



Research Article

COMPARATIVE STUDY OF *TADAGJAL* (ARTIFICIAL LAKE WATER) AND *HANSODAKA* (NATURALLY PURIFIED WATER IN *SHARAD RITU*) FROM THE SAME TADAG WITH RESPECT TO CHEMICAL PROPERTIES

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ABSTRACT

Ayurveda is an ancient science dealing with attaining health and curing diseases of ill. Good health makes our life happy. For that one has to take Wholesome of food which includes pure water also. We should always use the pure water to maintain health. Our Rishi's have mentioned regarding *Hansodaka* in Samhitas. *Hansodaka* is purified water in *Sharad ritu* by natural resources like Sunrays, Moonrays and an additional effects of Agasti star rays at night and *Kalprabhav* of *Sharad ritu*. This *Hansodaka* is pure water and ideal for drinking purpose. So to check this statement of our Rishi's, efforts are made here to compare such *Hansodaka* and simple *Tadagjal* in view of chemical properties, considering W.H.O. guideline in present era. **Aims and Objective:** To compare chemical properties of Simple *Tadagjal* and *Hansodaka* to check its suitability for drinking purpose. **Materials and Methods:** Total four samples were collected. Two were Simple *Tadadjal* and Two were *Hansodaka*. All Water samples were analyzed in standard laboratory for chemical properties. Reports were collected and analyzed. **Results and Conclusion:** *Hansodaka* is better than simple *Tadagjal* with respect to chemical properties. It may be due to combine effect of sunrays, moon rays and *Agasti* star rays in *Sharad ritu*. But *Hansodaka* is not suitable for drinking purpose as per W.H.O. guideline. it may be due to increased population, pollution, industrialization in present era as compared to ancient era. Hence we can say water purification by other methods is must in present era.

KEYWORDS: *Tadagjal*, *Hansodaka*, Chemical properties, *Sharad ritu*, *Agasti* star, Sunrays, Moon rays, *Kalprabhav*, Water purification.

INTRODUCTION

Main aim of Ayurveda is to attain pious acts (*Dhrama*), Wealth (*Artha*), desire (*Kama*) and salvation (*Moksha*) by health. These four things can be attained with the help of health. Good health makes our life happy but ill health takes away the happiness from the life. Chakrapani commenting on the Swasthavritta, mentions the condition free from the disease is *Swastha* i.e. healthy and the regimens followed to keep oneself healthy is *Swasthavritta*. Sharangdhara¹ quotes no creature in the universe is immortal, it is impossible to prevent death, but it is possible to prevent disease. So one should try for that which is preventable. Charakacharya² emphasises on maintenance of health. One should take care of his body by neglecting all other things because if body is not healthy then nothing is existing. Word *Swastha* comprises of *swa* meaning one's own and *Stha* means staying i.e. being in one's own natural state. Swasthavritta mainly focus on maintenance of health of healthy one. For that one has to take wholesome food and follow daily and seasonal regimen. In seasonal and daily regimen *Ahara* and *jal* has lot of importance.

Water is one of the nature's most important gifts to mankind. Water gives us life, satisfaction, helps in *Dhatuvridhi* and *Ojovridhi*. Satisfies the thirst, pacifies tiredness, exhaustion, intoxication, unconsciousness, drowsiness, sleep and burning sensation. It is *satmya* to all living and main factor for life. It is necessary for the digestion and absorption of food. It helps to maintain proper muscle tone, supplies oxygen and nutrients to cell. It helps in excretion of waste body products. It serves as natural air conditioning system by maintaining body temperature. We should always use the pure water³ to maintain the health and cure the disease. While talking about the pure water I have to mention here *Hansodaka*. Acharyas have mentioned regarding *Hansodaka* in *Samhitas*. *Hansodaka* is the water purified by natural resources like sun and moon rays and rays of *Agasti* star which in *Sharad Ritu*. According to Charakacharya⁴ water which is purified during day time due to Sunrays, moonlight, rays of different stars, and *Agastirays* at night time is called *Hansodaka*. It is pure and nontoxic. In *Samhitas* it is told that this *Agasti* star with sun and moon rays purifies the water in *Sharad ritu*. In view of this, we

tried here to study the chemical properties of *Tadagjal* and *Hansodaka* from the same *Tadag*. The purpose of selection of this topic is, today there are so many water borne diseases which affect on public health adversely. To avoid these diseases and maintain health it is necessary to use pure water.

AIM AND OBJECTIVES

- 1) To compare the chemical properties of *Tadagjal* and *Hansodaka*.
- 2) To explore the concept of *Hansodaka*.

MATERIALS

Criteria for Selection of *Tadag*

Tadag should be away from the human residential area. It should be well protected by wall to avoid contamination by humans, animals etc. It should away from the industrial drainage and disposal area of waste products. It should not be far away in the forest. Also it should be under surveillance.

In the present study, the *tadagjal* is collected from the *Vilad ghat tadag* located in the campus of Padmashree Dr. Vithalrao Vikhe Patil Foundation's educational institute, Ahmednagar, Maharashtra, having all above said criteria.

Total four times samples were collected. Every time the *Tadagjal* was collected in the sterilized glass bottles of 500ml capacity.

METHODOLOGY

In the present study, first sample collected 15 days before the *Agasti-darshan*. Second sample collected

OBSERVATION AND RESULT

after 7 days of *Agasti-darshan*. Third and fourth samples were collected after 14 and 21 days of *Agasti-darshan* respectively.

Agasti darshan was on 9-08-2013 with reference of Date Panchang 2013-2014. Here second sample collected after *Agasti darshan* but *Sharad ritu* not started so this sample is simple *Tadag jal*. Like this first and second samples are simple *Tadag jal*. Third and fourth samples collected after *Agasti darshan*, here *Sharad ritu* also started so these two samples are *Hansodakas*.

Method of sample collection:

Each and every time water collected in glass bottle of 500 ml capacity. Before collection of water the bottle with caps were sterilized with mild HCL acid and with boiling water. While collecting the water the precaution is taken that water will not get to much disturbed. The water is collected away from the edges with the help of long fibre rod. Every time temperature is measured immediately Then sterilized caps well fitted to bottles. Every time this bottles were labelled with sample no, type of analysis, date, time, source of water collection. Bottles kept in ice box and sent to Late Prin. B.V.Bhide Foundation's laboratory, Pune immediately. As Water analysis should be started within 6 hours of water collection.

The reports of water analysis were collected time to time, arranged in tabulated form and analyzed to learn chemical properties of *Tadagjal* and *Hansodaka*.

Table 1: Date, No. of samples and time of samples collected

Date	Sample No and type	Time of collection	Period
26.7.2013	1 (simple <i>Tadag jal</i>)	8.00 am	15 days before rising of <i>Agasti star (Varsha ritu)</i>
16.8.2013	2 (simple <i>Tadag jal</i>)	8.00 am	7 days after rising of <i>Agasti star (Varsha ritu)</i>
23.8.2013	3 (<i>Hansodaka</i>)	8.00 am	14 days after rising of <i>Agasti star (Sharad ritu)</i>
30.8.2013	4 (<i>Hansodaka</i>)	8.00 am	21 days after rising of <i>Agasti star (Sharad ritu)</i>

Table 2: Standard Guideline values of chemicals for drinking water quality as per W.H.O.³

Sr. NO.	Parameters	Normal guideline values as per WHO
1	PH	6.5-8.5
2	Total Hardness	100-300 mg/lit
3	Chlorides	200 mg/lit
4	Nitrates	50 mg/lit
5	Nitrites	3 mg/lit
6	Fluorides	1.5 mg/lit
7	Arsenic	0.01 mg/lit
8	Lead	0.01 mg/lit
9	Mercury	0.001 mg/lit
10	Cadmium	0.003 mg/lit
11	Copper	1 mg/lit
12	Zinc	3 mg/lit
13	Iron	0.3 mg/lit

Table 3: Common table showing comparative values of chemical parameters of all samples⁵

Sr. No.	Parameters	Samples (values in mg/lit) 1 2 3 4			
1	PH	7.62	8.24	7.64	7.24
2	Total hardness	87.39	92.66	98.46	116.37
3	Chlorides	7.51	8.21	9.52	21.6
4	Nitrates	1.69	2.08	2.14	1.89
5	Nitrites	2.41	2.56	1.92	1.76
6	Fluorides	ND	ND	ND	0.16
7	Arsenic	<10 ppb	<10ppb	<10ppb	<10ppb
8	Lead	0.00314	0.00301	0.00352	0.00286
9	Mercury	0.00168	0.00160	0.00115	0.00100
10	Cadmium	0.00585	0.00580	0.00300	0.00212
11	Copper	0.0089	0.0076	0.0084	0.0076
12	Zinc	3.76	3.72	2.54	2.41
13	Iron	0.72	0.65	0.58	0.41

(ND = not detected, ppb = parts per billion)

DISCUSSION

1) PH

It is defined as negative logarithm of H⁺ ion concentration expressed in molarities. Measurement of PH is one of the most important and most frequently used test in determining water quality. It is the measure of acidity or alkalinity of an aqueous solution. Most of the waters are slightly alkaline in nature due to presence of carbonates and bicarbonates. A number of minerals and organic matter interact with one another to give the resultant PH value of the sample. The presence or absence of free carbon dioxide, carbonates and air temperature causes variations in the PH value. The acceptable limit prescribed by drinking water standards⁵ is 6.5 to 8.5. Beyond this limit the water will affect the mucous membrane and water supply system. PH value less than 7 may cause severe corrosion of metals in the distribution system and elevated levels of certain chemical substances like lead. At PH levels above 8 there is progressive decrease in the efficiency of the chlorine disinfection process. In the present study the PH values of all the samples are within the desirable limit ranges from 7.24 to 8.24. First and second samples (*Tadagjal*) have 7.62 and 8.24 respectively. Third and fourth samples (*Hansodaka*) have 7.64 and 7.24 respectively.

2) Total hardness

Total hardness of water may be defined as the soap destroying power of water which increases the boiling point of water. The hardness in water mainly caused by four compounds i.e. calcium and magnesium bicarbonate and calcium and magnesium sulphate. The other less important components are chloride and nitrite of calcium magnesium, iron, manganese and aluminium. The total hardness is an important parameter of water quality whether it is to be used for domestic, agricultural, and industrial purposes. Calcium and magnesium are directly related to total hardness. An acceptable limit by drinking water standards is 100-300mg/l. The water with high total hardness is not suitable for potable purpose

which can lead to heart, kidney related diseases. Also it can cause encrustation in water supply structure and adverse effect on domestic use.

In the present study the total hardness values of all four samples are 87.39, 92.66, 98.46 and 116.97mg/l. The increase in total hardness of the water subsequently may be due to increase of calcium and magnesium compounds brought with rain water.

3) Chloride

Chlorides are common constituents of all natural waters. Higher value of it imports salty taste water, making it unacceptable for human consumption. The acceptable limit presented by drinking water standard is 200mg/l. The maximum permissible level is 600mg/l. Chloride in natural water results from agricultural activities, industries and Chloride rich rocks. High concentrations of chloride are due to the invasion of domestic wastes and disposals by human activities.

In the present study the chloride level is within permissible limit of W.H.O. However the chloride values of all samples ranges from 7.51 to 21.6mg/l. First and Second sample (*Tadagjal*) have chloride 7.51 and 8.21mg/l. Third and Fourth sample (*Hansodaka*) have chloride 9.52 and 21.6 mg/l. Rises in chloride values of water may be due to addition of rain water probably containing chloride rich rocks.

4,5) Nitrates (No3) and Nitrite(No2)

Nitrate and Nitrite are naturally occurring ions that are part of the nitrogen cycle. Recommended maximum limit of concentration of nitrate is 50mg/l. The high nitrogen content is an indicator of organic pollution. It results from the added nitrogenous fertilizers, decay of dead plants and animals, animal urines and faeces. They all are oxidized to nitrate by natural process and hence nitrogen is present in the form of nitrate. The increase in one or all the above factors is responsible for the increase of nitrate content. In our study the water source is well protected by human and animal pollution. Also there are

no farms in surrounding area so no chance of contamination by nitrogenous fertilizer. So all the four samples have the nitrate value within normal range i.e. tadagjal have nitrate values 1.69mg/l and 2.08mg/l. And *Hansodaka* have nitrate values 2.14mg/l and 1.89mg/l. The nitrite values of *tadagjal* are 2.41mg/l and 2.56mg/l. In *Hansodaka* Nitrite values are 1.92mg/land1.76mg/l. Like this all samples have nitrite within normal range.

6) Fluoride

Fluoride occurs as fluorspar, rock phosphate, triphite, phosphate crystals etc. in nature. Among factors which control the concentration of fluoride are the climate of the area and the presence of accessory minerals in the rock mineral assemblage through which the ground water is circulating Fluoride may occur naturally in water or it may be added in controlled amounts. Some fluorosis may occur when the fluoride level exceeds the recommended limit. The acceptable limit prescribed by drinking water standards for fluorides is up to 1.5mg/l.

The fluoride is essential for human beings as a trace element and higher concentration of this element causes toxic effect.

In the present study, fluoride is not detected in first two samples. In third sample (*Hansodaka*) also it is not detected. In fourth sample it is 0.16mg/l. The guideline normal value of fluoride is 1.5mg/l so this water needs fluorination for use of domestic purposes specially for drinking purpose.

7) Arsenic

Arsenic is one of the important health related inorganic chemical constituent of water. Arsenic is introduced into water through the dissolution of minerals and ores. It is also introduced from industrial effluents and from atmospheric deposition. Sometimes the concentration of arsenic may increases due to erosion from natural source. The average amount of arsenic getting from daily intake of water is similar to that of average amount getting from food. Whereas intake from air is negligible.

An accepted value of arsenic as per Indian standard of drinking water is 0.01mg/l. Beyond this limit the water becomes toxic.

In the present study the arsenic concentration present in tadagjal is less than 10ppb. Which is within the normal range. Also the arsenic concentration in *Hansodaka* is less than 10ppb which is also within normal range as per the prescribed guideline for drinking water.

8) Lead

Lead is present in natural sources in minor quantity. Lead in higher concentration interferes calcium metabolism and Vit. D metabolism. It is toxic to central nervous system. Also it is one of the possible human carcinogenic agent. By experiments in animals it is proved to be renal tumor inducer. The accepted health based guideline value of lead is 0.01mg/l. In present study lead present in first sample is 0.00314 mg/l and in second sample it is 0.00301 mg/l. Which are within normal limit. Lead concentration in third sample 0.00352mg/l and in fourth sample 0.00286mg/l which are also within normal limit.

9) Mercury

Surface and ground water contains mercury in inorganic form. It is usually less than 0.5µg/l. The mercury concentration affects mainly on kidney and central nervous system.

The guideline value accepted for mercury in mercury water is 0.001mg/l. Beyond this limit water becomes toxic.

In the present study the First sample contains 0.00168mg/l mercury, which is little bit higher than normal range. In Second sample it is 0.00160mg/l. In Third sample it is 0.00115mg/l and in Fourth sample it is 0.00100mg/l. It means in *Hansodaka* mercury comes to normal range which is a positive effect of Agasti star rays, daytime intensive sunrays and effect of moonlight at night time during *Sharad ritu*.

10) Cadmium

Cadmium metal is mainly used in the steel industry and in plastics. It's compound are used in batteries. It is released in the environment in wastewater. Contamination from fertilizers and local air pollution causes diffuse pollution. Drinking water may get contaminated by impurities in the zinc of galvanized pipes and some metal fittings. Cadmium accumulates in the kidneys. The guideline value for cadmium is 0.003mg/l.

In present study, Cadmium present in first sample is 0.00585mg/l and in second sample it is 0.00580mg/l which are higher than normal prescribed value as per guideline by W.H.O. While cadmium present in *Hansodaka* is 0.00300 and 0.00212 which are within the prescribed normal guideline value as per W.H.O. It means in *Hansodaka* cadmium levels are decreased to normal value. It is due to combine effect of Agasti star rays, intensive sunrays during daytime and soothing effect of moonlight at night in *sharad ritu*.

11) Copper

The prescribed normal guideline value for copper is 1mg/l. If this level is increased it causes corrosion of galvanized iron and steel fittings, staining of laundry and sanitary ware.

In present study the copper present in first sample is 0.0089 mg/l and in second sample it is 0.0076mg/l which are within the prescribed normal range. In *Hansodaka* 0.0084 and 0.0076 mg/l which are also within the normal limit.

12) Zinc

The prescribed normal guideline value for Zinc is 3 mg/l. Zinc concentration more than 4 mg/l causes undesirable astringent taste while water containing Zinc concentration more than 5 mg/l appears opalescent and develops a greasy film on boiling.

In present study, the Zinc concentration of *tadagjal* is 3.76 mg/l and 3.72 mg/l which are more than normal range and in *Hansodaka* it is 2.54 and 2.41 mg/l which are within the normal range. This indicates positive combine effect of sunrays, moonlight and rays of Agasti in *sharad ritu* which reduces higher zinc concentration to acceptable limit.

13) Iron

An anaerobic ground water may contain ferrous iron at concentration of up to several mg/l without discolorations and turbidity. On exposure to the atmosphere the ferrous iron oxidizes to ferric iron giving objectionable reddish brown colour to the water. Iron promotes growth of iron bacteria. These bacterias derive their energy from the oxidation of ferrous iron to ferric iron. In this process there is deposition of a slimy coating on the pipe. The higher concentration of iron causes a bitter astringent taste to water and a brownish colour to clothing and plumbing fixture.

In the present study the iron value of *Tadagjal* are 0.72mg/l and 0.65mg/l which are higher than the prescribed normal range. While in *Hansodaka* it is 0.58 and 0.41 mg/l. Which are also above but close to normal limit (0.3 mg/l). In Third and Fourth sample though iron concentrations are higher than normal level but they are decreased by first two samples. To this change we can say as positive effect of Agasti star rays in *Sharad ritu*.

CONCLUSION

The properties of *Hansodaka* are better than the properties of *Tadagjal*. There are definitely positive changes in almost all chemical parameters in the last two samples due to combine effect of intensive sunlight during the daytime, soothing effect of moon light

during night time and Agasti star rays and *kalaprabhav* in *Sharad ritu*. In the present study till there are some impurities like iron as a chemical in *Hansodaka*. In the present study *Tadagjal* as well as *Hansodaka* both are unfit for drinking as per the guideline values given by W.H.O. For confirmation more study is required in this regard.

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