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Determination of Na, K and Fe in Lactuca Sativa by using Atomic Absorption Spectrophotometric and Flame Photometric Techniques

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Abstract:

Determination of mineral composition of the selected vegetable lactuca sativa which is commonly used as food. Macroelement Sodium (Na), Potassium (K) and Iron (Fe) were analyzed using AAS and Flame-photometric techniques the microelement including Fe is found to be)7.03 ppm(; The results of macroelements obtained having values Na (9.61 ppm) and K (32.67 ppm); The results indicated that this vegetable has the potential to provide essential nutrients to the human beings and it is found to be a good source of Fe, Na and K.
The present method is accurate, the average recovery of Na, K and Fe were 100 %, 100.6 % and 105.8, respectively and precise the RSD is < 5%, <2 %,> 2% for Na, K and Fe respectively.

Key words: lactuca sativa, Atomic absorption spectrometry (AAS), Flame photometry.

تقدير الكمي لعناصر الصوديوم والبوتاسيوم والحديد في اوراق الخس باستخدام مطيافية الامتصاص الذري والانبعاث الذري اللهبي.

الخلاصة:

تم التقديرالكمي لتركيب العناصر في النباتات الحقلية من اوراق الخس والمستخدم كغذاء .استخدمت تقنية مطيافية الامتصاص الذري ومطيافية اللهب لتقدير عناصر الحديد والبوتاسيوم و الصوديوم، فكان تركيز الحديد (7.03 ppm) وتركيز الصوديوم ((9.61 ppm وتركيز البوتاسيوم (32.67 ppm) حسب المحاليل المحضرة من اوراق الخس، أوضحت هذه النتائج أن هذا الخضار لديه القدرة على توفير العناصر الغذائية الأساسية للبشر وجدت لتكون مصدرا جيدا من الحديد والصوديوم والبوتاسيوم.
اظهرت الطريقة الحالية نتائج دقيقة، وكان معدل الاسترجاعية عالي لعناصر الصوديوم والبوتاسيوم و الحديد 100٪ و 100.6٪ و 105.8٪ على التوالي والانحراف القياسي النسبي هو <5٪ للصوديوم ، و<2٪ للبوتاسيوم و< 2٪ للحديد.

Introduction:

Lettuce is a very popular vegetable crop grown in the Middle East and the countries of the Mediterranean basin, its production facing many problems commencing with its seed germination and their inhibition by extremes temperature, exsiccation and light intensity [1, 3]. Lettuce heading highly influence by ambient climate and cultural practices as their noxious effects display on plant stature and performance which reduce the marketable yield due to physiological disorders and disfigured heads [4, 7]. Irrigation water is one of the most effective cultural practice in vegetable agriculture especially in lettuce due to their root system of shallow effective (30cm) depth [8, 10]. The environmental essential feature for metal analysis of plants, chemical research and biological. Biological activity of metals in plants display as toxic agents or essential, and the range of ordinary concentration and evaluate role of metals as portion of the food category important, on other way, due to contamination operations of heavy metals, the curative, redolent and seasoning plants and the diet is part of their grade control which represses a small part [11].

AAS is the technique used for estimation of minerals in these samples combined with wet or dry ash of procedures for sample preparation [12].

Concentration of certain elements was systematic differences, might have

occurred between crops cultivated under conventional regimes and organic possibly due to the presence of high levels of arbuscular mycorrhizal fungi (AMF) in soils cultivated organically [13]. Both applications of iodate and iodide significantly refined nitrogen-utilization efficiency in comparison to the control; The iodate application rates of 40 µM lower significantly improved all nitrogen parameters analyzed making it possible to increase lettucequality and productivity [14];Application of biotic ligand model (BLM) was presaged metal toxicity to lettuce; Lactusa sativa; The present study of use of the accumulation of metal ions at the biotic ligands supports as predictor of toxicity of metals single and combinations [15].Take advantage of synthesis of silver nanoparticles from spinacia oleracea and leaves of lettuce sativa by the reducing capabilities of diversified phytochemicals present in it, as confirmed by the FTIR characterization analysis technique. UV-Vis spectroscopy the formation of silver nanoparticles was interpreted by the reduction of silver salts, respectively was reported; Using lettuce and spinach leaves exhibited to synthesized biogenic nanoparticles, existing antibiotic and various drugs, these synthesized nanoparticles was extended efficacy of the methodas antimicrobial agents of B.subtilis S.aureus K.pneumoniae and E. faceless strains [16]. Determination of the impact concentrations for both fabrics of Ag,Cu,Fe,Mn,and Zn for lettuce seeds(96-h root elongation) and daphnia magna (48-h immobility) by bioassays were performed; The appointed of each metal as toxicity identification evaluation was performed for lactuca (90-h EC 50) and Daphnia (48-h EC84), the results elucidated the order of toxicity of metals was (Ag = Zn= Fe= Cu >Mn) for lettuce seeds and (Ag>Cu>Zn>Fe>Mn) for Daphnia, (Mn and Fe)toxicity was diminutive by pH increase for lettuce grains and filtration through a CM resin. [17] .By using A.A.S., levels of some heavy metals (As, Cd, Cu, Fe, Mn, Pb and Zn) were inspected in Lactuca sativa grown in Maiduguri and edible portions of Amaranthusaudatus [18]. Completed two greenhouse experiments (6 times) one in the fall andone in the spring, variables implicated2 soil Zn levels and 6 cultivars, all variables showed to impact Cd cumulating in the leaf tissue [19]. For predict Cu , Zn concentricity in lettuce grown on polluted soils from the Montreal urban area effectiveness of several chemical evaluation procedures were studied plant growth surveys were performed in the greenhouse by field-collected and non-sticking soils , these soils were recognized using electrochemical speciation as well as several chemical extraction reagents of the soluble soil free of minerals species, the chemical property was accomplished with convertible metal pool determination using anion exchange membranes treated with EDTA or DTPA, the results showed that exchange resins procedures did not consistently mend predictions and the more sophisticated electrochemical speciation of metal uptake [20].

Experimental

Apparatus

1.Atomic absorption spectrophotometer (AAS)

A Nov AA 350 Germany Atomic absorption spectrophotometer (AAS) was used for metal determination equiponderant with 10.cm burner head; HCL of iron (λ248 nm) was used as radiation source.

2.Flame emission spectrophotometer (JenwayPFP7 / UK) is used for emission measurements.

3. Grinding of the plant samples was done using Agate ball mixer mill, A MM 2000 Retch mixer mill (Haan, Germany).

4.Analytical balance: DENVER Instrument Max 220 gm, d=.0001g.

Reagents

The concentrated hydrochloric acid was of analytical reagent tier (Analar). Deionized water was used during the work. 5% m/v nitric acid was used to wash all glassware and plastic ware then rinsed with deionized water.

Standard solutions of iron, potassium and sodium 100 ppm (JENWAY) calibration standard solutions of each metals ions were gained by suitably to dilute the stock solutions.

The plant sample analyzed was lactuca sativa was obtained from the Iraqi market; grounding the plant sample in the agate ball mixer mill using a power between 20 and 80% and mashing time in the range (2-5 min) to obtain the powdered sample which was then sieved so that the wanted particle size plant sample was exsiccated for 24 h at 70 c^{o} as recommended elsewhere (21, 22), once the sample was obtained as a dry powder it was kept in labelled capped glass flasks (23) inside a desiccator.

Preparation of Solutions:-

1.0.5 gram of the dried plant sample is accurately weighed in 250 mL beaker.

Add 25 mL of HCl (6 M), then boiled for about 30 min in the HOOD (till the volume of the solution drops to about 5 ml).

2.About 5 ml of hot deionized water was added to the sample and boiled.

3.The content of the beaker is very carefully filtered in a (50 mL) volumetric flask and made to the volume by deionized water [24].

4.The iron was analyzed using AAS, K and Na and using flame photometer.

The sample solution and standard solutions measurements were run in triplicate, calculates the contents of metals in samples are based on a calibration chart obtained from aquatic standards.

Results and Discussion:

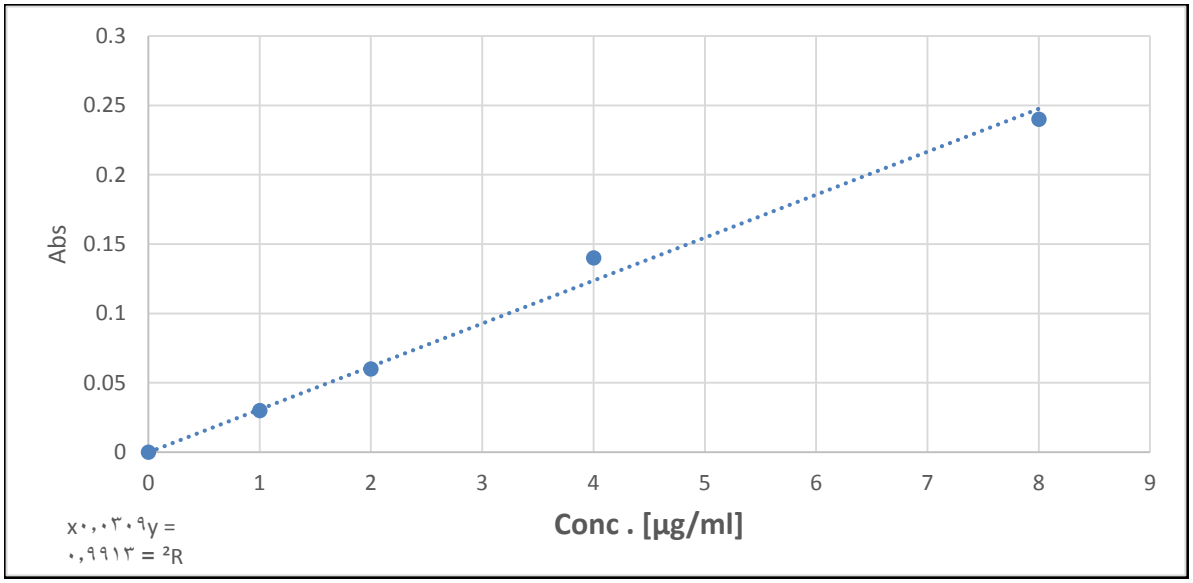

Fig-1: Calibration curve of Iron

Table-1: The Analytical data for Determination of Iron by Atomic absorption spectrometry

Concentration of Fe .[µg/ml]		Recovery %	SD	R.S.D %	Error %
Taken	found				
2	1.9	95%	0.0015	2.55	5
4	4.5	112.5%	0.0013	0.93	-12.5
8	7.7	110%	0.0011	0.46	-10

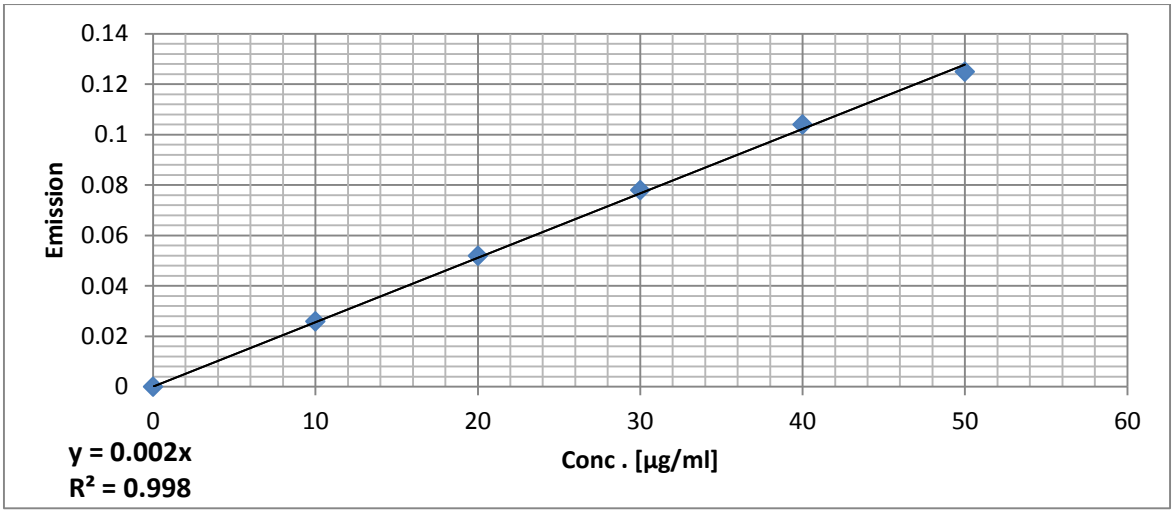

Fig-2: Calibration curve of Sodium

Table-2: The Analytical data for Determination of Sodium by Flame Atomic Emission Photometry

Concentration of Na.[µg/ml]		Recovery %	SD	R.S.D %	Error %
Taken	found				
20	20	100%	0.00229	4.61	0
30	30	100%	0.0289	2.89	0
40	40	100%	0.002236	2.170	0

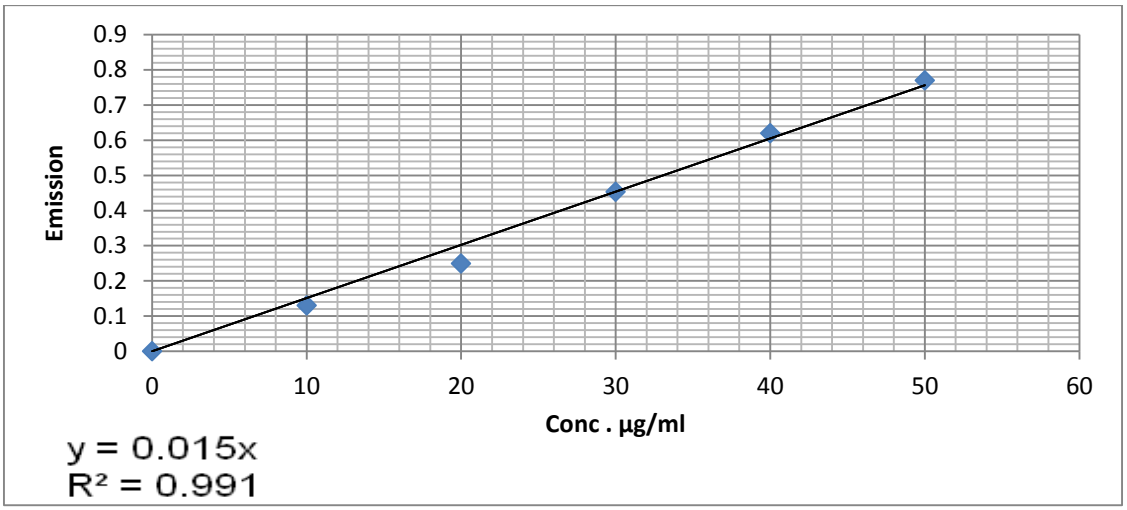

Fig-3:Calibration curve of Potassium

Table-3: The Analytical data for Determination of potassium by Flame Atomic Emission Photometry

Concentration of K .[µg/ml]		Recovery %	SD	R.S.D %	Error %
Taken	found				
20	19.8	99	0.0025	1.01	1
30	30.13	100.4	0.0015	0.33	-0.4
40	41.05	102.6	0.001	0.16	-2.6

Results:

The present method is accurate, the average recovery of Na, K and Fe were 100 %, 100.6 % and 105.8, respectively and precise the RSD is < 5%, <2 %,< 2% for Na, K and Fe respectively.

The suggested method described offers rapidly and efficient preparation of sample for direct determination of Fe, K and Na.

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