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Effect of Guggul ash on physico-chemical properties of water

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Abstract

The present paper focuses on properties of *Commiphora wightii*, Guggul- oleo-gum resin ash and its potential in water purification. The aqueous solution of ash is strongly alkaline (pH-12.57). The minerals-phosphorus, potassium, calcium, magnesium, sodium and aluminum were quantified 3.22, 56.05-, 234.45, 250.05, 5.3 and 19.32 g/kg d.m. respectively. The micronutrients iron and copper *i.e.* 0.013 and 0.099 g/kg d.m. were also present in ash, while mercury content was absent in the ash. The ash treatment affects quality of water significantly and after addition of ash, pH, color and odor of water changed, alkaline to neutral, colourless and odorless. Significant reduction in conductivity, TDS, hardness, BOD and COD were observed due to addition of Guggul ash in sewage, pond and tap water, respectively. The microbial population was also found decreased over control or untreated water.

Keywords: Ole-gum resin, *Commiphora wightii*, ash, minerals, micronutrients, microbes

Introduction

An oleo-gum resin exuded by the plant *Commiphora wightii* (*Burseraceae*) is of potential medicinal uses. It consists many chemical constituents *viz.*, steroids, diterpenoids, aliphatic esters, carbohydrates (61% resin, 29.3% gum) and several inorganic ions, sesamin, 6.1% moisture, and 0.6% essential oil *etc.* (Datt *et al.*, 1942; Bose and Gupta, 1964; Kumar *et al.*, 2003; Jain and Gupta, 2006) ^[2]. The bioactive chemicals of guggul are found useful in several diseases disorders related with bones, metabolism, inflammation, cardiovascular, tumor, wound, microbial infection, pain, skin and disorder of lipid metabolism. It is known as a Yog-Vahi rasayana which has synergistic action that enhances the effects of other herbal medicines when taken in conjunction. There are already over 25 medications on the market, some of which are combined with other herbal remedies. It is also one of the important ingredients of Hawan Samagri.

Materials and Methods

The 10 gm Guggul was burnt with cow dung and mango wood in equal quantity for half an hour. The properties of ash obtained after burning was determined.

Determination of pH

A pH meter was used for pH determination of water samples. 5 gm ash was dissolved in 50 ml of distilled water and measured pH.

Water-soluble extractive value of ash

Five gm. of the air-dried, ash was macerated with water in a flask, Shaked frequently, then filtered and evaporated filtrate to dryness. The residue was dried at 105 °C and weighed. The percentage of water-soluble extractives was calculated.

Ethanol soluble extractive value

5 gram of the air-dried ash was macerated with 50 ml of ethanol in a closed flask for 24 hours, shaking frequently and allowed to stand for 18 hours.

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The ethanol, evaporated to dryness in a tarred flat-bottomed shallow dish and was dried at 105 °C, and weighed.

Acid insoluble ash value

5 gram of the air-dried oleo gum resin was weighed in a silica dish and incinerated at a temperature 450 °C until free from carbon and then cold and weighed again. Then the ash was boiled with 25 ml of 2M hydrochloric acid for 5 minutes. The insoluble matter was collected on an ash-less filter paper, washed with hot water, ignited, cold in desiccators, and weighed. The percentage of acid-insoluble ash was calculated.

Estimation of minerals

Minerals Na, K, Ca, Mg, Si, Al and Fe in ash samples were estimated with help of atomic absorption spectrometry (AAS-Thermo Scientific SOLAAR M6), Toxic elements (As, Cd, Cu, Cr, Hg, Ni, Pb, Zn, Mn and Ba) was determined using ICP (Inductively Coupled Plasma-Perkin Elmer Sciex Elan 9000).

Results and Discussion

Properties of ash containing Guggul, Cow dung and Mango wood

The properties of ash obtained after burning of Guggul,

cowdung and wood. The ash mixed water is strongly alkaline, a pH of 12.57. The acid insoluble ash is observed 1.03%, while water soluble matter and alcohol soluble extractives were estimated 29.42 and 54.65% respectively. The minerals phosphorus, potassium, calcium, magnesium, sodium and aluminum were quantified 3.22, 56.05, 234.45, 250.05, 5.3 and 19.32 g/kg d.m., respectively. Similarly micronutrients, iron (13.50 mg/kg. d.m.), cadmium (6.90 mg/kg d.m.), chromium (192.0mg/kg d.m.), copper (98.88mg/kg d.m.) were also present in ash, while mercury content was not present in the ash.

The results of efficacy of Guggul ash in water purification is presented in Table 1. There is a significant change in colour (deep yellow to white/transparent) of water of three different sources *i.e.* pond, tap and sewage water. As observed, pH of all sources were found to increase (changed 6.7 to 7.1).

Significant (P=0.05) reduction in EC, TDS, hardness, BOD and COD were observed due to ash treatments. The EC, TDS and hardness of different sources varied /reduced 34.24-78.80%, 99.80-99.99% and 65.53-92.92% in sewage, pond and tap water, respectively. Similarly, BOD (55.26-95.10%) and microbes population (43.89-82.90%) were also found decreased over control or untreated water.

Table 1: Effect of treatment of water with ash on physico-chemical properties

Physico-chemical parameters	Sewage water				Pond water				Tap water				CD (0.05)
	Before treatment	After Treatment	% of decrease	% Reduction	Before treatment	After treatment	% of decrease	% Reduction	Before treatment	After Treatment	% of decrease	% Reduction	
pH	6.7	7.1	106	-5.97	6.9	7.0	102.8	-1.44	6.9	7.0	101.4	-1.44	0.06
Colour	Deep yellow	Whitish			whitish	colourless			colourless	Transparent			
Odor	UA	UA			UA	A			A	A			
Conductivity (µs/cm)	1657	1089	65.7	34.27	876	210	23.97	76.02	689	146	21.19	78.80	2.34
Total solids (mg/l)	3490	5.00	0.143	99.8	2887	0.98	0.033	99.96	1897	0.02	0.001	99.99	1.89
Total dissolved solids (mg/l)	421	0.056	0.013	99.98	389	0.034	0.008	99.99	123	0.021	0.017	99.98	4.56
Total suspended solids (mg/l)	3250	1.45	0.044	99.95	1869	276	14.76	85.23	1209	0.89	0.073	99.92	12.67
Total hardness (mg/l)	987	350	35.46	65.53	510	45	8.82	91.17	325	23	7.07	92.92	24.90
BOD (mg/l)	4.7	0.23	4.89	95.10	0.38	0.17	44.73	55.26	0.98	0.12	12.24	87.75	3.90
COD (mg/l)	1790	276	15.41	84.58	834	234	28.05	71.94	1031	215	20.85	79.1	12.89
Standard plate count (cfu/ml)	18x10 ⁻⁴	10.1x10 ⁻⁴	56.11	43.89	14.5x10 ⁻⁴	6.8x10 ⁻⁴	46.89	53.10	23.4x10 ⁻⁴	4.0x10 ⁻⁴	17.09	82.90	2.07

Values are the mean of five replications

Values are the mean of five replications,

Unacceptable= UA,

Acceptable=A

The ash mixed water is strongly alkaline, a pH of 12.57. The acid insoluble ash is observed 1.03%, while water soluble matter and alcohol soluble extractives were estimated 29.42 and 54.65%, respectively. The minerals phosphorus, potassium, calcium, magnesium, sodium and aluminum were quantified 3.22, 56.05, 234.45, 250.05, 5.3 and 19.32 g/kg d.m., respectively. Similarly micronutrients, iron (13.50 mg/kg.d.m.), cadmium (6.90 mg/kg d.m.), chromium (192.0mg/kg d.m.), copper (98.88mg/kg d.m.) were also present in ash, while mercury content was not present in the ash.

It is evident that ash treatment affects quality of water significantly and after addition of ash, the pH, color and odor of water changed, alkaline to neutral, colorless and odorless. After

treatment, microbial count also reduces up to 82.90%.

Our findings are consistent with previous studies reported the effect of ash of water quality and purification. The ash from medicinal plants was also reported to have antimicrobial activities against number of pathogenic bacteria, decreased up to 20% in sewage water. Mondkar (1982) [5]; Purandare and Prasad (2002) [6] were also reported potential of ash in purification. Sharma *et al.* (2011) [7] also studied the use of ash in purification of water of Narmada river (Madhya Pradesh), collected from four rivers-Omkareshwar, Mandaleshwar, Barwani, and Homa Therapy Goshala, near Maheshwar and emphasized that ash can be used to reduce the pollution of water resources as well as environment.

Conclusion

This study highlights the potential of oleo-gum resin ash in purification of water quality. The ash treatment affects quality of water significantly and after addition, physico-chemical properties of water changed. It is pertinent that the use of medicinally important oleo-gum resin of Guggul may be a practicable, result oriented scientific practice to clean the water.

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