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TO EVALUATE THE EFFECTIVENESS OF KHADIRADI BHASM IN WATER PURIFICATION-AN ANALYTICAL STUDY

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ABSTRACT

Water has a great role to play in the socioeconomic development of the human population. Potable water is essential to the life of everyone. The main water bodies from where water can be accessed are lakes, rivers, oceans, ponds and groundwater. The main functions of *Jala* are *Jeevana, Tarpana (satisfactory), Hridya, Buddhi Prabodhana, Sheet*, etc. without water there is no acuity in both the healthy and the diseased person.[1] Purification of water is of great importance in our life. Water purification was being done since 2000 BC as mentioned in Sanskrit literature. Purification of water were done keeping water in copper vessels, exposing water to sunlight, filtering water through sand and gravel, boiling, dipping hot iron in water were adopted.[2]

INTRODUCTION

Water is one of the essential requirements of life. It is an inorganic tasteless odourless and colourless substance. Water cover over 70% of the earth surface. Nature of Pure Water (Shuddha Jala)-The water without any Smell, Taste, Clear, Cold, Light, and satisfies the thirst is pure water.[3] Safe drinking water is a basic need for all humans. But still half of world specially developing countries are far from the goal to full fill the daily pure water requirement of their population. In India the quality of water is bilaterally deteriorated due to excessive exploitation and mixing of sewage and industrial waste in water sources. About

85% of rural population and more than 50% of urban population in India is directly dependent on ground water for their drinking and other use. Contaminated water on ingestion causes excessive thirst (Trishna), flatulence (Adhmana), abdominal disease (Udarvyadhi), fever (Jwara), cough (Kasa), loss of appetite (Kshudhamandhya), Goiter (Granthi), heaviness (Angagaurav), abdominal pain (Udarshool), constipation (Kosthabaddhata), edema (Shotha), anemia (Pandu), indigestion (Ajeerna), asthma (Shwasa) & rhinitis (Pratishaya) Also, even contact of contaminated water causes skin disorder (Kustha), itching (Kandu) & conjunctivitis (Netrabhishyanda).[4,5]

According to *Ayurveda*, water is considered as among the *Panchamahabhootas* and *Prana* or life of the entire universe. *Sushrut* has described the polluted water and put on emphasis on purification of water pollution the has also described the measure in purify the polluted water. The share of organic methods of purification in holistic medicine which is our treasures to be explored and unveiled to its best as mentioned by S*ushrut* i.e., the drugs specified should be collected and burned to purify the contaminated water. Cold ashes should be taken and cast into unclean water to purify it, or a handful (1 *Anjali* = 160 gm) of this ash could be placed in a pot containing drinking water to be utilized as needed.[6]

AIM AND OBJECTIVES

1. The main object here is to produce safe and clean drinking water for everyone.
2. To evaluate the efficacy of yoga of described in *Sushrut Samhita* for purification of water.
3. The secondary aim of study of water treatment is designed to easy to use.

So, keeping all factors of water pollution in mind it is considered to search an organic method of water purification which can provide an economic and safe alternative to clean drinking water this study is planned.

MATERIALS AND METHODS

The following drugs was selected for the study-

***Khadiradi Bhasm* preparation:** Wood ash is the inorganic and organic residue remaining after the combustion of wood or unbleached wood fiber. The physical and chemical properties of wood ash vary significantly depending on many factors.

Dhava (Anogeissus latifolia), Asan (Pterocarpus marsupium) Paribhadra (Erythrina varigata), Patala (Stereospermum sauveolens), Siddhaka (Shorea robusta) Mokshaka (Schrebra

swietenoides), Rajdruma (Cassia fistula) and Somvalka (Acacia catechu) is used. All raw drugs are taken in equal quantity, cleaned and dried drugs and burnt. The ash was collected & sieved to get fine powder.

Water Samples: All of the drinking water samples were taken from different 4 type sources of water. The samples were collected in 1-liter polyethylene (PE) bottles, which were washed with deionized water before use. The water samples were collected from the different sources. samples were from well, lake, river and bore well, in the month of march. The collected water samples were stored in a clean bottle for analysis. All the other parameters were found using IS of Drinking water 10500 (2012).

The water sample was collected from Chambal River (Kota), Kaylana Lake (Jodhpur), bore well (Karwar), and well (Mandor). The Parametrs of water quality were listed before and after treated by Khadiradi Bhasm'. The experimentally established values of each parameter are hereby compared.

These sample bottles were sealed and placed in a dark at a constant temperature range of 4–10°C to avoid any contamination and the effects of light and temperature. For chemical analysis of collected water samples including pH, total suspended solids (TSS), total dissolved solids (TDS), turbidity, and other chemical and biological parameters, a representative water sampling was carried out from each location.

RESULTS AND OBSERVATIONS

Different Physio-chemical parameters are required to for monitoring the quality of water.

1-2. Odor and taste: The drinking water should not have a disagreeable odor and taste. The odor and taste in the water is due to the growth of algae, fungi, diatoms, not cryophyte, decaying organic matters, hydrogen sulphide gas, etc.

The odor of the water should be observed at room temperature. The odor may be aromatic, grassy, fishy, For earthy, musty, peaty, disagreeable, sweetish, etc. The intensity of odor may be estimated by serial dilution with odor-free water - the so-called "Threshold-odor test". The recommended threshold odor number for drinking purposes is not over 3 units. In the study different water samples were treated with *Khadiradi Bhasm* we got odor and taste both of them are agreeable.

3. pH: When the pH of water becomes greater than 8.5, water taste can become more bitter but higher pH does not pose any health risks rather alkaline water has benefits in lowering blood sugar, improving gut health and improving the hydration of extreme athletes. Any alkaline substance when added to water can lead to increase in pH of water. Since *Khadiradi Bhasm* is itself alkaline in nature therefore raise in pH is expected. Thus, on observing the resut it is seen that initially the pH of Chambal River was 7.28, which increased from 7.28 to 11.60 after the treatment with Khadiradi Bhasm. pH of Kaylana Lake is raised from 7.39 to 11.15. Mandor's well pH increased from 7.19 to 10.03 and pH of borewell water vary from 7.23 to 10.73 when treated with *Khadiradi Bhasm*. But on analysing the results we have observed that the increase in pH of stationary water is less than running water.

4. TDS: Total dissolved solids (TDS) can have an important effect on the taste of drinking water. The palatability of water with a TDS level of less than 600 mg/litre is generally considered to be good. Drinking water becomes increasingly unpalatable at TDS levels greater than 1,200 mg/liter. Water with extremely low concentrations of TDS is unacceptable because of its flat, insipid taste. When the water sample of different sources were treated with ash, an increase in the water sample TDS was seen. Before

On treatment with *Khadiradi Bhasm*, TDS of the Chambal River raised from 328, to1140 and TDS of Kaylana Lake raised from 276 to 1060, whereas Mandor's well TDS raised from 720 to 916 and TDS of borewell water increased from 640.20 to 850.

After observation of results, we concluded that the increase in TDS is less in stationary water samples than in running water and this increment in TDS of water is in between acceptable limit to permissible limit, and thus can be used.

5. Hardness: Public acceptability of the degree of hardness may vary considerably from one community to another, depending on local conditions. The taste threshold for the calcium ion is in the range of 100-200 mg/litre, depending on the associated anion, and the taste threshold of magnesium is probably less than that for calcium. In some instances, water hardness in excess of 600 mg/liter is tolerated by consumers. After treatment with *Khadiradi Bhasm* the decrease in hardness of all water samples were observed. Hardness of water of Chambal River was decreased from 139.57 to 99.69 and hardness of Kaylana's Lake decreased from 119.62 to 50 whereas hardness in Mandor's well decreased from 358.91 to 160 and hardness of bore well water decreased from 320.75 to 80.

On analysing the result, it is seen that the effect of *Khadiradi Bhasm* on hardness of water is more on stationary water than running water.

6. Alkalinity: The concentration of ions in the water that neutralize the hydrogen ion is known as alkalinity. The most well-known alkalinity components are bicarbonate, carbonate, and hydroxide, respectively. High alkalinity gives a bitter taste to water. When *Khadiradi Bhasm* was used for water purification, the alkalinity of the water samples obtained from Chambal River and Kaylana Lake was increased but alkalinity of water samples of mandor's well and borewell was decreased. The Chambal River's alkalinity was 123.38 before *Khadiradi Bhasm* was employed, and it increased to 256.70 after that. The alkalinity of Kaylana's has been Change from 87.56 to 125. Mandor's well alkalinity Change from 170.16 to 250, while bore well water alkalinity Change from 157.10 to 225.

The alkaline nature of the *Khadiradi Bhasm* is responsible for changes in the alkalinity of the water. Also, the pH of the water changed when treated with *Khadiradi Bhasm*. The change of pH is always in accordance to the alkalinity and vice versa therefore the changes in alkalinity is seen accordingly.

7. Nitrate: Nitrate and nitrite are naturally occurring ions that are part of the nitrogen cycle. Naturally occurring nitrate levels in surface and groundwater are generally a few milligrams per liter. In many groundwaters, an increase in nitrate levels has been observed owing to the intensification of farming practices. When the nitrate level in drinking water exceeds 45 mg/liter, drinking water will become the main source of total nitrate intake.

When the ash has been used for water purification, the Nitrate level of the water samples collected from all sources is decreased. The Chambal River's Nitrate was 18.40 before *Khadirdi Bhasm* was employed, and it decreased to 15.60 after that. The Nitrate of Kaylana's has been down from 16.80 to 10. Mandor's well Nitrate varied from 35.40 to 20, while bore well water Nitrate fluctuated from 28.80 to 12. There was increased nitrate level within permissible limit observed.

Since *Khadiradi Bhasm* is alkaline in nature and nitrate present in water are in acidic form like HNO3 which are weak acids. Thus, there will be neutralisation of some, percentage of acid by alkali (*Khadiradi Bhasm)* leading to deacrease in nitarates in water samples.

8. Sulphate: The presence of sulphate in drinking water can cause noticeable taste. Taste impairment varies with the nature of the associated cation. It is generally considered that taste impairment is minimal at levels below 250 mg/litre. High sulphate level may cause of diarrhea, intestinal pain, lung irritation, dry skin etc. When the ash is used to purify water, the water's sulphate level increased. Sulphate level of Chambal River increased from 16.46 to 175.30, improved to 181.06 from 16.47 sulphate level in kaylana lake, well water mandor sulphate increases from 85.76 to 146.49 and borewell sulphate raised from 74.48 to 145.35. All water samples treated with *Khadiradi Bhasm* Sulphate was increased in acceptable limit.

Sulphates are the salts of strong acid but since *Khadiradi Bhasm* is weak alkali therefore *Khadiradi Bhasm* will not be able to replace the sulphates from water samples. Also, on analysing the results we have seen that there is increase in sulphate level. This increase is may be because of presence of sulphates in the *Khadiradi Bhasm.*

9. Flourides: Exposure to fluoride consumption occurs not only through water but also from food, tooth-paste, air pollution etc. Fluorides are usually present in higher concentration in ground waters than surface waters. Its concentration is closely related to dental and skeletal health. Excess fluoride level results in dental and skeletal fluorosis and decreased level in the water results in dental caries. Therefore, fluoride in water is called often ne base as "A Double-Edged Sword". The optimum How-To concentration for drinking purpose is 1 mg/L (ppm) but the permissible upper limit is 1.5 mg/L (1.5 ppm).
No effect on Fluoride content of water when the *Khadiradi Bhasm* was used to cleanse it.

10. Chlorides: Chloride is considered to be an essential nutrient for human health and main source of chloride is from food, with drinking water. Chloride in drinking water is not harmful. All waters contain chlorides, more so in coastal areas, thus chloride concentration varies from place to place. The standard prescribed limit of chloride for drinking purpose is 200 mg /liter. The maximum permissible limit is 600 mg/liter.

When *Khadiradi Bhasm* add with different water sample chloride level increased. Chambal river chloride level raised from 42.45 to 438.70. Kaylana lake showed chloride level from 112.54 to 452.85 and well water sample's chloride level jumped from 212.27 to 367.94. Borewell water sample's chloride level also raised from 178.64 to 314.20. Chloride level is increased due to some percentage of *Bhasm* dissolve in water samples.

11. Turbidity: Drinking water must be free from turbidity. Excessive turbidity, or cloudiness, in drinking water is aesthetically unappealing, and may also represent a health concern. The turbidity or muddiness is due to the presence of mud, clay, silt and other particulate matters. Turbidity interferes with the disinfection of water. Usually, surface waters are turbid and ground waters are clear.

When we put Ash in water, its turbidity got within range sample of Chambal River and Kaylana Lake not change and well water sample turbidity decreases from 28.8 to nil and borewell's turbidity 12.54 before the treatment. After treatment got nil turbidity.

12. Arsenic: Arsenic is introduced into the water through the dissolution of minerals and ores, from industrial effluents, and from atmospheric deposition. The average daily intake of inorganic arsenic in water is estimated to be similar to that from food. Intake from air is negligible. A provisional guideline value for arsenic in drinking water of 0.01 mg/litre is established.

Arsenic in water samples is slightly decreased Chambal River, well water and borewell's from 0.002 to 0.001. Arsenic level in Kaylana Lake is 0.003 before the treated with *Khadiradi Bhasm* and after found it is 0.001.

13. Copper: The presence of copper in a water supply may interfere with the intended domestic uses of water. Staining of laundry and sanitary ware occurs at copper concentrations above 1 mg/lit. According to Indian Standard of drinking Water Cu should be 0.05 to 1.5 only. When we used ash for water purification, the Cu decreased a bit. Cu quantity in Chambal River, Kaylana Lake water reduced from 0.002 to 0.001. whereas Mandor's well from 0.004 to 0.001 and borewell sample Cu limit from 0.005 to 0.001.

14. Cadmium: Cadmium metal is used in the steel industry and in plastics. Contamination in drinking water may also be caused by impurities in the zinc of galvanized pipes and some metal fittings, although levels in drinking water are usually less than 1µg/litre. The absorption of cadmium compound is dependent on the solubility of the compound. Cadmium accumulates primarily in the kidneys. A guideline value for cadmium is established at 0.3 µg/liter.

Khadiradi Bhasm is not effective on Cadmium metal. After treating with Bhasm all water samples, not found any changes their cadmium level.

15. Chromium: Chromium is widely distributed in the earth's crust. In general, food appears to be the major source of intake. The absorption of chromium after oral exposure is relatively low and depends on the oxidation state. The guideline value for chromium is 0.05 mg/litre, which is considered to be unlikely to give rise to significant health risks. No effect of *Khadiradi Bhasm* on chromium content was observed.

16. Lead: Lead is present in tap water to some extent as a result of its dissolution from natural sources. The amount of lead dissolved in the plumbing system depends on several factors, including pH, temperature, water hardness, and standing time of the water, with soft, acidic water being the most plumbosolvent.

Lead is a general toxicant that accumulates in the skeleton. Infants, children up to six years of age, and pregnant women are most susceptible to its adverse health effects. Lead also interferes with calcium metabolism, both directly and by interfering with vitamin D metabolism. Lead is toxic to both central and peripheral nervous system, inducing sub encephalopathic neurological and behavioural effects. The health-based guideline value of lead is 0.01 mg/litre. No fluctuation on lead volume overserved. *Khadiradi Bhasm* is not effective on different water samples for lead.

17. Iron: Anaerobic groundwater may contain ferrous iron at a concentration of up to several mg/liter without discoloration or turbidity in water when directly pumped from the well. On exposure to the atmosphere, however, the ferrous iron oxidizes to ferric iron, giving an objectionable reddish-brown color to the water. At a level above 0.3 mg/liter, iron stains laundry and plumbing fixtures.

Iron content increases in water samples obtained from different sources after treatment with *Khadiradi Bhasm*. Iron in Chambal River jumped from 0.11 to 0.14. In Kaylana Lake water Fe raised from 0.17 to 0.19. Well, water showed Fe level from 0.20 to 0.26, and in borewell increases from 0.18 to 0.24. Some percentage of *Khadiradi Bhasm* dissolve in water samples so, iron level slightly increased.

18. Zinc: Zinc imparts an undesirable astringent taste to water. Water containing zinc at concentrations in excess of 10 mg/liter may appear opalescent and develop a greasy film on boiling, although these effects may also be noticeable at concentrations as low as 5 mg/liter.

Chambal's water sample zinc decreased from 0.03 to 0.01. Zinc Content in Kaylana Lake from 0.05 to 0.02. Zn down from 0.358 to 0.27, and borewell samples showed from 0.23 to 0.14.

19. Fecal coliform: Coliform is a group of bacteria including around 18 bacterial species, which indicates the sanitary quality of the drinking water. Generally, coliform is non-pathogenic bacteria that do not cause diseases. However, the presence of coliform in drinking water gives the hint that pathogenic bacteria may also enter that particular drinking water source along with the contamination of sewage. On that account, coliforms in drinking water are considered a potential health hazard for human consumption. The laboratory test results indicate either 'coliform present' or 'coliform absent'.

There is a very effective result of *Khadiradi Bhasm* on fecal coliform almost up to 75% of bacteria are removed. A good fall was seen in fecal coliform numbers when ash was added to water samples. If initially assumed 100% fecal coliform in each water sample, then after treating with ash resulting 70% coliform was removed from Chambal River. 67% was removed in Kaylana Lake water sample, 65% in well, and 68% coliform was removed.

20. E. coli: E. coli (Escherichia coli) is a type of non-coliform bacteria that can be mainly found in the fecal matter of warm-blooded animals. It is a commensal in the intestine of those animals. The presence of E. coli in drinking water is considered an extreme health hazard since E. coli can cause diseases in humans. The common symptoms of those diseases caused by E. coli are fever, abdominal cramps, and diarrhea. The victims are mainly elderly persons, children, and those who are immunocompromised.

When the water sample of different sources was treated with ash, a good decrease in the number of E. coli. before treatment with *Khadiradi Bhasm* if, E. coli no. in the Chambal River was 100% which decreased to 66%. *Bhasm* removed 63% E. coli from Kaylana Lake. and 71% of E. coli were removed from Mandor's well. Whereas, 64% removed E. coli of borewell water.

CONCLUSION

- ✓ **E. coli and Fecal Coliform:** *Khadiradi Bhasm* was found effective on E. coli and Fecal coliform. The E. coli and Faecal coliform were reduced by 71%. after treatment of impure water sample with *Khadiradi Bhasm.*

- ✓ **Turbidity:** the water samples collected from Kaylana Lake and Chambal River are comparatively less turbid than water samples collected from Madore well and borewell. But after treatment with *Khadiradi Bhasm* and filtering with filter paper, all water samples were cleaned i.e., no turbidity was seen.
- ✓ **Metals (Cd, Cu, Pb):** No effect was found of *Khadiradi Bhasm* on metals.
- ✓ **TDS:** After observation of results, we concluded that the increase in TDS is less in stationary water samples than in running water and this increment in TDS of water is in between the acceptable limit to permissible limit, and thus can be used.
- ✓ **pH:** pH of all water samples was changed when *Khadiradi Bhasm* was added to the samples due to the alkaline nature of *Khadiradi Bhasm*. pH less increased in Stationary water than in running water. Water taste can become more bitter but higher pH does not pose any health risk rather than alkaline water has benefits in lowering blood sugar, improving gut health and improving the hydration of extreme athletes.
- ✓ **Alkalinity:** The alkaline nature of the *Khadiradi Bhasm* is responsible for changes in the alkalinity of the water. Also, the pH of the water changed when treated with *Khadiradi Bhasm*. The change of pH is always in accordance with the alkalinity and vice versa therefore the changes in alkalinity is seen accordingly.
- ✓ Remaining parameters (Arsenic, Copper, Fluoride, Chloride, odor, taste, Zinc, Iron, Sulphate, Nitrate etc.,) slightly changed but they are still in the permissible limit.

From the above study, it is clear that the *Khadiradi Bhasm* shows better effect on stationary water more than running water. The aim of any study is to verify the old facts and find out the new facts. In the present study, the old fact of the purification of stationary contaminated water from *Khadiradi Bhasm* is verified. and thus, the aim of the research is fulfilled. So, we conclude that is ash useful for the purification of water and maybe a better effect is obtained if the ash is kept in water for a longer time. (More than 12 hours).

REFERENCES

1. Shastri Kaviraj Ambikadatta, Susruta Samhita, Chaukhamba Publication Varanasi, Reprint 2014, Sutrasthan.
2. MC Gupta, BK Mahajan, Textbook of Preventive and Social Medicine, Jaypee, Third addition, 2005.
3. Shastri Kaviraj Ambikadatta, Susruta Samhita, Chaukhamba Publication Varanasi, Reprint 2014, Sutrasthan.

4. Murthy, K.R.S., Astanga Samgraha of Vagbhatta, Chaukhambha orientalia, Varanasi, India, 2016; Sutrasthana.
5. Sitaram, B., Astanga hrdayam of Vagbhata. Chaukhambha orientalia, Varanasi, India, first edition, 2008; Sutrasthan.
6. Murthy, K.R.S., Sushruta Samhita, Chaukhambha orientalia, Varanasi, India, 2010; Kalpasthan.