



**PHARMACEUTICAL EVALUATION OF MA'UL-QALAI (TIN WATER)**

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**ABSTRACT**

In Unani system of medicine, several metals and minerals have been in use for various clinical conditions. The metals and minerals are processed in the dosage form of *ma-ul-ajsad*. The pharmaceutical procedure is known as *Ifa*. It was developed way back in medieval times, especially in the 10<sup>th</sup> century CE. The Arab al-Chemists explored the medicinal properties of metals and minerals. Later on the Arab physicians employed as medicines. They were aware of the inherent medicinal properties of these inorganic substances. According to the process of *Ifa*, the transferred or obtained particles in the solvent are in nano form. However, the physical description of these nano sized particle is not mentioned in the Unani texts due to non-availability of measurement facility during thousand years ago. In the present study, an attempt was made to evaluate the the *Ma'ul-Qalai* (Tin water) in techno-scientific terms, and hence, generate scientific evidence. *Ma'ul-Qalai* (Tin water) is found a mention in a number of *Qarabadeen* (Unani Pharmacopoeia). It was prepared pharmaceutically in the form of 3 (three) versions with 1<sup>st</sup>, 5<sup>th</sup> and 15<sup>th</sup> *put* to each version. Each version was subjected to a battery of tests, viz., particles shape and size by the means of AAS, Zetasizer and TEM.

**KEYWORDS:** *Ifa*, *Ma'ul-Qalai*, Tin water, AAS, Zetasizer and TEM.

**INTRODUCTION**

*Qalai* (tin) is a silvery-white metal. It is malleable somewhat ductile, and has a highly crystalline structure. Due to the breaking of these crystals, a tin cry is heard when a bar is bent. Etymologically, Tin is derived from the Anglo-Saxon word *tin* with the symbol Sn which comes from its Latin word *stannum*, and has atomic number 50.

*Qalai* is employed as a coating material for brass or copper cooking utensils. It serves the purpose of protecting from the poison of *zangar*. The *Qalai* coating has become a profession. The *qalawala* digs a pit in the ground, and a temporary blast furnace is prepared and airing it with bellows. The heated utensil is blasting it off after sprinkling a little *nausadar* (sal amoniac or ammonium chloride) which gives out deep white smoke and a peculiar ammoniac smell. The powder is then rubbed all over the utensil's interior to get rid the utensil of any grit, and make it more abrasive. Then a piece of *qalai* is touched to the blasting hot interior of the utensil. After melting of *qalai*, it is quickly rubbed on whole of the utensil forming a shining lining of *qalai*. The utensil is dipped into a bucket full of water. The sudden contact of the hot utensil with the water creates a shrill and sharp sound that dims with the utensil recovering its normal temperature.

The Romans often dipped copper dishes into molten *qalai* to give a better taste to their drinks taken with the tinned items. It has been observed that workers in tin mines do not suffer from furuncles, and due to this observation stannoxyl was introduced which has been successfully tried in patients suffering from furunculosis and was also used successfully in the treatment of eczema and psoriasis. The hollow tin pipe was used first time for the pleural drain, this is a Greek innovation (Ghani, ynm; Nadkarni, 1982; Chopra, 2006; Richard, 2012).

In the Unani classical literature, *Qalai* is described of two types.

- a) *Khanj* : It is natural.
- b) *Misraka* : It is synthetic.

The al-chemists were accustomed with this metal and they correlated it with the Jupiter. It can dry the chronic ulcers when sprinkle on them. It is also used for the treatment of scorpion bite. The *qalai* as a medicine given in diseases of the lungs and in cerebral disorders like convulsions and epilepsy. It is also recommended for diseases related to uterus. It is also used externally in foul ulcers and fistula. Filings of *qalai* have been recommended for destroying worms particularly the taenia (Ghani, ynm; Ibn Sina, 2010; Husain, 1927; Khan,

1303 AH; Kabiruddin, ynm; Hubal, 2005; Nadkarni, 1982; Hill, 2003).

*Ma'ul-Qalai* is a Unani liquid pharmaceutical/dosage form prepared by *amal-e-itfa*. This solution shows significant therapeutic effect and used in different diseases and some time as an ingredient in different compound formulations, e.g. *zaroor*, *zaroor-e-aksareen*, *zarooq-e-jayyad* etc. It is used as *muqawwi-e-bah* (aphrodisiac), *muqawwi-e-ahsha* (visceral tonic) (Khan, ynm; Arzani, ynm; Kabiruddin, ynm).

## MATERIALS AND METHODS

*Qalai* (Tin) was procured from the open market, Delhi. It was authenticated by Shree Krishna Laboratory, New Delhi.

## Method of preparation

- *Qalai* (tin) was taken with its weight 54.30 grams.
- 300 ml distilled water.
- *Qalai* (tin) was heated with blue lamp gun until it became red hot. It turned hot at the temperature of 200°C in 30 seconds. Then it was dipped in distilled water until it lost its heat.
- The aforementioned procedure is termed as a single *put*. The same was repeated for 15 times, i.e. 15 *puts* were performed on *Qalai*.

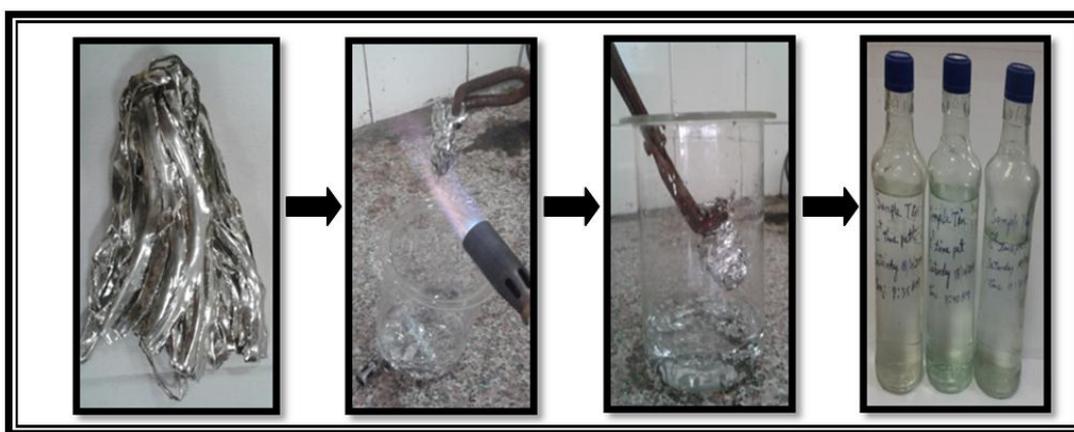


Fig. 1: Process of making *Ma'ul-Qalai*

## Water loss after *put* procedure

Table 1: Water loss after *Itfa* procedure

No. of <i>Put</i>	Water loss
1 <sup>st</sup> <i>put</i>	No water lost
5 <sup>th</sup> <i>put</i>	5 ml lost
15 <sup>th</sup> <i>put</i>	10 ml lost

## Weight loss of *Qalai* (tin) after *Itfa* procedure

Table 2: Weight loss of *Qalai* (tin) after *Itfa* procedure.

No. of <i>Put</i>	Weight loss
0 <i>put</i>	54.30 grams
1 <sup>st</sup> <i>put</i>	53.00 grams
2 <sup>nd</sup> <i>put</i>	53.57 grams
3 <sup>rd</sup> <i>put</i>	53.13 grams
4 <sup>th</sup> <i>put</i>	53.02 grams
5 <sup>th</sup> <i>put</i>	52.80 grams
6 <sup>th</sup> <i>put</i>	52.34 grams
7 <sup>th</sup> <i>put</i>	52.10 grams
8 <sup>th</sup> <i>put</i>	51.90 grams
9 <sup>th</sup> <i>put</i>	51.70 grams
10 <sup>th</sup> <i>put</i>	51.53 grams
11 <sup>th</sup> <i>put</i>	51.20 grams
12 <sup>th</sup> <i>put</i>	50.95 grams
13 <sup>th</sup> <i>put</i>	50.03 grams

14 <sup>th</sup> <i>put</i>	49.70 grams
15 <sup>th</sup> <i>put</i>	49.23 grams

## PHYSICO-CHEMICAL ANALYSIS OF *MA'UL-QALAI*

### ORGANOLEPTIC PROPERTIES

- Appearance:** Appearance was recorded according to the consistency.
- Determination of Taste:** This was performed by the volunteers.
- Determination of Color:** The color of the drug formulation was noted.
- Determination of smell:** A small portion of the sample was examined by slow and repeated inhalation of air over the material.

### DETERMINATION OF pH

- pH of 1% solution:** One ml sample was mixed in 100 ml of distilled water and pH was checked with a standardized glass electrode.
- pH of 10% solution:** Ten ml sample was mixed in 100 ml of distilled water and pH was checked with a standardized glass electrode.

**SPECIFIC GRAVITY**

The specific gravity was determined with picnometer. The picnometer was filled with sample at a temperature 25°C.

The specific gravity was calculated by the formula given below.

Specific gravity = weight of sample/weight of distilled water (DW).

Wight of DW= weight of picnometer with DW – weight of picnometer.

Weight of sample= weight of picnometer with sample – weight of picnometer (Sandhyarani *et al.*, 2014).

**QUALITATIVE ANALYSIS OF 1<sup>ST</sup>, 5<sup>TH</sup>, 15<sup>TH</sup> PUT SAMPLE OF MA'UL-QALAI (TIN WATER)**

It was done by AAS (Atomic Absorption Spectroscopy) (Corporation Ltd, India) by Krishna Laboratory, New Delhi.

**QUANTITATIVE ANALYSIS OF 1<sup>ST</sup>, 5<sup>TH</sup> AND 15<sup>TH</sup> ATOMIC ABSORPTION****SPECTROPHOTOMETRY (AAS)**

It was done by AAS (Atomic Absorption Spectroscopy) (Corporation Ltd, India).

**PARTICLE SIZE ANALYSIS BY MALVERN ZETASIZER**

Particle size was determined with a Zetasizer version 7.11, serial no. MAL 1073927-BETA 21. The sample for particle size analysis was added to a small dispersion unit called a cuvette. Average values were calculated (Shinde *et al.*, 2015).

**PARTICLE SHAPE ANALYSIS BY TRANSMISSION ELECTRON MICROSCOPY (TEM)**

Field-emission transmission electron microscope (FE-TEM) [JEOL, JEM-2100, and 200 kV] was used for analysis (Anwar *et al.*, 2013).

**RESULTS AND DISCUSSION**

Present study was carried out to pharmaceutically evaluate the *Ma'ul-Qalai*. Formulation was made in three versions 1<sup>st</sup>, 5<sup>th</sup> and 15<sup>th</sup> and their organo-leptic, physico-chemical and other tests were carried out.

**Organo-leptic properties****pH measurement of 1<sup>st</sup>, 5<sup>th</sup> and 15<sup>th</sup> put sample of *Ma'ul-Qalai*****pH measurement of 1<sup>st</sup> put sample**

The mean values of pH of *Ma'ul-Qalai* (1<sup>st</sup> put sample) in 1% and 10% solutions were found to be 6.73 ± 0.02 and 6.67 ± 0.016, respectively.

**Table 6: Specific gravity of *Ma'ul-Qalai* (1<sup>st</sup>, 5<sup>th</sup> and 15<sup>th</sup> put sample).**

S.No.	1 <sup>st</sup> put sample	5 <sup>th</sup> put sample	15 <sup>th</sup> put sample
1.	1.003	1.003	1.005
2.	1.002	1.002	1.004
3.	1.001	1.004	1.003
Mean ± SD	1.002 ± 0.001	1.003 ± 0.001	1.004 ± 0.001

**Table 3: pH values of *Ma'ul-Qalai* (1<sup>st</sup> put sample) in 1% and 10% solution.**

S. No.	pH (1%)	pH (10%)
1.	6.75	6.69
2.	6.73	6.67
3.	6.71	6.66
Mean ± SD	6.73 ± 0.02	6.67 ± 0.016

**pH measurement of 5<sup>th</sup> put sample**

The mean values of pH of *Ma'ul-Qalai* (5<sup>th</sup> put sample) in 1% and 10% solutions were found to be 6.59 ± 0.02 and 6.52 ± 0.01, respectively.

**Table 4: pH values of *Ma'ul-Qalai* (5<sup>th</sup> put sample) in 1% and 10% solution.**

S. No.	pH (1%)	pH (10%)
1.	6.61	6.53
2.	6.57	6.51
3.	6.59	6.52
Mean ± SD	6.59 ± 0.02	6.52 ± 0.01

**pH measurement of 15<sup>th</sup> put sample**

The mean values of pH of *Ma'ul-Qalai* (15<sup>th</sup> put sample) in 1% and 10% solutions were found to be 6.59 ± 0.02 and 6.52 ± 0.01, respectively.

**Table 5: pH values of *Ma'ul-Qalai* (15<sup>th</sup> put sample) in 1% and 10% solution.**

S. No.	pH (1%)	pH (10%)
1.	6.61	6.53
2.	6.57	6.51
3.	6.59	6.52
Mean ± SD	6.59 ± 0.02	6.52 ± 0.01

**Specific gravity measurement of 1<sup>st</sup>, 5<sup>th</sup> and 15<sup>th</sup> put sample of *Ma'ul-Qalai***

The mean values of specific gravity of *Ma'ul-Qalai* (1<sup>st</sup>, 5<sup>th</sup> and 15<sup>th</sup> put sample) were found to be 1.002 ± 0.001, 1.003 ± 0.001 and 1.004 ± 0.001, respectively.

Qualitative tests of *Ma'ul-Qalai*Table 7 : Qualitative tests of *Ma'ul-Qalai*.

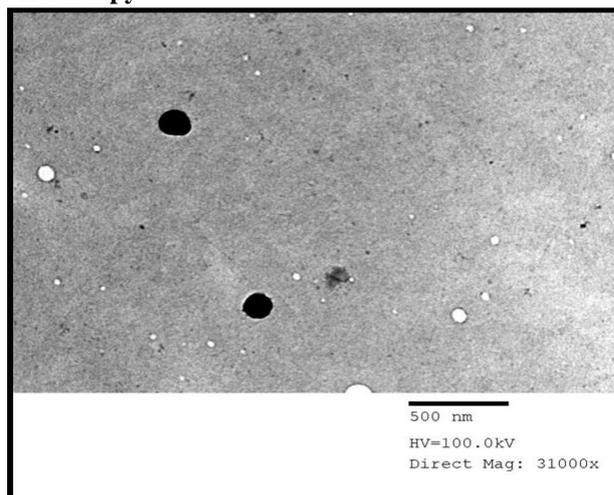
S.No.	No. of put	Presence of Qalai
1.	1 <sup>st</sup> put	+ve
2.	5 <sup>th</sup> put	+ve
3.	15 <sup>th</sup> put	+ve

## Quantitative analysis by Atomic Absorption Spectrophotometry (AAS)

Table 8 : Quantitative analysis of *Ma'ul-Qalai* by AAS.

S.No.	No. of put	Tin (Sn <sup>+4</sup> )	Tin (Sn <sup>+2</sup> )
1.	0 put	Absent	Absent
2.	1 <sup>st</sup> put	14 ppm	Absent
3.	5 <sup>th</sup> put	33 ppm	Absent
4.	15 <sup>th</sup> put	107 ppm	Absent

## Shape analysis by TEM (Transmission Electron Microscopy)

Fig. 2 : TEM image of *Ma'ul-Qalai*.

- The particles shape of 15<sup>th</sup> put sample of *Ma'ul-Qalai* was found to be irregular, i.e., in the clogged and cluster form.

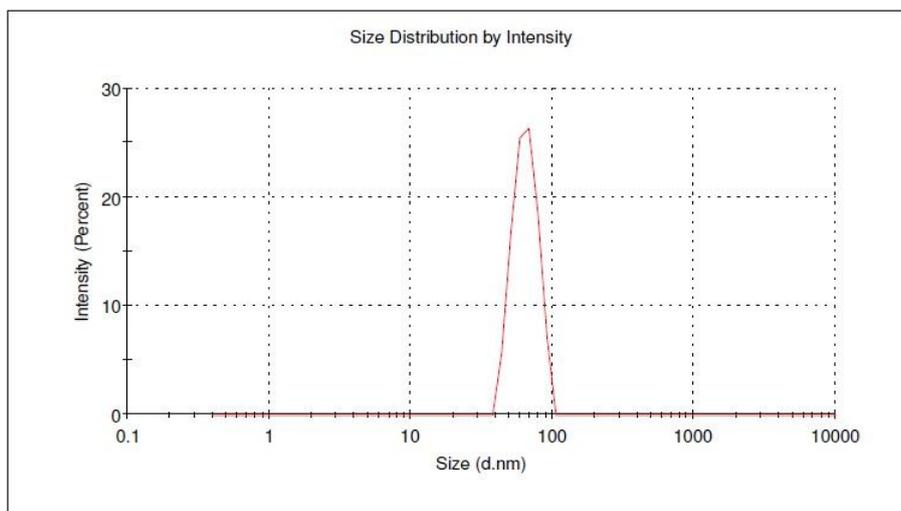
## Particle size analysis

The sample of *Ma'ul-Qalai* was analyzed by Malvern Zetasizer, version 7.11, serial no. MAL 1073927-BETA 21.

## Sample Details

Sample Nam... Tin Water 1  
 General Notes: 5' sonic  
 SOP Name: mansettings.nano  
 File Name: 8. Tibbia College... Dispersant Name: Water  
 Record Number: 17 Dispersant RI: 1.330  
 Material RI: 1.59 Viscosity (cP): 0.8872  
 Material Absorbti... 0.010 Temperature (°C): 24.9  
 Attenuator: 10 Measurement Position (mm): 3.00  
 Count Rate (kcps... 349.4  
 Cell Description: Disposable micro cuvette (40µl)  
 Duration Used (... 60

Size (d.nm):	% Int	St Dev (d.n...	Z-Average (d.nm): 142.2
Peak 1: 65.10	100.0	12.55	PDI: 0.223
Peak 2: 0.000	0.0	0.000	Cumulants Fit Error: 0.0419 In Range: 92.8
Peak 3: 0.000	0.0	0.000	Multimodal Fit 0.0... Intercept: 0.914



Peak 1<sup>st</sup> showed that particles are 65 nm in range.

## DISCUSSION

*Qalai* (Tin) is a most popular inorganic substance used in Unani medicine. In order to get its medicinal properties, a specialized process had been devised as *Itfa*. By this process the nano form of its particles are transformed in the water and it becomes a dosage form as *Ma-ul-Qalai* (Tin water). The nano sized particles obtained through this process were found in 65 nanometers which is an ideal size of a nano medicine. Hence, this study validates not only the traditional wisdom of Unani physicians, but generates pharmaceutical evidence too. Moreover, it is highly economical.

## CONCLUSION

In the present study the *Ma'ul-Qalai*, was pharmaceutically prepared and three versions of each at 1<sup>st</sup>, 5<sup>th</sup> and 15<sup>th</sup> *put* were scientifically studied and its Standard Operating Procedure (SOP) regarding particles shape and size and physico-chemical standard were evaluated. It was noted that when the number of *put* increased, the pH values of *Ma'ul-Qalai* was decreased and specific gravity increased when the number of *put* increased. Qualitative analysis of *Ma'ul-Qalai* showed the presence of tin in it. It was observed that as the numbers of *puts* were increased, the quantity of metal also increased in the sample. The particle shape in all *Ma'ul-Qalai* was found to be clogged and cluster form. In *Ma'ul-Qalai*, particles size was found to be 65 nm in range.

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