Instrumental Neutron Activation for Analysis of some Human Renal stone samples

Reham A Mohamed. Fatma H. El. Sweify[a], Mohamed Ali[a], Wafaa S. Hegazy[b],

a) Radioisotopes production and Radiation Source Division, Atomic Energy Authority, P. O. Box 3459, Cairo Egypt

b) University College for Girls, Arts for Science and Education, Ain Shams University, Cairo Egypt

Abstract

Recently the incidence rate of renal stone disease is increased in Egypt. In addition to industrial and environmental effects in this increase, trace elements may also have a role in the formation of such stones, inspit of their significance in biological lithogenesis. In this study instrumental neutron activation analysis (INAA) technique is applied for elemental analysis of some renal stones, collected from patient living in different provinces in Egypt. The samples are collected from male, female and children. The patients are of varied ages. The analyses are carried out under various conditions of irradiation and cooling time. Major, minor and trace elements were determine. Standard material is used for accuracy and quality control measurements.

The analyzed elements were:
As, Br, Ca, Co, Cr, Cu, Fe, Hf, In, Mg, Mn, Na, Se, Sr, Tb, V and Zn under the experimental conditions
Some of these elements are biologicaly essential and others are dangerous or toxic.

Keywords:
Kidney stones – Renal tones – Gall stones – Neutron Activation Analysis – INAA – Short irradiation – Long irradiation.

1- Introduction:

Recently, the incidence rate of urinary and gall stones disease, in Egypt is increased. These diseases can affects the urinary tract and may lead to permanent damage of kidneys **[Wijayarathna, K. S. N., & Abeygunasekrea, A. M. 2013]** as well as it may affect the function of liver. These diseases are nearly a common public health issues in population especially those living in villages. These populations represent 57.8% of all the Egyptian citizens. These diseases especially renal stones is more prevalent in Afro- Asian region **[Abboud, I. A. 2008**], especially those living in hot and dry climatic regions **[Abeywikarama, B., Ralapanawa, U., & Chandrajith, R. 2015].**

***Corresponding Author: E-mail: romaatif33@gmail.com**

The process of formation of the stones is still not exactly understood till now. Many factors may affect the formation of these stones, among which environmental conditions, pollution resulting from industry and agriculture, dehydration and hydrogeochemical factors **[Abeywikarama, B., Ralapanawa, U., & Chandrajith, R. 2015],** Drinking water hardness, dietary intake habits in particular high intake of animal proteins, oxalates and law intake of potassium bearing fruits **[Tur, J., Prieto, R., & Grases, F. 1991]** and finally geographical location **[Zaravandi, A., Heidari, M., & Mausapoor, E. 2013]**

Some vegetables and fruit, in particular those contain high contents of oxalate and calcium may have essential effect on the formation of such stones.

Urinary stones are mainly biominerals which can be categorized into four groups; calcium oxalate, calcium phosphate, uric acid and strivite(magnesium ammonium phosphate) stones are the most common **[Hesse, A., Tiselius, H. G., Sinener, R., & Hoppe, B. 2009]**.

Calcium oxalate are usually crystalline in the forms of calcium oxalate monohydrate, dihydrate or trihydrate **[Echigo, T. Kimata, M., Kyono, A., & Simiziue, M. 2005]** & **[deganello, S. 1981]** and phosphate stones crystalline in one of the following form:

Calcium phosphate apatite, Calcium hydrogen phosphate dehydrates hydroxyl apatite and octa-calcium phosphate. Uric acid stones (urate) can be occur both in anhydrous and hydrated forms. Struvite is magnesium ammonium phosphate: Calcium is mostly the major constituent of urinary stones. It has high affinity towards oxalate and phosphates. Other elements are also precipitated with calcium as minor constituent like alkali and alkaline earth. Also some transition elements such as Cr, Mn, Fe, Cu and Zn as well as Pb **[Chandrajith et al. 2006; Zarasvandi et al. 2014; Giannossi et al. 2012]**. Among urinary stones, calcium phosphate contains greater numbers of trace elements with higher concentration **[Chandrajith et al. 2006; Zarasvandi et al. 2014; Giannossi et al. 2012]**.

In addition inorganic contents, renal stones can be occurred as mixture compounds with organic matter such as proteins, carbohydrates, lipids and organic compounds **[Talham et al. 2006]**. Moreover, stones crystallization can occur with the supersaturation of dissolved salts in urine **[Parks et al. 2004]**, In view of the high incident rate of urinary stones in the south and south west of Iran a study has been carried out on trace elements content including heavy metals in 39 urinary stones. X-ray diffractometry was applied for investigation of the mineralogy of the renal stones **[Abboud, I. A. 2008], [Abeywikarama, B., Ralapanawa, U., & Chandrajith, R. 2015]**, Major and trace element contents were determined using ICP-MS method. Another intensive study on mineralogical, compositional and isotope characterization of human kidney stones in Sri Lanka population has been performed **[Wijayarathna, K. S. N., & Abeygunasekrea, A. M. 2013]**. Other factors may have also an effect on kidney stone formation such as gender, nutrition, fluid intake, climate and even socio-economic status **[Golovanova et al. 2006; Safarinejad 2007; Pourmand and Pourmand 2012; Pearle and Lotan 2012]**.

The prevalence of renal stone disease has been rising in both sexes, and is 2–3 times more common in males than in females **[Dajani et al. 1988; Andrew and Chandru 2001; Stamatelou et al. 2003]**. Peak incidence rate occurs in the second or third decade of life **[Shokouhi et al. 2008]**. The lifetime prevalence of kidney stone disease is estimated at 1–15 % **[Pearle and Lotan 2012].**

Neutron activation analysis is one of the most important analytical techniques which is used for non-destructive simultaneous multi-elements analysis of various samples of different

chemical compositions and origins. This is attributed to its sensitivity, accuracy and specificity.

In previous work this technique has been applied for analysis of various samples for different proposes. **[F. H. El-Sweify et al. (1997), F. H. El-Sweify et al. (2003), E.Metwally et al. (2004), E.A.A. El-Shazly et al. (2004). F.H. El-Sweify et al. (2007), F.H. El-Sweify et al. (2008), N.A. Tadros, F.H. El-Sweify et al. (2011), Fatma H. El-Sweify et al. (2016)]**.

In the present study INAA technique is applied, to analyze different human samples of renal and gall stones collected from Egyptian patients (male and female) and studying the possible factors which may influence the crystal formations in the considered organs which helps in in acquiring data concerning the role of patient's dietary intake, geographical location, and environmental conditions on the formation of such stones.

2- experimental and methods:

2.1. Sampling:

In this study some urinary and gall stones are collected from patients admitted Al-Matrya National Institute of kidney and urinary tract at Cairo to undergo surgery for urinary stone removal. 10 stone samples are collected from males, 5 from females and 5 from children.
Each of patient is asked to fill out a questioner prior to his/her surgery regarding personal details including gender, age, location of residence and other relevant social information are given identification (Code Numbers)

2.1.1. Pre-treatment of stone samples:

All samples are washed using deionized water and placed on sterile gauze, air dried, then transferred separately into polyethylene bottles. The samples are then sonicated in a water bath for 15 min for removing any blood clots and other remanences, after air drying, each stone is ground into powder using agate mortar and kept in a poly ethylene bottle with a code number.

2.2. Laboratorial equipments

2.2.1. Compton Suppressions System with HPGe detector.

Compton-Suppression Systems are used to reduce the background continuum for low-background counting. This reduction improves the overall spectrum quality especially for small volume samples. The Compton suppressions system is supplied by ORTEC. The detector, lead shielded to avoid interference for background.

Characteristics of HPGe (multi channel analyzer)

Compton-Suppression Systemsis a complete system including specially designed lead shield, timing electronics, suppression shield detector, and HPGe detector with efficiency 60%, with a resolution of (2.30 keV) at FWHM and 1332 keV and Peak to Compton 56:1

2.2.2 Processor circulating laboratory oven.

A laboratory oven, OF-02G, JEIO TECH manufacturing (Korea), is used for drying the bionanocomposite samples.

2.2.3 Bi-distilled water system.

Bi-distilled water system GFL Bi-Dist. 2104, KARL KOLB manufacturing (Germany), is used for obtaining the bi-distilled water.

2.3. Irradiation

One slandered reverence material is used namely SOIL-7. Triplicate accurately weighed (0.19 - 0.2 mg) of each sample or stander is taken for irradiation. A digital analytical balance of model WH 205-4, Wiggen Hauser manufacturing (Germany), with a sensitivity of 1x 10^{-4} g, is used for weighting the samples. The balance is calibrated periodically for quality control of the analysis. Very clean poly ethylene bottles and spatula are used to assure for QC of the processes.

2.4 Gamma measuring

Gamma ray spectra of the irradiated samples are record after cooling time ranging between 10 – 20 days to allow for decay of irradiation-induced short-lived isotopes produce in the sample to avoid unnecessary radiation exposure. Analysis of other elements which produced only irradiation-induced radioactive isotopes, are analyzed under short time irradiation conditions.

2.4.1 Gamma measurements

2.4.1.1. Relative method.

The method is based on the simultaneous irradiation of the unknown sample with standards. The radioactivity of the standards and the samples must be measured under identical conditions using suitable measuring technique. The half-life time, and the gamma- spectra of a nuclide are the aid in establishing the identity of radioactive nuclides.

Finally, the activities of the standards and the samples are compared, and the mass of an unknown element (x) in the sample is determined by calculation using the following equation:

$$\frac{\text{Mass of (x)in sample}}{\text{Mass of (x)in standard}} = \frac{\text{activity from (x) in sample}}{\text{activity from (x)in standard}}$$

There are many Standers Reference Materials (SRM), which prepared by the National Institute of Standards and Technology (NIST) and the US Geological Survey (US GS) in the United States, the International Atomic Energy Agency (IAEA) in Vienna, or other sources. These standards are often used as primary standards for NAA.

2.4.1.2. Absolute method

The induced activity due to a particular element in a sample is proportional to the amount of that element in the sample under a given set of conditions, also the knowing of the isotopic abundance is very important in carrying out sensitivity calculation and neutron flux measurement, so the activity induced in the sample is not only dependent on the amount of target element present but also on flux intensity $n.cm^{-2}.Sec^{-1}$ **[J.C. Balilar, et. Al.(1973), N,N. GreenWood and A.Earnashaw et. al.(1997)]**

In some cases, especially in multi-elements analysis, some elements may be present in the sample but not present in the standard. In such cases, one can make use of an analyzed element in the sample using the standard with enough certainty to analyze other elements in the sample and not present in the standard.

The possibility of using a single element as a comparator for multi-elements NAA is thus attractive. A mass (m) of an element in the sample can be determine by comparing the photopeak area (A) of a suitable gamma-line of the element's induced radioactive isotope, with that of another element ($A*$) and the mass ($m*$) determined in the sample using the standard, from the following equation **[Abd EL-Razik, A. M. et. Al. (2000), Tahra El sayed Mohammed Salim (2010)]**

$$(m) = \frac{m*.A.M.\delta*.a*.b*.E*.S*.d*}{A*.M*.\delta.a.b.E.S.d}$$

Where:

The asterisk $*$ refers to the element determined using the standard;

M = Atomic mass of the irritated element.
δ = Cross section for (n,γ) reaction of the target nuclide.
a = Isotopic abundance of the target nuclide.
b = absolute gamma intensity in the decay scheme.
E = Efficiency of the detector for the γ-ray determined using standard sources.
S = Saturation factor = $1 - e^{-\lambda t_i}$, where λ is the decay constant and t_i is the irradiation time.
d = Decay factor = $e^{-\lambda t_d}$, where t_d is the cooling time.

In case of short irradiation time, it's important to take the dead time fractions into consecrations this is due to short irradiation, short measuring time and short half lives of the induced radioactive nuclides and the high radio activity, consequently the following equation is used for calculation.

$$A_0 = \frac{N_P.(1+D_t)/T_m}{S.d.C.wt}$$

Where:

N_P = Net peak area.
D_t = dead time fraction, where dead time fraction = dead time / 100
S = Saturation factor = $1 - e^{-\lambda t_i}$, where λ is the decay constant and t_i is the irradiation time.
d = Decay factor = $e^{-\lambda t_d}$, where t_d is the cooling time.

C = Counting factor = $\frac{1-e^{-\lambda t_m}}{\lambda t_m}$, where t_m is the measuring time, in case of equal measuring time counting factor will be neglected.
So final equation will be,

$$A_0 = \frac{N_P.(1+D_t)}{S.d.wt}$$

3- Results and discussion

In this chapter the data obtained from analysis of all different collected samples using the chosen analytical methods and the separation studies of different objectives are presented and discussed.

3.1. Density measurements on stone samples.
The densities of the collected stone samples are calculated for these purposes. The volumes of accurately weighed stone samples are measured using small accurately graduated tube with thin bottom end. The determined data are represented in the tables (1, 2 and 3)

The following data are divided into three groups, namely (male, children, female).

3.1.1. In the case of group one (males) as can be seen from the following table the stones are collected from 18 patients their ages range from (27-74) years, the density values vary between 0.6133 – 1.567 gm/cm^{3,} except in the case of sample (48) the density range is higher (2.66 gm/cm^3).

- **Male**

Table (1) Densities of the collected renal stones from male patients.

ID	Age	Density g/cm^3	Type of stone	Location
30	48	1.4508	Renal	Shubra AL Khimah, Al Qalyubia
35	50	1.3242	Renal	Al Fayoum
36	35	0.6133	Renal	Arab Al Haswah, Al Qalyubia
37	32	1.3517	Renal	Al Qalyubia
45	27	1.2790	Renal	Minya Al Qamh
48	39	2.66	Renal	Helwan, Cairo Gov.
50	47	1.2244	Renal	El Zagazig
68	68	1.4385	Renal	Al Dokki
72	43	1.506	Renal	Al Fayoum
95	38	1.08366	Renal	Shubra Al Khema
97	35	0.99866	Renal	Qism EL Minya
98	46	1.3603	Renal	Al Marg
99	43	0.9021	Renal	Shubra Al Khema
103	56	1.29381	Renal	AL Salam, Alexandria
114	64	1.0837	Renal	Imbaba
116	74	1.567	Renal	Al Ma'asarah
134	42	1.3491	Renal	Al Nozha
135	43	1.1751	Renal	Al Fayoum

3.1.2. In the case of group two (children)

In this case Stones are collected only from four patients their ages ranging from 8-15 years. It is expected that children in this ages is difficult to find more patients suffering under this disease.

The density of the collected stones ranges from 1.23825 – 1.45 gm/cm^3.

- **Child**

Table (2) Densities of the collected renal stones from children patients.

ID	Age	Density g/cm^3	Type of stone	Location
69	15	1.2775	Renal	Rafah, North Sinai Gov.
90	8	1.45	Renal	Al Matarya, Cairo Governorate
102	13	1.29381	Renal	Al Badrashin, Giza Gov.
123	13	1.23825	Renal	Al Fayoum

3.1.3. In the case of group three (females)

Stones are collected from 8 patients. Their ages ranging from (22-63) years, living in different placeless in Egypt. The density ranging from 0.1340 – 1.5463 gm/cm^3, except one sample has higher density (2.67 gm/cm^3) this sample ID (88) lived in Cairo

- **Females**

Table (3) Densities of the collected renal stones from female patients.

ID	Age	Density g/cm^3	Type of stone	Location
32	55	0.1340	Renal	Al Omraneya
79	63	1.2754	Renal	Al Matareya
82	38	1.5462	Renal	Al Khankah
84	22	1.07425	Renal	Assiut
86	46	0.9999	Renal	Al Qalyubia
88	40	2.67	Gall	Ghamra
130	56	1.4453	Renal	Al Khanka
140	43	1.142838	Renal	Al Khanka

3.2. Effect of temperature on composition of the collected samples.

Weighed quantities of the collected samples are taken for studying the effect of heating at 100° C for 24 hours and 48 hours on the change of the weight. The losses in the weight of samples after heating in each case as well as the percentage losses are determined.

The obtained data are divided into three groups, namely (male, children, and female).

3.2.1. In the case of group one (males) As can be seen from the following table the stones are collected from 18 patients their ages range from (27-74) years. The weight loss percentage after heating for 24 hrs at 100° C ranges from 1.13% - 9.41% in 8 cases and the weight loss percentage after heating for 48 hrs at 100° C ranges from (1.219% - 5.6%) Higher percentage weight loss is observed in the case of samples (48, 68 and 96). In the case of ID 116 and 135 the weight loss percentages are, relatively very high (14.3%) and (34%) respectively

- **Male**

Table (4) weight loss and percentage weight loss values of stone samples collected from male patients after heating for 24-48 hrs at 100° C.

ID	Age	Weight before heating	Weight after 24 h heating	Weight loss	Weight loss percentage
30	48	0.5078	0.4960	0.0118	9.41%
35	50	1.9862	1.9026	0.0836	8.36%
36	35	0.0184	0.01835	5×10^{-5}	0.271%
37	32	0.392	0.3787	0.0133	1.33%
45	27	1.4070	1.3911	0.0159	1.13%
47	59	1.209	1.0680	0.141	11.66%
48	39	0.4109	0.3993	0.0116	2.82%
50	47	0.6122	0.5744	0.0378	6.17%
68	68	1.7262	1.4306	0.2956	17.12%
72	43	1.3558	1.3177	0.0381	2.81%
96	46	0.6999	0.4944	0.2055	29.3%

ID	Age	Weight before heating	Weight after 48 h heating	Weight loss	Weight percentage
98	46	0.6939	0.6738	0.0201	2.89%
99	43	0.1714	0.1651	6.3×10^{-3}	3.67%
103	56	1.0780	1.0541	0.0239	2.217%
114	64	0.6394	0.6316	7.8×10^{-3}	1.219%
116	74	0.4701	0.4027	0.0674	14.3%
134	42	1.2142	1.1461	0.0681	5.6%
135	43	0.9401	0.6178	0.3228	34%

3.2.2. In the case of group two (children)

Children studies are patients their ages ranging from 8-15 years. Children at this age supposed not to suffer from stone disease. The weight loss percentage after heating for 24 hrs at 100° C in only one sample below 10% ID.90 (1.103%), higher percentage weight loss is observed in almost cases of samples ID.123 (26.7%), ID.102 (34%) and ID.69 (39.54%)

The weight loss percentage after heating for 24 hrs at 100° C is indicated in the following table.

- **Child**

Table (5) weight loss and percentage weight loss values of stone samples collected from children patients after heating for 24 hrs at 100° C.

ID	Age	Weight before heating at 100° C	Weight after 24 hrs heating at 100° C	Weight loss	Weight loss percentage
69	15	0.1533	0.0926	0.0607	39.54%
90	8	0.725	0.7170	8×10^{-3}	1.103%
102	13	1.4232	0.9370	0.4862	34%
123	13	0.4952	0.3628	0.1324	26.7%

In the case of group three (females)

Stones were collected from 8 patients. Their ages range from (22-63) year, living in different placeless in Egypt. These samples have weight loss percentage ranging from (1.33% - 7.45%), two samples have weight loss percentage higher 10% this sample ID.86 (12.38%) and ID.32 (28%)

- **female**

Table (6) weight loss and percentage weight loss values of stone samples collected from female patients after heating for 24-48 hrs at 100° C.

ID	Age	Weight before heating	Weight after 24 hrs heating	Weight loss	Weight loss percentage
32	55	0.4729	0.3378	0.1351	28%
79	63	0.6377	0.6201	0.0176	2.759%

ID	Age	Weight before heating	Weight after 48 hrs heating	Weight loss	Weight loss percentage
82	38	0.7731	0.7619	0.0112	1.44%
84	22	1.2891	1.2598	0.0293	2.27%
86	46	0.6999	0.6132	0.0867	12.38%
88	40	0.0574	0.0534	4.3×10^{-3}	7.45%
130	56	0.1879	0.1854	2.5×10^{-3}	1.33%
140	43	3.5429	3.4745	0.0684	1.93%

3.3. Instrumental neutron activation analysis

3.3.1. Instrumental Neutron Activation Analysis under short irradiation conditions.

The pneumatic irradiation rabbit system (PIRS) built in the vertical thermal column of the ET-RR-2 reactor (Inchass, Egypt) is used for short irradiation time measurements. Stone samples are irradiated for a period of 200 seconds. After the irradiation, each irradiation sample was transferred immediately and automatically through the pneumatic system to the counting system for ɤ-ray spectrometric analysis. The samples are placed at distance of about 7 cm from the detection system.

To obtain thermal to epithermal flux ratio a group of gold foil weighing between 0.00235 mg and 0.00549 mg were sealed in polythene vials and irradiated separately at the same position.

The counting time for each sample was 200 seconds and decay time about 40-100 second. The concentration is calculated relatively by comparing concentration of standard material SOIL-7 and concentration of the same elements in stone samples.

Table(7) Relevant nuclear properties of isotopes used in INNA of trace elements in the analyzed stone samples under short irradiation and cooling times

Element	Target Isotope	Abundance (%)	Cross Section (b)	n,ɤ Produced Isotope	ɤ- Lines (Kev)	$T_{1/2}$
I	^{127}**I**	100.0	6.2	^{128}**I**	443 , 527	25 m
Mg	^{26}**Mg**	11.0	0.0382	^{27}**Mg**	844 , 1014	9.46 m
Mn	^{55}**Mn**	100.0	13.3	^{56}**Mn**	847 , 1811 , 2113	2.58 h
In	^{115}**In**	95.7	157	^{116}**In**	1294 , 1097 , 417	54 m
Na	^{23}**Na**	100.0	0.53	^{24}**Na**	1369 , 2754	15 h
Cl	^{37}**Cl**	24.23	0.428	^{38}**Cl**	2167 , 1642	37.1 m
Al	^{27}**Al**	100.0	0.230	^{28}**Al**	1779	2.246 m
Ca	^{48}**Ca**	0.187	1.1	^{49}**Ca**	3085 , 4072 , 4739	8.72 m
K	^{41}**K**	6.7302	1.46	^{42}**K**	1525	12.36 h
Si	^{30}**Si**	3.10	0.107	^{31}**Si**	1266	2.62 h
V	^{51}**V**	99.75	4.88	^{52}**V**	1434	3.75 m
Br	^{79}**Br**	50.69	11.1	^{80}**Br**	616 , 666	17.6 m

ɤ-Spectra were recorded for each sample as well as for the standard IAEA-Soil-7 the concentration of the analyzed elements was calculated reflective to that in the standard.

Concentration of the analyzed element in relation of living location as a studied factor (analyzed under short irradiation conditions)

From the obtained results of INAA under short irradiation conditions it is indicated that Na, Mg, Ca, Mn, Al, In and Cl are found in all analyzed stone samples in all cases male, female and children. Na, Mg and Ca are present as major elements.
All are found as trace elements, the two elements Cl and In are also found in all analyzed stone samples, however they are analyzed qualitatively. I is analyzed nearly in all studied elements, however qualitatively. Mn is found as a trace element in some of the analyzed elements. Si is detected and determined as major elements, however in only few samples. The concentration of Ca and Mg ranging from (0.075- 74.13%) and (0.069- 47.58%) respectively. Some samples have higher concentration of Ca than Mg. The type of stones in this case is mostly calcium oxalate or calcium phosphate.

In some other stones the concentration of Mg is higher than calcium which may indicate that the type of stone is struvite. Some stones contain high concentration of both Ca and Mg i.e. (sample ID 35, 135) indication that such stones contain mixed types i.e. calcium oxalate (or phosphate) + struvite.

Surprisingly, Si is present in seven stone samples mainly in the female stones (4 cases), (2 males) and (1 child) with concentration ranging (0.022-2.451%).
Some other elements are present and determined in seven stone samples which are ID (97, 102, 123, 146, 69, 125 and 155), from these samples it is found 4 children samples, 2 males and one female.

Some other elements are found in some samples as tracers which are V, W and Cu

- From comparing the concentrations of Ca and Mg one may be predicts the type of stone. Thus male stone samples of ID. 30, 36, 37, 45, 46, 48, 50, 72, 98 and 116 must be calcium stones either oxalate or phosphate which is indicated from their higher Ca concentration than magnesium concentration.
On the other hand male stone samples of ID. 68, 99, 103, 114, 134 have low concentration of calcium and magnesium so it may be uric acid (urate) stones.
Only one sample of ID. 155 have higher magnesium concentration than calcium so it predicts to be sturavite stone. However, two stone samples of ID. 72 and 135 have high concentration of both calcium and magnesium must be mixed stone of calcium stones either oxalate or phosphate and sturavite stone.

- Female stone samples of high concentration of Ca than Mg are ID. 82, 88, 130 and 140 these samples consider a calcium stones either oxalate or phosphate.
Three uric acid (urate) stones defined at female samples of ID. 79, 84 and 86 which is indicate from their low Ca and Mg concentration.
One female sample of ID. 32 have higher magnesium concentration than calcium so it predicted to be sturavite stone.

- children stone samples of ID. 102 and 103 are sturavite due to high concentration of Mg than concentration of Ca. only one sample of ID. 90 detect to be calcium stones either oxalate

or phosphate, also one stone sample of ID. 146 was uric acid (urate) stone and also one stone sample of ID. 69 was a mixed stone of calcium stones either oxalate or phosphate and sturavite stone.

Table(8) Concentration of the analyzed element in relation of living location as a studied factor (analyzed under short irradiation conditions)

a- male:

ID/ Age	Sex	Irradiation induced radioactive isotope Concentration (%, ppm)												Location
		^{24}Na %	^{27}Mg %	^{49}Ca %	^{87m}Sr	^{56}Mn ppm	^{28}Al ppm	^{116m}In	^{31}Si %	^{38}Cl	^{80}Br	^{128}I	Other ppm	type	AL Qalyobia Governorate
37/ 32Y	M	0.549	1.032	42.72	-	0.861	102.7	D.ND	-	D.ND	-	D.ND	-	Renal	toukh
36/ 35Y	M	0.401	1.071	74.13	-	-	380	D.ND	-	D.ND	D.ND	D.ND	-	Renal	Arab Al Haswah, Toukh
95/ 38 Y	M	0.088	-	7.691	-	1.54	54.73	D.ND	0.498	D.ND	-	D.ND	^{52}V=0.018	Renal	Shubra Al Khimah
99/ 43 Y	M	0.138	-	0.709	-	2.56	52.79	D.ND	-	D.ND	-	D.ND	^{52}V=0.076	Renal	Shubra Al Khimah
30/ 48 Y	M	1.117	1.176	42.74	D.ND	2.21	86.2	D.ND	-	D.ND	-	-	-	Renal	Shubra Al Khimah
ID/ Age	Sex	^{24}Na %	^{27}Mg %	^{49}Ca %	^{87m}Sr	^{56}Mn ppm	^{28}Al ppm	^{116m}In	^{31}Si %	^{38}Cl	^{80}Br	^{128}I	Other ppm	type	AL Fayoum Governorate
35/ 20 Y	M	1.529	15.28	40.21	D.ND	-	146.8	-	-	D.ND	-	-	^{52}V=0.0914	Renal	takia
72/ 43Y	M	0.508	0.1436	39.763	-	2.27	57.11	D.ND	-	D.ND	D.ND	D.ND	-	Renal	Takia
135/43Y	M	0.597	46.33	11.24	D.ND	-	67.73	D.ND	-	D.ND	-	-	^{42}K=7.79	Renal	Youssef El Seddik Police Station
ID/ Age	Sex	^{24}Na %	^{27}Mg %	^{49}Ca %	^{87m}Sr	^{56}Mn ppm	^{28}Al ppm	^{116m}In	^{31}Si %	^{38}Cl	^{80}Br	^{128}I	Other ppm	type	Ash Sharquia Governorate
45/ 27Y	M	0.808	1.703	41.36	-	1.8	49.08	D.ND	-	D.ND	-	D.ND	-	Renal	Minya Al Qamh
50/ 47Y	M	0.370	0.336	46.36	-	2.12	63.33	D.ND	-	D.ND	-	-	-	Renal	Az Zagazig
155/50Y	M	0.169	35	3.066	-	-	52.87	D.ND	-	D.ND	-	-	^{42}K=5863.47	Renal	Mashtoul as Souq
ID/ Age	Sex	^{24}Na %	^{27}Mg %	^{49}Ca %	^{87m}Sr	^{56}Mn ppm	^{28}Al ppm	^{116}In	^{31}Si %	^{38}Cl	^{80}Br	^{128}I	Other ppm	type	Cairo Governorate
103/ 56Y	M	0.132	-	0.075	-	1.82	34	D.ND	-	D.ND	-	D.ND	–	Renal	Al Matariyah, Helmeyat AZ Zaytoun
48/ 39Y	M	1.175	2.229	42.65	-	-	201.8	D.ND	-	-	-	D.ND	–	Renal	Helwan

98/ 46Y	M	0.35 8	-	44.1 9	-	-	63.0 6	-	-	D.ND	-	D.ND	^{52}V=0.1 13	Renal	AL Marg
134/4 2Y	M	0.04 5	0.06 9	0.24 4	-	-	66.2	-	-	D.ND	-	D.ND	^{187}W=D. ND	Renal	El-Nozha
ID/ Age	Sex	^{24}Na %	^{27}Mg %	^{49}Ca %	^{87m}Sr	^{56}Mn ppm	^{28}Al ppm	^{116}In	^{31}Si %	^{38}Cl	^{80}Br	^{128}I	Other ppm	type	Giza Governorate
114/6 4Y	M	0.04 9	-	0.54 17	-	2.41	84.0 6	D.ND	-	D.ND	-	D.ND	^{86}Cu= D.ND	Renal	Imbaba
68/ 68Y	M	3.12 9	0.22 0	0.38 2	-	1.56	52.5 5	D.ND	0.52 2	D.ND	-	D.ND	-	Renal	Al Dokki
ID/ Age	Sex	^{24}Na %	^{27}Mg %	^{49}Ca %	^{87m}Sr	^{56}Mn ppm	^{28}Al ppm	^{116}In	^{31}Si %	^{38}Cl	^{80}Br	^{128}I	Other ppm	type	New valley Governorate
116/7 4Y	M	0.37 4	0.27 6	39.9 3	-	1.49	72.9 2	D.ND	-	D.ND	-	D.ND	-	Renal	Dakhla Oasis

b- female:

ID/ Age	Sex	Irradiation induced radioactive isotope Concentration (%, ppm)												Location
		^{24}Na %	^{27}Mg %	^{49}Ca %	^{87m}Sr	^{56}Mn ppm	^{28}Al ppm	^{116m}In	^{31}Si %	^{38}Cl	^{80}Br	^{128}I	Other ppm	type	AL Qalyobia Governorate
82/ 38Y	Fe	0.17 7	-	41.5 8	-	207. 1	61.9 4	D.ND		D.ND	-	D.ND	-	Renal	Al Khankah City
140/4 3Y	Fe	0.13 7	0.09 05	40.2 4	-	1.4	77.9 3	D.ND	-	D.ND	-	D.ND	-	Renal	Al Khankah City
86/ 46Y	Fe	3.12	0.22	0.38 26	-	1.56	52.5 5	D.ND	0.52 2	D.ND	-	D.ND	-	Renal	Qalama
130/6 5Y	Fe	0.11 5	-	27.6 2	-	5.39	251. 5	D.ND	-	D.ND	-	D.ND	-	Renal	Al Khankah City
ID/ Age	Sex	^{24}Na %	^{27}Mg %	^{49}Ca %	^{87m}Sr	^{56}Mn ppm	^{28}Al ppm	^{116}In	^{31}Si %	^{38}Cl	^{80}Br	^{128}I	Other ppm	type	AL Fayoum Governorate
84/ 22Y	Fe	0.03 5	-	0.47 28	-	1.08	69.7 2	D.ND	0.02 2	D.ND	-	D.ND	-	Renal	Al Wilidiyyah
ID/ Age	Sex	^{24}Na %	^{27}Mg %	^{49}Ca %	^{87m}Sr	^{56}Mn ppm	^{28}Al ppm	^{116}In	^{31}Si %	^{38}Cl	^{80}Br	^{128}I	Other ppm	type	Cairo Governorate
79/ 63Y	Fe	0.19 3	0.10 8	0.85 0	-	2.22	62.1 8	D.ND	0.56 6	D.ND	-	D.ND	^{42}K=18 45.54	Renal	Al Matariyah
88/ 40Y	Fe	0.44 4	1.10 10	44.4 61	-	0.53 9	241. 0	D.ND	2.45 1	D.ND	-	D.ND	^{187}W=D. ND	Gall	El zaher, Ghamrah
32/ 55Y	Fe	34.0 8	34.0 80	12.0 42	-	-	71.5 3	D.ND	-	D.ND	-	D.ND	-	Renal	Al Omraneyah

c- child

ID/ Age	Sex	Irradiation induced radioactive isotope Concentration (%, ppm)												Location
		^{24}Na %	^{27}Mg %	^{49}Ca %	^{87m}Sr	^{56}Mn ppm	^{28}Al ppm	^{116}In	^{31}Si %	^{38}Cl	^{80}Br	^{128}I	Other ppm	type	Cairo Governorate
90/ 8Y	Ch.	0.127	-	9.9908	-	1.7	131.8	D.ND	1.576	D.ND	-	-	^{52}V=0.12	Renal	Al Matariyah
ID/ Age	Sex	^{24}Na %	^{27}Mg %	^{49}Ca %	^{87m}Sr	^{56}Mn ppm	^{28}Al ppm	^{116}In	^{31}Si %	^{38}Cl	^{80}Br	^{128}I	Other ppm	type	Giza Governorate
102/13Y	Ch.	0.250	47.58	0.169	-	-	68.97	D.ND	-	D.ND	-	D.ND	^{42}K=16431	Renal	Al Badrashin
123/13Y	Ch.	0.245	23.11	0.178	-	-	48.81	-	-	D.ND	-	D.ND	^{42}K=10833	Renal	Dahshour, Al Badrashin
146/13Y	Ch.	0.024	2.1052	0.1150	-	0.155	15.8	D.ND	-	D.ND	-	D.ND	^{42}K=666.41 ^{52}V=0.0268	Renal	Al Badrashin
ID/ Age	Sex	^{24}Na %	^{27}Mg %	^{49}Ca %	^{87m}Sr	^{56}Mn ppm	^{28}Al ppm	^{116}In	^{31}Si %	^{38}Cl	^{80}Br	^{128}I	Other ppm	type	North Siniai Governorate
69/ 15Y	Ch	0.783	42.33	12.75	D.ND	-	102.05	D.ND	-	D.ND	-	-	^{42}K=5230.97	Renal	Rafah

3.3.2. Instrumental Neutron Activation Analysis under long irradiation conditions.

The collected samples are also analyzed under long irradiation and cooling time to determine other elements which needs long irradiation time in order to obtain induced-irradiation radioactive isotopes. Long lived radioactive isotopes which are used for determination of their corresponding elements. Long cooling time is unnecessary radiation exposure resulting from short lived isotopes.

Since they produce no short lived radioactive isotopes these elements produced by irradiation mainly long lived. The irradiation carried out under thermal flux of 10^3 ns^{-1} cm^{-2}. The ratio of thermal and epithermal neutron flux was 20.

Table (9) Relevant nuclear properties of isotopes used in INNA of trace elements in the analyzed stone samples under long irradiation and cooling times

Element	Target Isotope	Abundance (%)	Cross Section (b)	n,γ Produced Isotope	γ- Lines (Kev)	$T_{1/2}$
Cr	^{50}Cr	4.35	15.9	^{51}Cr	320	27.70 d
Au	^{197}Au	100.0	98.8	^{198}Au	412	2.6935 d
Au	^{198}Au	1000	98.8	^{199}Au	158 , 208	3.139 d
Br	^{81}Br	49.31	2.69	^{82}Br	776 , 554 , 619	35.34 h
Zn	^{64}Zn	48.6	0.78	^{65}Zn	1115	244 d
Ca	^{46}Ca	0.004	0.7	^{47}Ca	1297 , 808 , 489	5.54 d
Co	^{59}Co	100.0	37.0	^{60}Co	1332 , 1173	5.272 y
Sc	^{45}Sc	100.0	26.5	^{46}Sc	889 , 1121	83.82 d
Hf	^{180}Hf	35.2	12.6	^{181}Hf	482 , 133 , 346	42.4 d
Se	^{74}Se	0.9	51.8	^{75}Se	265 , 136 , 280 , 121 , 401	120 d
Rb	^{85}Rb	72.17	0.46	^{86}Rb	1077	18.7 d

Sr	**^{84}Sr**	0.56	0.81	**^{85}Sr**	514	54.9 d
K	**^{39}K**	93.258	1.69	**^{40}K**	1461	1.38E09 y
Sb	**^{123}Sb**	42.7	4.326	**^{124}Sb**	603 , 1691	60.3 d
Tb	**^{159}Tb**	100.0	25.5	**^{160}Tb**	879 , 299 , 966	72.1 d
Fe	**^{58}Fe**	0.3	1.15	**^{59}Fe**	1099 , 1292	45.1 d
Eu	**^{151}Eu**	47.8	9204	**^{152}Eu**	122 , 344	13.33 y
Eu	**^{153}Eu**	52.2	390	**^{154}Eu**	123 , 274 , 723 , 1005	8.8 y
Ga	**^{71}Ga**	39.9	4.71	**^{72}Ga**	843 , 2202 , 603	14.1 h
Mn	**^{53}Mn**	100.0	13.3	**^{54}Mn**	835	312.5 d
As	**^{75}As**	100.0	4.3	**^{76}As**	559 , 657 , 1216	26.4 h
Cu	**^{65}Cu**	30.38	2.17	**^{66}Cu**	1039 , 834	5.1 m
Sn	**^{112}Sn**	1.0	1.15	**^{113}Sn**	225	115.1 d
Na	**^{24}Na**	10	-	**^{22}Na** (n,2n)	1275	2.619 y

- ^{40}K is a natural (primordial) radioactive isotope which is present in nature

ɣ-Spectra were recorded for each sample as well as for the standard IAEA-Soil-7 the concentration of the analyzed elements was calculated reflective to that in the standard.

From INAA of the collected stones under long irradiation conditions the following elements are analyzed quantitatively as can be seen from the following table : these elements are Cr, Br, Se, Fe, Co, Rb, Tb, Au, Fe and Hf.
Some elements are analyzed qualitatively such as Zn and Sr. All these elements are present as trace elements.

The elements Zn, Cr and Se are present as traces and determined in some stone samples. Zn is detected and analyzed in almost all samples. These elements are human health essential.

Table (10) Concentration of the analyzed element in relation of living location as a studied factor (analyzed under short irradiation conditions)
a- male:

ID/ Age	**Sex**	**Irradiation induced radioactive isotope Concentration (ppm)**										**Location**
		^{51}Cr ppm	**^{82}Br ppm**	**^{65}Zn ppm**	**^{160}Tb ppm**	**^{85}Sr ppm**	**^{75}Se ppm**	**^{86}Rb ppm**	**^{59}Fe ppm**	**^{60}Co ppm**	**Other ppm**	**AL Qalyobia Governorate**
37/ 32Y	**M**	**7.47**	**-**	D.ND	**-**	D.ND	**-**	**-**	**-**	**0.178**	-	**Toukh**
36/ 35Y	**M**	**1.439**	**13.17**	D.ND	**-**	**-**	**-**	**-**	**-**	**-**	**^{198}Au= 1.898E-07**	**Arab Al Haswah, Toukh**
99/ 43 Y	**M**	**55.21**	**1.41**	D.ND	**-**	D.ND	**26.740**	**4.72088**	**3.815E-7**	**3.48**	**^{181}Hf= 3.0**	**Shubra Al Khimah**
30/ 48 Y	**M**	**-**	**-**	D.ND	**11.42**	**-**	**-**	**-**	**-**	**0.0445**	**-**	**Shubra Al Khimah**
ID/ Age	**Sex**	**^{51}Cr %**	**^{82}Br ppm**	**^{65}Zn ppm**	**^{160}Tb ppm**	**^{85}Sr ppm**	**^{75}Se ppm**	**^{86}Rb ppm**	**^{59}Fe ppm**	**^{60}Co ppm**	**Other ppm**	**AL Fayoum Governorate**
35/ 20 Y	**M**	**4.81**	**-**	**-**	**-**	**-**	**-**	**2.07**	**-**	**4.9e-05**	**^{40}K= D.ND**	**-**

72/ 43Y	M	3.5	-	D.ND	-	D.ND	-	-	-	1.73e-05	-	Takia
135/4 3Y	M	7.49	-	D.ND	-	D.ND	-	11.9	-	9.9e-06	-	Youssef El Seddik Police Station
ID/ Age	Sex	^{51}Cr ppm	^{82}Br ppm	^{65}Zn ppm	^{160}Tb ppm	^{85}Sr ppm	^{75}Se ppm	^{86}Rb ppm	^{59}Fe ppm	^{60}Co ppm	Other ppm	Ash Sharquia Governorate
45/ 27Y	M	6.93	-	D.ND	-	-	-	-	-	0.163	-	Minya Al Qamh
50/ 47Y	M	9.42	-	D.ND	-	D.ND	-	-	-	0.454	^{40}K= DND	Az Zagazig
155/5 0Y	M	17.6	-	0.050523	-	8.48	-	8.48	-	0.106	-	Mashtoul as Souq
ID/ Age	Sex	^{51}Cr ppm	^{82}Br ppm	^{65}Zn ppm	^{160}Tb ppm	^{85}Sr	^{75}Se ppm	^{86}Rb ppm	^{59}Fe ppm	^{60}Co ppm	Other ppm	Cairo Governorate
103/ 56Y	M	9.77	-	D.ND	-	-	-	-	-	-	-	Al Matariyah, Helmeyat AZ Zaytoun
134/4 2Y	M	5.8	-	D.ND	-	-	0.0444	-	-	0.0577	^{181}Hf= 0.101 ^{40}K= DND	El-Nozha
68/ 68Y	M	6.94	-	D.ND	-	-	0.084	-	-	-	^{40}K= DND	Al Dokki
ID/ Age	Sex	^{51}Cr ppm	^{82}Br ppm	^{65}Zn ppm	^{160}Tb ppm	^{85}Sr	^{75}Se ppm	^{86}Rb ppm	^{59}Fe ppm	^{60}Co ppm	Other ppm	New valley Governorate
116/7 4Y	M	7.4	-	D.ND	-	-	-	-	77.737	-	^{40}K= DND	Dakhla Oasis

b- female:

ID/ Age	Sex	Irradiation induced radioactive isotope Concentration (ppm)									Location
		^{51}Cr ppm	^{82}Br ppm	^{65}Zn ppm	^{160}Tb ppm	^{85}Sr ppm	^{75}Se ppm	^{86}Rb ppm	^{59}Fe ppm	^{60}Co ppm	Other ppm	AL Qalyobia Governorate
82/ 38Y	Fe	6.5	-	D.ND	-	D.ND	0.046	-	-	-	-	Al Khankah City
140/4 3Y	Fe	3.18	-	D.ND	-	-	0.0435	-	-	-	-	Al Khankah City
86/ 46Y	Fe	5.03	-	D.ND	-	-	-	6.77E-05	39.51	0.702	-	Qalama
130/6 5Y	Fe	94.336	0.9304	D.ND	-	-	-	-	6.734E-7	0.7593	-	Al Khankah City
ID/ Age	Sex	^{51}Cr %	^{82}Br ppm	^{65}Zn ppm	^{160}Tb ppm	^{85}Sr ppm	^{75}Se ppm	^{86}Rb ppm	^{59}Fe ppm	^{60}Co ppm	Other ppm	AL Fayoum Governorate
84/ 22Y	Fe	5.46	-	D.ND	-	-	9431	-	-	0.016	-	Al Wilidiyyah
ID/ Age	Sex	^{51}Cr ppm	^{82}Br ppm	^{65}Zn ppm	^{160}Tb ppm	^{85}Sr	^{75}Se ppm	^{86}Rb ppm	^{59}Fe ppm	^{60}Co ppm	Other ppm	Cairo Governorate
88/ 40Y	Fe	2.943	1.088	D.ND			0.271	-	-	0.06858	^{198}Au= 1.346e-7	El zaher, Ghamrah

32/ 55Y	Fe	3.93	-	D.ND	-	-	-	14.27	-	0.0831	-	Al Omraneyah

C- child:

ID/ Age	Sex	Irradiation induced radioactive isotope Concentration (ppm)									Location
		^{51}Cr ppm	^{82}Br ppm	^{65}Zn ppm	^{160}Tb ppm	^{85}Sr	^{75}Se ppm	^{86}Rb ppm	^{59}Fe ppm	^{60}Co ppm	Other ppm	Cairo Governorate
90/ 8Y	Ch	6.97	-	D.ND	0.0325	-	0.0667	-	-	-	^{181}Hf= 0.0815	Al Matariyah
ID/ Age	Sex	^{51}Cr ppm	^{82}Br ppm	^{65}Zn ppm	^{160}Tb ppm	^{85}Sr	^{75}Se ppm	^{86}Rb ppm	^{59}Fe ppm	^{60}Co ppm	Other ppm	Giza Governorate
102/1 3Y	Ch	12.43	-	D.ND	-	-	-	6.62	-	0.086	-	Al Badrashin
123/1 3Y	Ch	5.03	-	D.ND	-	-	-	-	-	0.15	-	Dahshour, Al Badrashin
146/1 3Y	Ch	1.73	0.149	D.ND	-	-	-	4.98	-	-	-	Al Badrashin
ID/ Age	Sex	^{51}Cr ppm	^{82}Br ppm	^{65}Zn ppm	^{160}Tb ppm	^{85}Sr	^{75}Se ppm	^{86}Rb ppm	^{59}Fe ppm	^{60}Co ppm	Other ppm	North Siniai Governorate
69/ 15Y	Ch	27.04	0.399	D.ND	0.25	D.ND	-	-	-	0.111	-	Rafah

References

Abboud, I. A." Mineralogy and chemistry of urinary stones: Patients from North Jordan". Environmental Geochemistry and Health, 30(5), 445–463. (2008). https://doi.org/10. 1007/s10653-007-9128-7.

Abeywickarama, B., Ralapanawa, U., & Chandrajith, R. "Geoenvironmental factors related to high incidence of human urinary calculi (kidney stones) in Central Highlands of Sri Lanka". Environmental Geochemistry and Health, 38(5), 1203–1214. https://doi.org/10.1007/s10653-015- 9785-x (2015).

Andrew, J. P. & Chandru, P. S. "Diagnosis and initial management of kidney stones". American Family Physician, http://www.aatp.org/atp/20010401/1329.html. p. 17. (2001).

Abd EL-Razik, A. M. (2000).

Chandrajith, R., Wijewardana, G., Dissanayake, C. B., & Abeygunasekara, A. "Biomineralogy of human urinary calculi (kidney stones) from some geographic regions of Sri Lanka". Environmental Geochemistry and Health, 28(4), 393–399. https://doi.org/10.1007/s10653- 006-9048-y (2006).

Dajani, A., Khadra, A. A., & Baghdadi, F. "Urolithiasis in Jordanian Children.: A Report of 52 Cases". British Journal of Urology, 61(6), 482–486. (1988).

Deganello, S. "The structure of whewellite, CaC_2O4H_2O at 328 K. Acta Crystallographica Section B: Structural Crystallography and Crystal Chemistry", 37(4), 826–829. (1981).

Echigo, T., Kimata, M., Kyono, A., & Shimizu, M." Reinvestigation of the crystal structure of whewellite [$Ca(C_2O_4)H_2O$] and the dehydration mechanism of caoxite [$Ca(C_2O_4)_3H_2O$]". Mineralogical Magazine, 69(1), 77–88 (2005).

El-Shazy, E. A. A., Abo Zahra, Sh. F. El-Sweify, F. H., Kanias , G. G.: 'Simultaneous Multi-element determination in some cosmetic samples of different origin using neutron activation analysis". J. Radiochim. Acta 92,111(2004).

El-Sweify, F.H, El-Sweify, A.H.H., Abd El-Razek, A.M.: "Flax (Linumusitatissimum L.)As a source for animal feed and its contents of some elements". Proc. Conf. "Food-borne contamination and Egyptian health" J. Mansoura Univ., Egypt 26-27 Nov, p. 201(1997).

El-Sweify, F.H, El-Sweify, A.H.H., Abd El-Razek, A.M.: "Multielements determination samples of some organs of flax, field soil and irrigation water using neutron activation analysis". Arab J. Nucl. Sci. Appl. 30, 199 (1997).

El-Sweify, F.H., Hammad, F., Abd El-Razek. A.M.: Analysis of trace elements in liquid samples of different origans using CNAA. Al-Azhar Bulletin of Sci., Proc., Cairo Egypt, 5th. Int. Sci., Conf., 25-27 March, P. 15 (2003).

El-Sweify, F.H., Metwally, E., Abdel-Khalik, H.: Analysis of pencil graphite samples of various origins using instrumental neutron activation analysis. J. Radiochim. Acta 96, 63(2008).

Fatma H. El-Sweify, Mahmoud A. El-Amir, Mohamed Mostafa, Hala E. Ramadan, and Ghada M. Rashad, A.M.: "Simultaneous multi-element determination in different seed samples of Dodonaea viscosa hopseed using instrument neutron activation analysis" J. Radiochim. Acta, P. 104(3): 211-220(2016).

Giannossi, M. L., Mongelli, G., Tateo, F., & Summa, V. "Mineralogical and morphological investigation of kidney stones of a Mediterranean region (Basilicata, Italy)". Journal of X-Ray Science and Technology, 20(2), 175–186. (2012).

Golovanova, O., Palchik, N., Maksimova, N., & In, A. "Comparative characterization of the microelement composition of kidney stones from patients in the Novosibirsk and Omsk regions" (2009)..

Hesse, A., Tiselius, H. G., Siener, R., & Hoppe, B. "Urinary stones: diagnosis, treatment, and prevention of recurrence". 3rd revised and enlarged edition. Karger: Basel (2009).

J.C.Bailar, H.J.Emeleus, R.Nyholm, A.F Trotman – Dickenoon "Comprehensive Inorganic Chemistry", vol.4. Lanthanides. © Pergamon (1973)

Jute (Corchorus capsularis) seed samples. Arab, J. Nucl. Sci. Appl. 37(1), 53 (2004).

N,N.Greenwood and A.Earnshaw " The chemistry of the elements. Butterworth heincmann, Great Britain. November (1997).

Pearle. M. S, Yair Lotan, "Urinary Lithiasis: Etiology, epidemiology, and pathogenesis in: Campbell-Walsh urology", 10thed. (2012).

Pourmand, G., & Pourmand, B. "Epidemiology of stone disease in Iran". In urolithiasis (Vol. 85–87). London: Springer (2012).

Safarinejad, M. R. "Adult urolithiasis in a population-based study in Iran: prevalence, incidence, and associated risk factors". Urological Research, 35(2), 73–82 (2007).

Shokouhi, B., Gasemi, K., & Norizadeh, E. "Chemical composition and epidemiological risk factors of urolithiasis in Ardabil Iran". Research Journal of Biological Sciences, 3(6), 620–626 (2008).

Stamatelou, K. K., Francis, M. E., Jones, C. A., Nyberg, L. M., & Curhan, G. C. "Time trends in reported prevalence of kidney stones in the United States": 1976–19941. Kidney International, 63(5), 1817–1823. (2003).

Tahra El sayed Mohammed Salim., "Studies and application on Neutron Capture (n, ɤ) using K_0-Method " , physics Department, Women's college for Arts, Science and Education, Ain Shams Univ. (2010)

Talham, D. R., Backov, R., Benitez, I. O., Sharbaugh, D. M., Whipps, S., & Khan, S. R. "Role of lipids in urinary stones: Studies of calcium oxalate precipitation at phospholipid Langmuir monolayers. Langmui"r, 22(6), 2450–2456. https://doi.org/10.1021/la052503u.

Tölgyesy, J.; et al. (1971).

Tur, J., Prieto, R., & Grases, F. "An animal model to study the effects of diet on risk factors of calcium stone formation". Scandinavian Journal of Urology and Nephrology, 25(4), 311–314. (1991).

Wijayarathna, K. S. N., & Abeygunasekera, A. M. "Pathogenesis of nephrolithiasis. Sri Lanka" Journal of Surgery, 31(3), 28–32. https://doi.org/10.1016/j.juro.2012. 11.069. (2013).

Zarasvandi, A., Heidari, M., Sadeghi, M., & Mousapoor, E. "Major and trace element composition of urinary stones, Khuzestan province, Southwest, Iran". Journal of Geochemical Exploration, 131, 52–58. (2013).

الملخص باللغة العربية

حول إستخدام تقنية التحليل التنشيطي النيتروني الآلي لتحليل بعض عينات الحصوات الكلوية للإنسان

ريهام عاطف ،فاطمة السويفي[أ] ، محمد على[أ]، وفاء حجازي[ب]

أ-قسم الكيمياء النوويه- شعبة انتاج النظائر المشعة (هيئة الطاقة الذرية) ص.ب ٣٤٥٩ القاهرة - مصر

ب- كلية البنات للآداب والعلوم والتربية – جامعة عين شمس – القاهرة - مصر

- قد إزداد حديثاً معدل مرض الحصوات الكلوية في مصر يرجع ذلك إلى المؤثرات الصناعية والبيئية بالإضافة إلى ذلك فقد يكون للعناصر الضئيلة دوراً في تكوين مثل هذه الحصوات بالرغم من أهميتها في العمليات الحيوية.

- في هذه الدراسة أُستخدمت تقنية التحليل التنشيطي النيتروني الآلي للتحليل العناصري لبعض الحصوات الكلوية التي تم تجميعها من مرضى يعيشون في محافظات مختلفة في مصر. جمعت هذه العينات من مرضى من الرجال والنساء والأطفال ذوي أعمار مختلفة.

- أُجريت التحاليل تحت ظروف مختلفة من أزمنة التشعيع والتبريد وقد قدرت تركيزات عناصر رئيسية وثانوية وكذلك ذات التركيزات الضئيلة. أستخدمت مادة قياسية لقياسات درجة الصوابة ومراقبة الجودة. العناصر المحللة هي: As, Br, Ca, Co, Cr, Cu, Fe, Hf, In, Mg, Mn, Na, Se, Sr, Tb, V Zn, وذلك تحت الظروف التجريبية المستخدمة.

- بعض هذه العناصر أساسية من الناحية الحيوية وبعضها قد يكون خطيراً، في حالة إذا زاد التركيز تم إقتراح بعض الإرتباطات بين تركيز هذه العناصر وكلٍ من الجنس والعمر ومكان الإقامة. كما تم إستنباط نوع الحصوات من نتائج تركيز بعض العناصر.