



## Measuring the Density of Calcium and Magnesium Elements in Pistachio Leaf by ICP Modern Method and Comparing it With Titration Methods and Atomic Absorption

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### Abstract

**Introduction:** Calcium critical limit in pistachio plants is about 1.3 percent of plant dried material; magnesium critical limit in pistachio leaves is about 0.6 percent of plant dried material. To measure calcium and magnesium there are several methods in which three methods of titration and atomic absorption that are more common and used to libraries more in addition to ICP modern method are used. This research was first performed all through the country and is so important because of using ICP system. Because This system is a modern method, very exact and expensive plus rare. This research uses forty samples of pistachio leaf's extract. After preparing needed calcium and magnesium standards for every system, density of samples' calcium and magnesium were measured. This research aims to obtain the most precious method of measuring plant calcium and magnesium elements after ICP system as possible and by the lowest experimental errors. **Materials and methods:** Extract of related plant was obtained by dry ash method and assimilation digestion by normal 3 chloride acid. **Results and discussion:** Regarding that ICP system method is the most precious and modern method, so this is a criterion and results of titration method and plant calcium and magnesium atomic absorption were measured to ICP system and rates of accuracy, deviations and measuring errors were determined. **Conclusion:** After measuring by ICP method, in this research titration by 97.65 percent accuracy (2.35 percent error) and then atomic absorption system by 93.13 percent accuracy ( 6.87 percent error) to measure density of plant calcium and magnesium are suggested.

**Keywords:** Calcium, Magnesium, ICP, Titration, Atomic absorption

### Introduction

Calcium critical limit in pistachio plants is about 1.3 percent of plant dried material and its absorption form by plant Ca; magnesium critical limit in pistachio leaves is about 0.6 percent of plant dried material. Magnesium is also absorbed from soil solution as Mg. To measure calcium and magnesium there are

several methods in which three methods of titration and atomic absorption that are more common and used to libraries more in addition to ICP modern method are used. This research was first performed all through the country and is so important because of using ICP system. This system is a modern method, very exact and expensive plus rare. This research uses forty samples of pistachio leaf's extract. After preparing needed calcium and magnesium standards for every system, density of samples' calcium and magnesium were measured. This research aims to obtain the most precious method of measuring plant calcium and magnesium elements after ICP system as possible and by the lowest experimental errors.

## Materials and methods

Extract of related plant was obtained by dry ash method and assimilation digestion by normal 3 chloride acid.

### 1- Measuring the density of calcium and magnesium elements in pistachio leaf by titration methods

To measure calcium and magnesium 5cc of prepared plant extract was poured in an erlen and then 5cc of ammonium buffer added to it. After this stage some drops of Aeriokerm black tea was added too and finally was titrated by normal 0.01 EDTA by Bort system. The color changed from red to blue. To measure calcium and magnesium 5cc of prepared extract was poured in an erlen and then 5cc of normal soda added to it after this some morkside was added by pin tip in erlen too and finally was titrated by normal 0.01 EDTA by Bort system. The color changed from red to purple.

### 2- Measuring the density of plant's calcium and magnesium by atomic absorption

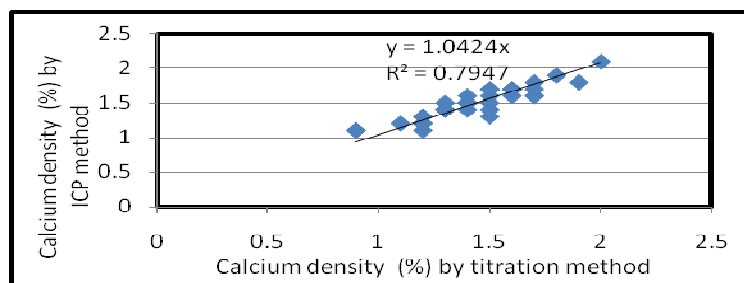
To prepare samples in this way, 1cc of samples is integrated with 2cc Nitrate Lasntanium and reached to the volum in Jojo balloon . After calibrating system by needed standards of calcium and magnesium, samples' density is measured and recorded by atomic absorption system, model GBC932AA which works with Acetylene gas.

### 3-Measuring the density of plant's calcium and magnesium by ICP system (Inductivity Cable Plasma)

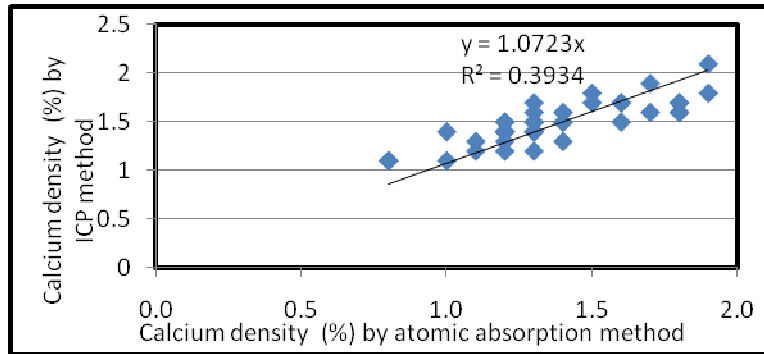
In this method after calibrating system by needed standards, samples' extract was given to ICP system, model Optima 7000 DC which was measured and recorded exactly and automatically.

## Results and discussion

Regarding that ICP system method is the most precious and modern method, so this is a criterion and results of titration method and plant calcium and magnesium atomic absorption were measured to ICP system and rates of accuracy, deviations and measuring errors were determined.

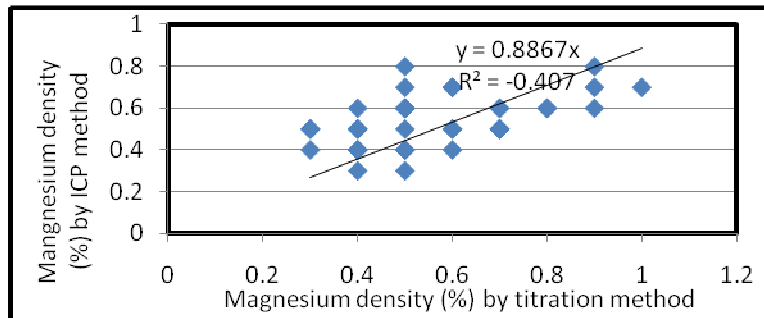


**Figure 1:** Curve of comparing calcium density by titration method to calcium density by ICP method

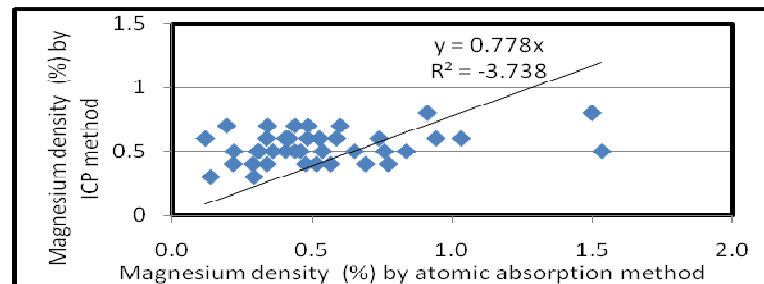


**Figure 2:** Curve of comparing calcium density by atomic absorption method to calcium density by ICP method

Comparing figures 1 and 2 shows that titration method measures plant calcium density more exactly and with lower errors by atomic absorption method and is closer to ICP method. If correctness of ICP system is considered equal to 100 and with intangible error (zero), correctness of titration method is 95.30 percent (4.7 percent error) and correctness of atomic absorption system equal to 91.94 percent (8.06 percent error).



**Figure 3:** Curve of comparing Magnesium density by titration method to calcium density by ICP method



**Figure 4:** Curve of comparing Magnesium density by atomic absorption method to calcium density by ICP method

Comparing figures 3 and 4 shows that titration method measures plant magnesium density more exactly and with lower errors by atomic absorption method and is closer to ICP method. If correctness of ICP system is considered equal to 100 and with intangible error (zero), correctness of titration method is relatively similar to ICP and correctness of atomic absorption system equal to 94.33 percent (5.67 percent error). Regarding that in atomic absorption method there is error of disturbance of other elements, probably its error is more than titration method. In addition, if an atomic absorption system with acetylene gas and N<sub>2</sub>O is used, its correctness will increase and error rate of test will decrease. In this research after measuring by ICP method, in this research titration by 97.65 percent accuracy (2.35 percent error) and then atomic absorption system by 93.13 percent accuracy ( 6.87 percent error) to measure density of plant calcium and magnesium are suggested.

### Resources

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