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REDISCOVERING TRADITIONAL METHODS FOR PURIFICATION OF WATER USING IMPORTANT MEDICINAL PLANTS

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Abstract

Natural plant extracts have been used for water purification for many centuries. Most of these extracts are derived from the seeds, leaves, pieces of bark or sap, roots and fruit extracts of trees and plants. For example, Strychnos potatorum (nirmalī), Moringa oleifera were used as a purifier between the 14th and 15th centuries BC according to the Sanskrit treatise (śāstra) "suśŗta saṃhitā". References are available in ancient manuscripts but not in practice because our people have forgotten our glorious past. An attempt is made to understand properties of medicinal plants which help to purify water. In 'suśŗta saṃhitā' Combination of nine common medicinal plants mentioned to purify water. Use of medicinal plants ash, mixed with alum cleanses water while retaining its natural benefits. Low cost alternative traditional technologies can replace the complicated and expensive water purifiers, so that people from developing countries are assured of pure potable water, free of all pathogens and toxic substances.

Keywords: Strychnos Potatorum, Moringa Oleifera, Suśŗta Saṃhitā**,** Traditional Technologies, Pathogens.

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INTRODUCTION

Since *Vedic* period, utmost importance is given to conservation and protection of water which is reflected by a few sayings such as: *'Plants and water are treasures for generations' (ŗgVeda, vii.70-4). 'Waters and herbs should have no poison' (ŗgVeda, vii.70-4 vi – 39-5). 'Waters are to be freed from defilement' (Atharva Veda, x-5-24')* etc based on this evidence, it is known that the earlier people had given a vast focus on conservation of water and plants.

The absence of clean water and sanitation are major risk factors for ill health. In ancient times, culturally, several methods have been practiced for assessing and maintaining water quality. Especially, the references are appeared in Ayurveda literature. For instance, Suśŗta**,** author of **'**suśŗta saṃhitā**'** and famous Indian physician provided a detailed practical guidance for water purification with using nirmalī seeds, roots of *Kamala* (lotus/water lily), rhizomes of algae and three stones, *Gomedha* (garnet) Moti (pearl) and *Sphatik* (quartz crystal). Similarly, exposing contaminated water to the sun or immersing a red hot iron rod or hot sand in it for purification purpose was also suggested. *Varāhamihira*, author of *Bŗhat*-saṃhitā**,** described various concepts regarding ground water resources.

Similarly he suggested a method to purify contaminated ground water by using a powder mix extracted from *Anjana* metal and some of the herbs such as *Bhadramustha*, Khas (vetiver), *Amla* (emblica officinalis, gooseberry) and nirmalī (kataka), Socially and culturally, some of aforesaid methods are transformed by generations and a few new techniques are also practiced additionally. Some of the traditional methods of maintaining water quality (Kümmerer, 2009) were Use of Alum in Water, Using cloth for filtering, Keeping Tortoises in open wells, Use of Moringa Seeds, Combination of local plant and filtration methods unfortunately these practices were limited to acquire quality water from muddy water. Since the end of the last century, due to metropolitan development, a large amount of waste products have been released by industrial, agricultural, and domestic activities of humans, resulting in terrible problems such as global warming and the generation of wastewater containing high levels of pollutants (Kümmerer, 2009). Due to this, the rivers, lakes are contaminated and groundwater too. In present times, the quality water is a precious commodity and available in limited amounts. Therefore the removal of contaminants of concern is now as ever imported in the production of safe drinking water and the environmentally responsible release of great water problems (Kümmerer , 2009).

The details about the each plant and its morphological features, biochemical properties and propagation techniques has been mentioned in below Table

Common name	Scientific name	Morphological features	Biochemical properties	Propagation methods
Dhava	Anogeissus latifolia (Roxb. ex DC.) Wall. ex Guill. &Perr. Combretaceae	small to medium-sized tree, Leaves are oppositey or nearly- oppositely arranged, simple, entire, with grayish-yellow or whitish hairs below. Flowers are small and have parts in fives. Sepals are joined together in a stalk-like tube, expanded at top into a 5-lobed cup. There are no petals. Stamens are 10, in 2 rows. Fruit is a 2-winged pseudoachene, packed into a dense head. Sepal tube survives till fruting, and forms a beak	Anti oxidant , anti microbial , anti-helminthic	Can be propagated by cuttings as well as seeds Best grow after rain.
Sāla	Shorea robusta Gaertn.f. Dipterocarpaceae	Large, deciduous tree up to 50 m tall,Leaves simple, shiny, glabrous, about 10-25 cm long and broadly oval at the base, Flowers yellowish-white, arranged in large terminal or axillary racemose panicles.	Antibacterial Antimicrobial Free radical scavenging and Antioxidant activity	By cuttings as seed viability is very less and watered regularly as it is moisture sensitive.
Asana	Pterocarpus marsupium Roxb. Fabaceae	Large deciduous tree with a stout crooked stem and widely spreading branches. Yellowish- grey, thick bark and outer layer.Compound leaves 5-7 leaflets, coriaceous, oblong, obtuse, emarginated , shining,Yellow flowers in terminal panicles.Pale yellow corolla with crispid margins.Leaves imparipinnate; leaflets elliptic-ovate or oblong, emarginated . Flowers yellow, in terminal panicles. Pod orbicular, winged.	Astringent ,Liquiritigenin and Isoliquiritigenin	Through seeds by seed treatment of soaking in normal water and cow dung slurry for 24 and 48 hours respectively
Pāribhadra	ErythrinaindicaLam. Papilionoideae	Medium-sized, spiny, deciduous tree normally growing to 6-9 m (occasionally 28 m) tall and 60 cm dbh. Young stems and branches are thickly armed with stout conical spines up to 8 mm. Leaves trifoliate, alternate, bright emerald-green, on long petioles 6-15 cm, rachis 5-30 cm long, prickly; leaflets smooth, shiny, broader than long, 8-20 by 5-15 cm, ovate to acuminate with an obtusely pointed end. Leaf petiole and rachis are spiny ,Flowers have bright pink to scarlet erect terminal raceme ,Fruit is cylindrical torulose pods.	Antibacterial	cuttings
Pāṭala	Stereospermum suaveolens Dc. Bignoniaceae	large deciduous tree with greyish or dark brown bark, exfoliating in scales. Leaves imparipinnate; leaflets elliptic. Rowers purplish-yellow, fragrant, in large, lax panicles. Capsule straight, cylindric, greyish with white dots.	Free radical scavenger, anti microbial, anti protozoal.	Seeds sowing
Rājavṛkṣa	Cassia fistula L. Fabaceae	a medium-sized tree, growing to 10–20 m (33–66 ft) tall with fast growth. The leaves are deciduous, 15–60 cm (5.9–23.6 in) long, and pinnate with three to eight pairs of leaflets, each leaflet 7–21 cm (2.8–8.3 in) long and 4–9 cm (1.6–3.5 in) broad. The flowers are produced in pendulous racemes 20–40 cm (7.9–15.7 in) long, each flower 4–7 cm (1.6–2.8 in) diameter with five yellow petals of equal size and shape. The fruit is a legume, 30–60 cm (12–24 in) long and 1.5–2.5 centimetres, broad, with a pungent odor and containing several seeds. The tree has strong and very durable wood, and has been used to construct "AhalaKanuwa", a place at Adams Peak, Sri Lanka, which is made of Cassia fistula (ahala, ehela, or aehaela, in Sinhala) heartwood.	anti oxidant , anti-fungal , larvicidal and ovicidal activity , anti-bacterial , anti-parasitic property.	Seeds sowing

Continue……

Siddhaka Nirgundi	Vitexnegundo L. Verbenaceae	woody, aromatic shrub growing to a small tree. It commonly bears tri-or penta-foliate leaves on quadrangular branches, which give rise to bluish-purple coloured flowers in branched tomentose cymes.	Anti-bacterial , Anti-feedant,Anti-filarial,Anti-fungal ,Anti-larval ,Anti-viral ,Insecticidal ,Larvicidal ,Mosquito repellant	Cuttings
Mokṣaka	Schrebera swietenioides Roxb. Oleaceae	It is a moderate sized tree of 20 m height with thick grey bark growing in deciduous forests up to an altitude of 1200 m, throughout India. Leaves opposite, simple or imparipinnate; rachis usually winged. Infloresence a paniculate cyme, Flowersheterostylous and bisexual. Calyx campanulate, loosely enveloping the corolla, truncate or irregularly and obscurely lobed. Corolla salver-shaped, white, sometimes tinged with pink or puce; tube well developed, cylindrical; segments 6 or more, spreading to reflexed, each with a group of swollen brown to purplish hairs at the base.	Antioxidant,Anti toxic	Seeds sowing followed by seed treatment
Somavalka	Acacia catechu(L. f.)Willd. Mimosoideae	Acacia catechu is a small or medium-sized, thorny tree up to 15 m tall; bark dark grey or greyish-brown, peeling off in long strips, or sometimes in narrow rectangular plates, brown or red inside; branches slender, puberlous when young but glabrescent , with 2 curved, 8-mm prickles at the base of each petiole. Leaves bipinnately compound, with 9-30 pairs of pinnae and a glandular Rachis, Flowers in 5-10 cm long axillary spikes, pentamerous, white to pale yellow,with a campanulate calyx,Fruit a strap-shaped pod	Antioxidant , iron-chelator.	Seeds sowing followed by soaking in water.

The present paper shows the current status of proposed research and explores about a traditional method for water purification by using mixed ash of nine significant plants which is mentioned in suśṛta saṃhitā**.**

MATERIALS AND METHODS

The data, on nine important medicinal plants, has been collected from ancient manuscripts and electronic data base (google scholar). The list of plants have been referred by various Ayurveda *nighaṇṭus* and *dravyaguṇa* texts to authenticate plant terminology and pertained articles have been studied. Each plant has been tagged with the relevant information of their morphological features, biochemical properties and propagation techniques, it is disclosed in a table form.

Nine Significant Plants for Water Purification

According to the present study, it is clearly expressed that there is a less focus on ancient literature in finding purification processes for contaminated water beyond charcoal level. But, in deep study of suśṛta saṃhitā**,** it is known that the ancient scholars are well versed using plant ashes in purification of contaminate water. This method is quite similar to the present times.

At the same time this process is extremely unique and appears less expensive from the current processes. In this method, a mixer ash of nine different plants is used to purify contaminate water. The nine plants viz. '*dhava, aśvakarṇa, asana, pāribhadra, pāṭala, siddhaka, mokṣaka, rājadṛma* and *somavalka* (suśṛta saṃhitā, *5.3.9*)*'*. Basically, *the process was conducted to purify the manually poisoned water. Ancient times, Kings are used to use animated poison to kill enemies and used to put the poison in lakes, reservoirs, revers and pots. The royal physicians are used this process to save their king's life.*

This study is focused to apply the same traditional process on chemically contaminate water or wastewater. However, a standard measure for this is not known. Also a scientific study on this aspect is not yet happened. Here, a plan of study is done on this aspect to explore the efficacy of the mixer ash of plants in purifying chemically contaminate water.

Conclusion

The population is increasing day by day and access to pure water is still a major challenge in the developing countries. In India, contaminated drinking water, polluted river and unsafe well water remain a major cause of morbidity and mortality. Commercially the pure water is expensive and not affordable to general public. Majority of the victims are women and children living in slums and rural areas due to seasonal diseases caused by contaminated drinking water. Hence, use of plants as water purifiers is simple and effective. It is common practice from ancient times and this can be used to treat water while retaining its natural benefits.

There, a few treatment techniques which are typically considered for the removal of emerging contaminants from drinking water as well as wastewater such as adsorption, Advanced Oxidation Processes (AOPs), Nano-filtration (NF), and Reverse Osmosis (RO) membranes. Except adsorption etc methods are high investment and maintenance costs, cause to secondary pollution (generation of toxic sludge, etc.) and complicated procedure involved in the treatment.

Thus, There is a urgent need to find traditional methods which are at cost effective, easy in treatment and no scope for secondary pollution.

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