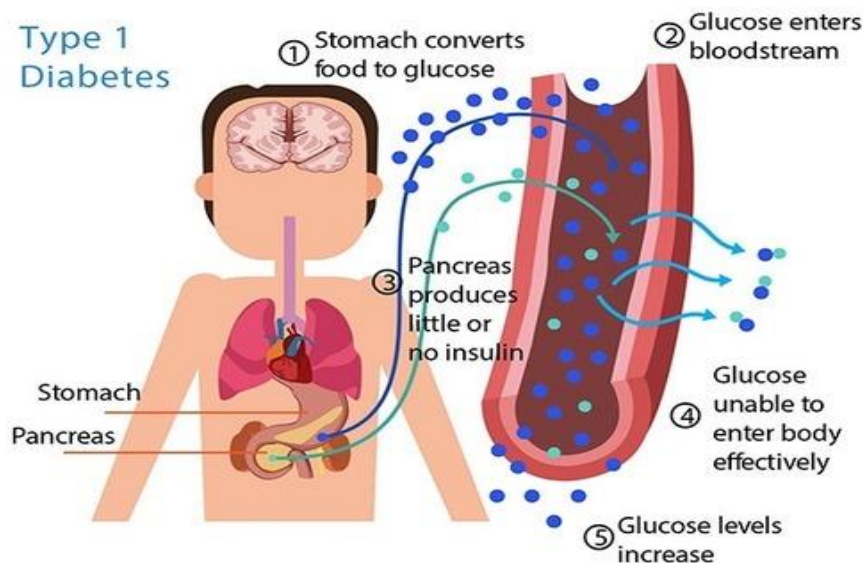
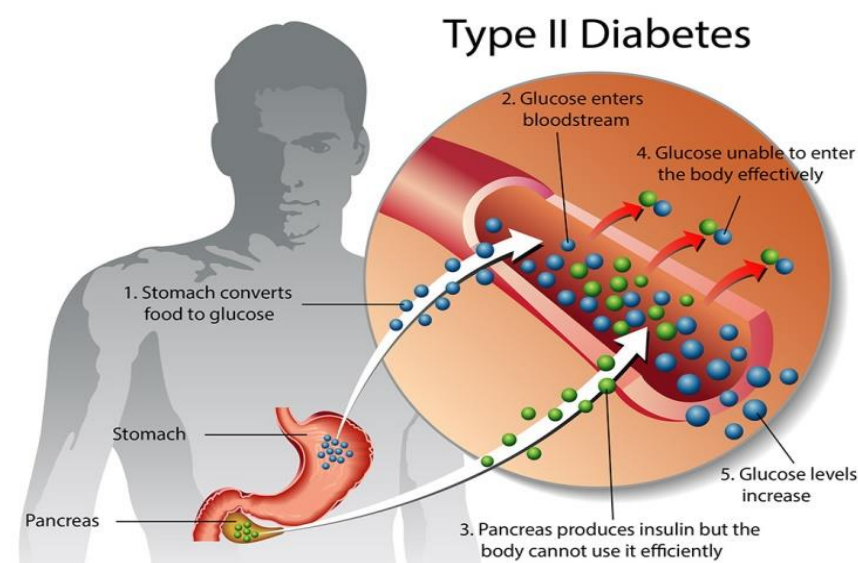


Fig 2 : Insulin dependent diabetes<sup>[5]</sup>

Different factors, such as genetics and some viruses, may cause type 1 diabetes. Although type 1 diabetes usually appears during childhood or adolescence, it can develop in adults. Even after a lot of research, type 1 diabetes has no cure. Treatment is directed toward managing the amount of sugar in the blood using insulin, diet and lifestyle to prevent complications.

2) **Type 2 diabetes/ Non-insulin dependent diabetes mellitus (NIDDM):** This is the most prevalent type of diabetes, and it usually strikes adults. We refer to this as insulin resistance (figure 3). In this the circulation sugar accumulates in the circulation as a result of its inability to reach these cells to be stored for energy. Insulin resistance is a progressive condition that takes time to manifest.



**Fig 3 :** Non-insulin dependent diabetes <sup>[6]</sup>

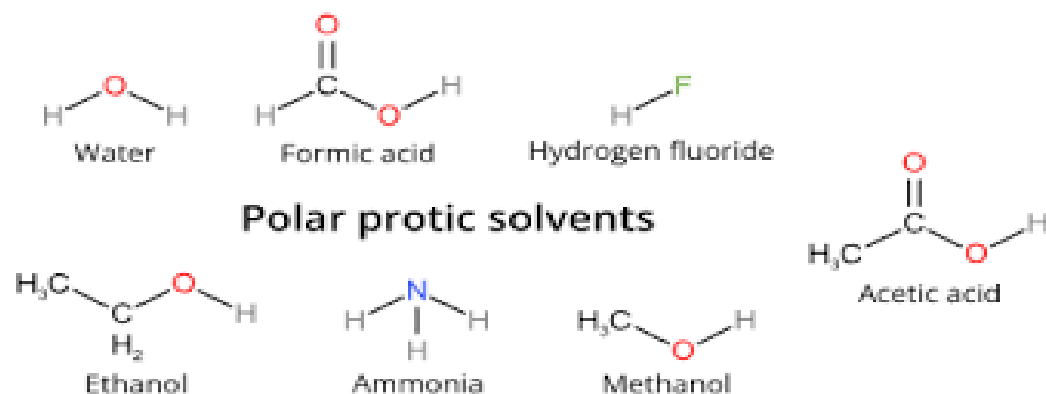
**Some of the symptoms of type 1 diabetes and type 2 diabetes are:**

- Feeling more thirsty than usual.
- Urinating often.
- Losing weight without trying.
- Presence of ketones in the urine.
- Feeling tired and weak.
- Feeling irritable or having other mood changes.
- Having blurry vision.
- Having slow-healing sores.

#### **PROTIC SOLVENTS<sup>[7]</sup>:**

Polar protic fluids have at least one hydrogen atom directly bonded to an electronegative atom (like an O-H or N-H link), So they can form hydrogen bonds. They efficiently solvate anions and cations. The examples of polar protic solvents are water, ethanol etc. (fig 4).

High dielectric constants and dipole moments are characteristic of polar protic liquids.

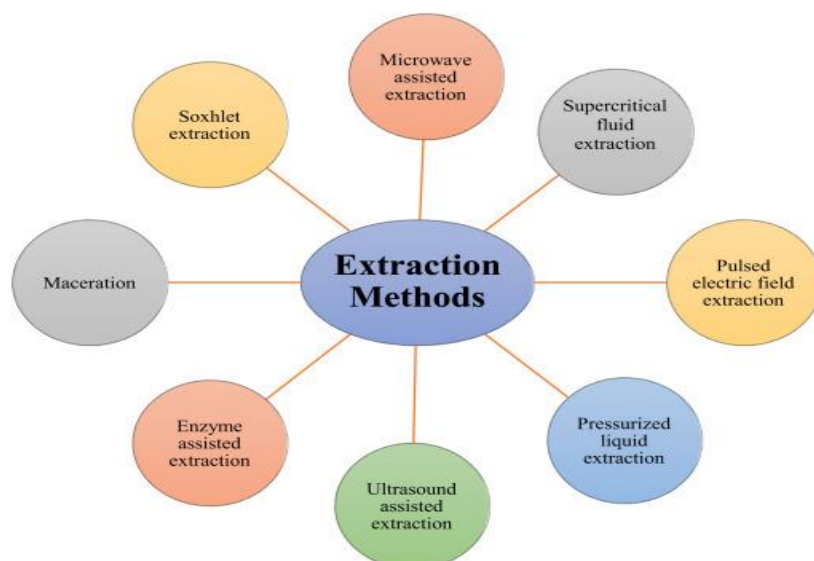


**Fig. 4 :**Protic Solvents<sup>[8]</sup>

When a hydrogen atom is attached to an oxygen (like in a hydroxyl group -OH), a nitrogen (like in an amine group -NH<sub>2</sub> or -NH-), or a fluoride (like in hydrogen fluoride), the solvent is said to be protic in chemistry. Broadly speaking, a protic solvent is any solvent that has a labile H<sup>+</sup> in it.

**EXTRACTION METHODS<sup>[9]</sup>:**

The process of separating the medicinally active portions of plant or animal tissues from the inactive or inert components through the use of particular solvents in standard extraction procedures is referred to as "extraction" in pharmaceutical contexts. Plant-based products are mostly impure liquids, semisolids, or powders meant for topical or oral application only. There are many types of extraction method (figure 5).



**Fig 5 :** Types of Extraction Methods<sup>[10]</sup>

**Extraction products include classes of preparations known as:**

- Decoctions
- Infusions
- Fluid extracts
- Tinctures
- Pilular (semisolid) extracts
- powdered extracts.

**Parameters for Selecting an Appropriate Extraction Method :**

1. It is best to authenticate plant material before extracting it. Any foreign material needs to be removed entirely.
2. Select the appropriate plant portion and note the plant's age as well as the time, season, and location of collection for quality assurance purposes.
3. Heat-generating processes should be avoided wherever possible and grinding methods should be indicated.

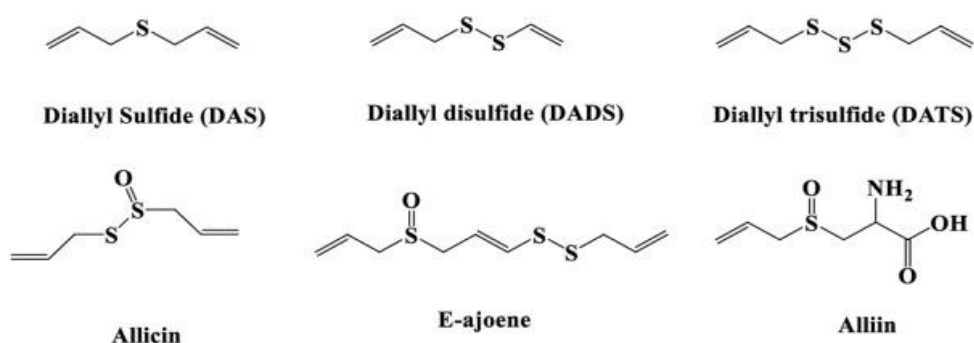
**GARLIC (*Allium sativum* L.)<sup>[11]</sup>:**

- Synonym : Garlic, Allium, Lahsun
- Biological Source : The drug consists of bulb of *Allium Sativum* Linn (figure 6)
- Family : Garlic (*Allium sativum* L.), a bulbous plant belonging to the Lillaceae family,



**Fig 6 :** Bulb of *allium sativum*<sup>[12]</sup>

- **Geographical Source :** It is now grown in many nations worldwide. Due to its flavor and seasoning capabilities as well as its health-promoting attributes, garlic is utilized extensively . Most commonly it is grown in central asia, south Europe, usa and india.
- **Part Use :** Bulb
- **Uses :** Additionally, it is a therapy for diabetes and bacterial in traditional medicine.
- **Chemical Constituents :** Garlic contains carbohydrates, proteins, fats, mucilage, and essential oil (volatile oil). The volatile oil is the main active constituent. It contains allicin, allyl propyl disulphide and alliin (figure 7). Alliin is converted into allicin by action of enzyme allinase. Ajoene is also one of the important constituents of garlic formed by self condensation of allicin.



**Fig 7 :** Chemical Constituents of *allium sativum*<sup>[13]</sup>

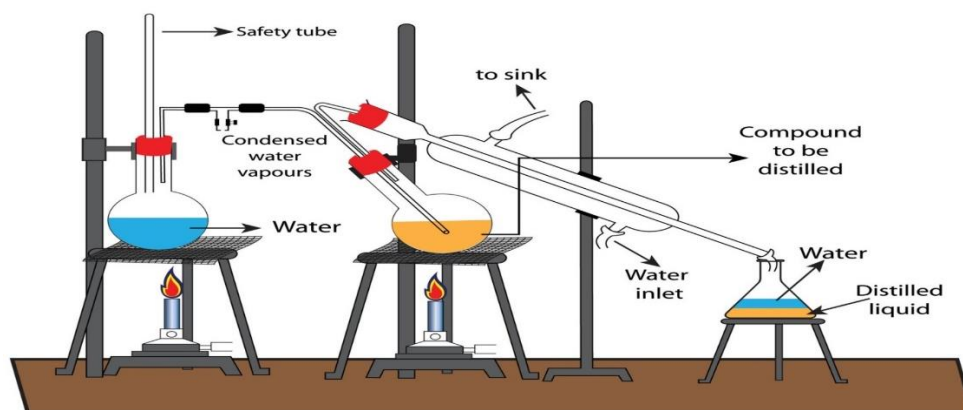
Fever, diabetes, rheumatism, intestinal worms, colic, flatulence, dysentery, liver problems, TB, facial paralysis, high blood pressure, and bronchitis are among the other conditions that *allium sativum* is used to treat.

## MATERIALS AND METHODS

### Sampling and sample treatment:

The garlic were obtained from Indore Local village area of M.P. State. The garlic's translucent layer was carefully removed, and it was then sun-dried for two weeks. The dry garlic cloves were ground into a powder using a mortar and pestle, then sieved and kept for later use in a sealed plastic container. Unless specified differently, all of the reagents were analytical reagent grade. Unless otherwise indicated, distilled water was used to prepare solutions and dilution. Unless otherwise indicated, triplicates of the physiochemical analyses were performed.

**Steam Distillation Method :** The basic idea behind it is that steam is fed insoluble water or water that is insoluble in water but contains volatile organic matter (garlic oil is volatile). This organic matter is then distilled with steam that is heated below 100 °C to obtain more pure material through additional separation (figure 8). This law's general technology flow process is as follows: peel the garlic, wash it, add water to mash it into pieces, then enzymolysis, steam distillation, water-oil separation, and finally, garlic oil. However, because of higher fermentation and vapourizing temperatures, allicin is lost and activity of allinase declines, resulting in a lower oil yield. Additionally, the garlic oil from Gaines is pure and fresh, with a single, juicy flavour<sup>[14]</sup>.



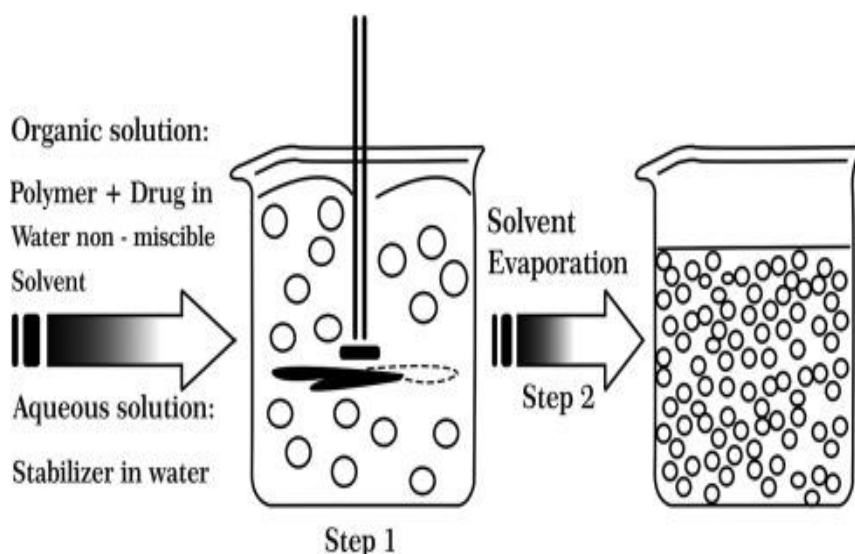
**Fig 8 :** Steam Distillation<sup>[15]</sup>

**Solvent Extraction Method<sup>[16]</sup> :**

Garlic oil has the property of being mildly soluble in water and soluble in organic solvents like ethanol, benzene, and ether. This allows the oil to be extracted using an organic solvent.

The garlic oil obtained by this method differs greatly from that obtained by steam distillation; it is also easily refined and purified, requires little equipment, and is inexpensive. A drawback is that if the solvent is completely eliminated, the garlic oil may have an odd flavour or odour that lowers the product's quality. The antimicrobial properties of alcoholic extracts.

Additionally, ethanol extracts exhibit potent antibacterial properties. The characteristics of ethanol extracts for Gram-negative *E. coli*, with MIC and MBC values of 113.64  $\mu\text{L}/\text{mL}$  and 227.27  $\mu\text{L}/\text{mL}$ , respectively. The type of garlic utilised had a substantial impact on Gram-positive *S. aureus*, with MIC values ranging from 113.64 to 227.27  $\mu\text{L}/\text{mL}$  and MBC values between 227.27  $\mu\text{L}/\text{mL}$  and 454.54  $\mu\text{L}/\text{mL}$ .



**Figure9** : Solvent Extraction<sup>[17]</sup>

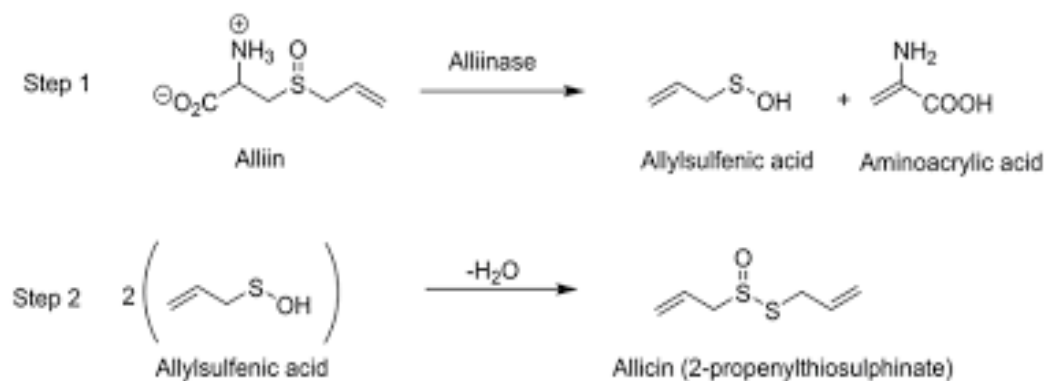
**UV-Vis spectroscopy:** It can be used to accurately determine the drug concentrations in aqueous solutions. The UV method Among the methods used most commonly in pharmaceutical analysis is visible spectrometry. It involves calculating how much visible (400–800 nm) or UV (200–400 nm) radiation is absorbed by a material in a solution (figure 10).



**Fig 10** : UV Visible Spectroscopy<sup>[18]</sup>

**Step of allcinsynthesis<sup>[19]</sup> :**

The volatile oil is the main active constituent. It contains alliin, allyl propyl disulphide and alliin. Alliin is converted into alliin by action of enzyme allinase (figure 11).

Fig 11 : Synthesis of allicin<sup>[20]</sup>

## RESULT AND DISCUSSION :

### Effect of Steam Distillation Method using protic solvent water :

Fig. 12 illustrates that allicin extraction efficiency in water was found to be high, as evidenced by its extraction rate of 109  $\mu\text{g}/\text{mL}$  (figure 12).

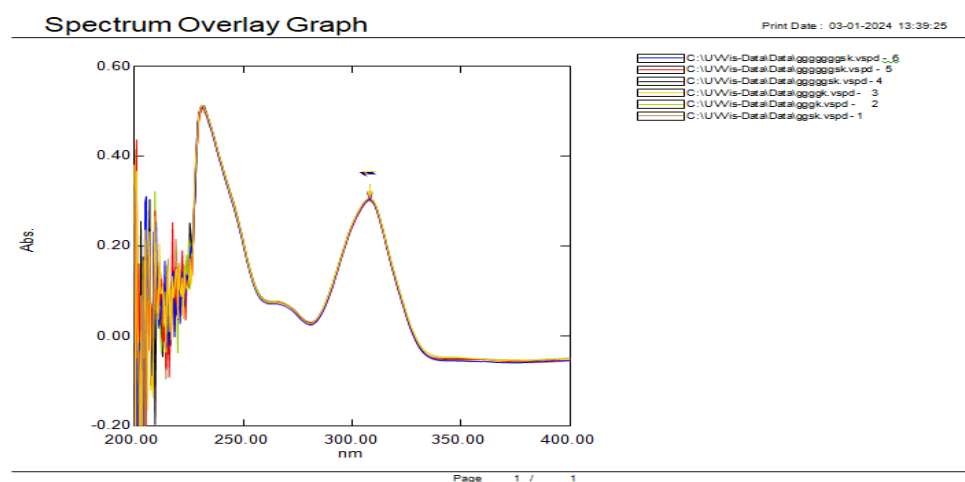


Fig 12 : Absorbance Graph of allicin after steam distillation

### Effect Solvent Extraction Method using protic solvent ethanol:

Because allicin is unstable in non-polar organic solvents and ethanolic solutions generate a very high amount of allicin, ethanol was used as the solvent in this work (fig 13). For solvent extraction the allicin extraction efficiency in ethanol was found to be very high as compared to water (Table 1), and evidenced by its extraction rate of 140  $\mu\text{g}/\text{mL}$  (figure 13).

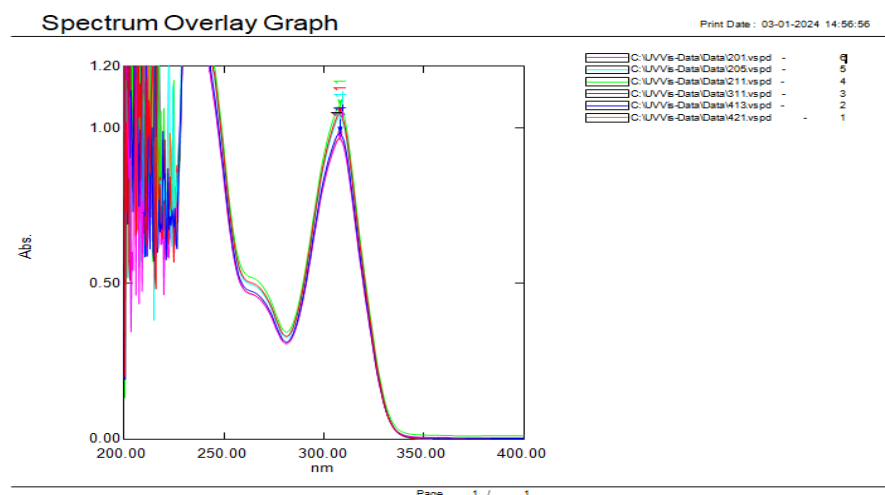


Fig 13 : Absorbance Graph of allicin after solvent extraction

**Table 1:** Summarize of the extraction alliin from garlic using different Protic Solvent.

Extraction Process	Protic Solvent	Result
Steam Distillation	Water	109 µg/ml concentration of alliin
Solvent Extraction	Ethanol	140 µg/ml concentration of alliin

**CONCLUSION:**

In this research study, we have demonstrated that water extract of *aliumsativum* gives 109 µg/ml concentration of alliin and ethanolic extract of *aliumsativum* gives 140 µg/ml concentration of alliin. And the alliin extraction efficiency in ethanol was found to be very high as compared to water means solvent extraction method is more effective than steam distillation method.

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