

**Original Review Article****DOI: 10.26479/2019.0503.39****REVIEW: A NOVEL AYURVEDIC TECHNIQUES APPROACH FOR
VALUE ADDITION OF WASTE MATERIALS****Yadav Yadevendra^{1*}, Sunny Sani¹, Sharma K. C.¹, Peter Hema², Adhana Kumar Rajesh³**

1. Department of Rasa Shastra & Bhaishjaya Kalpna Uttarakhand Ayurved University,
Rishikul campus, Haridwar (UK), India.

2. Department of Rasa Shastra evum Bhaishjaya Kalpna, Haridwar ayurvedic medical college
and research center, Mustafabaad (Padartha), Laksar Road, Haridwar, India.

3. Department of Agadtantra, Uttarakhand Ayurved University, Main campus, Haridwar (UK), India.

ABSTRACT: Waste is not only an environmental problem, but also an economic loss. How can we change the way we produce and consume so as to produce less and less waste, Moreover, can waste use as a resource? It needs great skill to minimize the production and reuse of waste into useful substance. The Indian economy is based on agriculture. In traditional agriculture practice, none of the substance is useless. Nature made everything recyclable and its constituent just are employed in conversion of the matter. As per Ayurveda, various kinds of materials are obtained from Jangama, Parthiva and Odbhidha. Similarly these are also the sources of waste substance. Likewise, Ayurvedic classics provide detailed knowledge of use of agroforestry waste, mining waste, foundry & forge waste and dairy industries wastes etc. to use waste that is generated as a resource of useful medicine and besides to minimize the amount of waste sent to landfill.

KEYWORDS: Jangama, Partiva, Odbhidha, Bhasma, Anupana.

Corresponding Author: Dr. Yadav Yadevendra* M.D. (Ayu.)

Department of Rasa Shastra & Bhaishjaya Kalpna Uttarakhand Ayurved University,
Dehradun (UK), India. Email Address: yadevendra.ayu@gmailcom

1. INTRODUCTION

Word Web defines waste disposal as a “unit for getting rid of and destroying or storing used, damaged or other unwanted industrial, agricultural or domestic products and substances” [1]. It also entails proper discard or discharge of the material waste in accordance with the local environmental

regulatory framework. Poor waste management contributes to climate change and air pollution, and directly affects many ecosystems and species. Landfills, considered the last resort in the waste hierarchy, release methane, a very powerful greenhouse gas linked to climate change. But ancient Ayurvedic scholar considered that every sort of material has medicinal value [2]. However, it requires special processing technique to convert into medicine(s). Poisonous substances like, *Datura metal* Linn, *Aconitum chasmanthum* stapf.ex Holes etc. and other substances mention in Schedule E (I) of Drugs and Cosmetic Act 1940 & rules 1945[3] can be converted into medicines by adopting various treatment techniques mentioned in Ayurvedic pharmaceuticals. In Ayurveda, every substance in earth is classified into 3 categories viz Jangama, Odbiddha & Partiva [4]. So, for the convenience of the study waste is broadly kept in these three groups. Ayurvedic Pharmaceuticals delivers treatment methods that are used to transform the profile of the roughage (waste) into medicinal form. Otherwise, the last technology is composting, burning and briquetting [5]. Burning and compositing are chiefly responsible for myriad of problems like greenhouse effect, various type of infections, water borne diseases etc. For sustainable development, wastes should be recycled, reused, and channeled towards the production of value added products [6]. Therefore, this study is based on an insight into utilization of common wastes, their conversion techniques and their therapeutic uses in Ayurveda. It has also been focused to bring out the existing knowledge on Ayurvedic compendia and knowledge available in different official and reliable websites.

(A) Jangama Dravya

It is available through livestock and other animals. It may be domestic, pet animals and wild. Some wastes are produced by animals and their Ayurvedic pharmaceutical processing techniques with corresponding uses are as following:

(i) Egg Shells

Eggshell is an agricultural waste largely considered as useless and is discarded. This waste has potential for producing hydroxyapatite, a major component found in bone and teeth. Hydroxyapatite is an excellent material used in bone repair and tissue regeneration. Calcium carbonate (calcite) is the main component in eggshells and is the major inorganic substance found in an egg and it makes up about 94% of chemical composition of eggshell. This makes it an essential material for hydroxyapatite production. Others chemical compound found are organic matter which makes up 4%, magnesium carbonate (1%), and calcium phosphate (1%) as well as insoluble proteins [7]. Cytotoxicity test carried out using osteoblast cell culture has revealed the biocompatibility of eggshell based medicine [8]. To make Bhasma, egg shells are cleaned with organic acid, salt or ammonium chloride. After then, incinerate them in heap of 4.7 kg of cow dung cake to make Nano-sized [9]. The calcination temperatures for eggshell based medicine varies from 800°-900°C and at this temperature all issues related to disease transmitting pathogens and allergens are destroyed [10]. All these features contributed to the excellent quality of Kukkutanda Twaka Bhasma that is much

closer to the composition and structure of biological apatite. Bone mineral is a salt where the ratio of calcium to phosphate (C/P) is 1.5 to 1.7 and the hydroxyapatite C/P ratio is generally assumed to be 1.67 which is within the range [11]. It is used to treat ailments such as Shweta-pradara (leucorrhea), Rakta-pradara (Menorrhagia), Prameha (Diabetes Mellitus), Mutra-roga (urinary tract infection) and Manshika Daurbalya (mental disorders). It also has properties such as Rasayana (immunomodulation) and Balya (strength). The Bhasma are administered with milk as Anupana[12]. Average weight of egg shell is 4-6 gms. So an egg-shell is enough for daily requirement of body for 1-2 weeks. Snail conch, mother of pearl, coral & turtle shell is used in different medicines.

(ii) Urine of animals

Eight type of animal's urine is indicated in different conditions, diseases and common characteristics of urine is mentioned by Acharya Charaka [13]. While Acharya Sushruta mentioned the property of all animal's urine [14] individually. He has also mentioned the use of cow and buffalo urine in treatment of Pandu (Anemia) [15]. In Chakradutta, use of elephant urine and dung is mentioned in treatment of Switra (leucoderma) [16].

(iii) Stool of animals

Extract of cow dejection is one of the components of Panchagavya obtained from cow [17]. Due to alkaline nature of pigeon, eagle & crow's feces are used in the Darana (Non-surgical method of abscess draining) of infective inflammation area, where a surgical technique is quite difficult [18]. Livestock feces are also used as traditional fuel and dry cow dung is only fuel for making medicine like Bhasma.

(iv) Peacock and hen wings

Ash obtained from burning of these wastes is used in scorpion bite, hiccough, vomiting and dyspnea etc. with different Anupana (Vehicle) [19].

(v) Bee wax

It has numerous useful medicinal properties like, wound healing and also used in Vattika and Raktaja disorders, Kustha, Visarpa [20]. It is mixed with Tila taila in equal proportion for preparation of Siktha Taila, which is used as base material for making topical formulations. [21]

(vi) Spider web

It is useful in the extraction of copper like essence from fecal matter of earth worm (*Pheretima postuma*). This essence is indicated in skin disorders, various types of urinary disorder and renal calculus.[22]

(vii) Hoofs, Horns, Task and skin

Molt skin of snake is used in leucoderma and induction of labour [23] after making Masi from it. Similarly Masi, made by skin, fur, nails, hoofs or bones of quadrupedal, is applying on the area of body for regeneration of skin hairs.[24]

(B) Odbhidda Dravya

This sort of substance is obtained from kingdom-Plantae. This is the biggest category of source of raw medicine.

(i) Rhizome of banana

Banana (*Musa* sp.) is the second most important fruit crop cultivated in India next to mango. Its year-round availability, affordability, varietal range, tastes, nutritive and medicinal value makes it the favorite fruit among all classes of people. Banana and plantains are grown in about 120 countries. Total annual world production is estimated at 86 million tons of fruits. India leads the world in banana production with an annual output of about 14.2 million tons. Banana is a very popular fruit due to its low price and high nutritive value. It is consumed in fresh or cooked form both as ripe and raw fruit. Banana fiber is used to make items like bags, pots and wall hangers. Rope and good quality paper can be prepared from banana waste. Banana leaves are used as healthy and hygienic eating plates [25]. Most of the farmers make organic fertilizers from rhizome of it. But it has so many medicinal values, so its extract is useful in the treatment of condition like diabetes, renal stone etc. While in Ayurveda, rhizome of Banana (*Musa Paradisiaca*) juice is use in processing of formulation and itself as medicine since ages. Its juice uses in Samanya Shodhana (general/ common purification process) of Dhatu (metals). This is the most technic-economical method than any other [26] mention method in classical text. Shodhana is prerequisite for Marana process (conversion of metal and mineral into Nano-sized metallic medicine by incineration) of Dhatu. It is one of the chief ingredients of Kadalikand ghrita, which is drug of choice for Soma roga [27]. Moreover, neither any kind of preservation method is required for its storage and nor any kind of special type of technique is required for their juice extraction.

(ii) Crop residue

Farmers continues to burn the paddy and straw fields despite a ban in some states to curb air pollution and destroy the fertility of soil [28]. Sometimes accidental fire in field of Rabi crop was due to electric short circuit, burnt remnants of cigarette, biddi and from domestic traditional fuels. Conversion of crop residue and their ash into Kshara (Alkali) is alternative use of disposal of waste. If we due do this operation in plan and systemic manner might be able to prevent nutrient loss from soil. Kshara is used in the treatment of tumor, piles, tropical sprue, cough, renal stone, worm infestations and wound etc [29].

(iii) Weeds

Parthenium hysterophorus, *Achyranthes aspera*, *Calotropis procera* & *Euphorbia neriifolia* is almost considered as enemy to agriculture. Except *Parthenium hysterophorus* all these weeds are required for making Kshara in Ayurvedic Pharmaceutics [30] but some Ayurvedic expert of these days making Kshara from this also.

(iv) Over-aged vegetables

In India, those farmers that are growing vegetables like radish, turnip, apple and grapes have to dispose their crop because lack of demand, over ripening & not getting suitable price. This news came from all corners of India from time to time. Radish and turnip can be used for making Kshara Kalpana. Rotten apple can be processed into cidar vinegar and grapes into Asava-arista (self-generated alcohol).

(v) Seeds

Seeds of Black plum (*Syzygium cumini*), Mango [31] (*Mangnifera indiaca*), Indian gooseberry [32] (*Phyllantus emblica*) and Neem [33] (*Azadirachta indica*) were used in treatment of diabetes, gynecological disorders, leucorrhoea and skin diseases respectively. Generally these seeds are considered as non-edible part of fruits.

(vi) Saw dust

Powder of white and red variety of sandal wood, deodar, pinus wood are contents of some Ayurvedic formulation like Chandanasava [34], Chyavanprasha, Avipatikara churna, Vishatinduka Tail and Chandanadi taila. So saw dust, a by-product of sawing mill and wood craft industries can be a valuable product.

(C) Parthiva Dravya**(i) Scrap of metals**

Very fine scrapes [35] of precious, coinage metal, iron [36] and alloys are used in making Dhatu Bhasma. These medicines are not only a good source of essential micro-mineral, but also used in treatment of various diseases from very long time by Ayurvedic practitioners. Making medicine from scrap not only reduces the cost of operation due to ease in the process, but also it is low in cost. Alteration in particle size and crystal size of Bhasma of metal is achieved by using different treatment technique and media [37]. Particle size of this medicine is about Micron to Nano range. So this is reason why final formulation is of different color. In modern medical science metallic medicine are used as xenobiotic [38] and vehicle for drug delivery to the target site. So Bhasmanirman is most ancient processing technique of biosynthesis of Nano-metallic medicine [39]. These are use as itself medicine as well as drug delivery system [40] of medicine i.e. Yogawahi in Traditional system of medicine [41]. Pharmaceutical nanotechnology discipline is now well-established for drug delivery, diagnostics, prognostic and treatment of diseases through its Nano-engineered tools.

(ii) Iron Slag

Slag is the glass-like by product left over after a desired metal has been separated (i.e., smelted) from its raw ore [42]. Slag is usually a mixture of metal oxides and silicon dioxide. Indian Iatrochemistry also defined the Madura [43] in same way. Traditional crucibles are made by mixing

it, in soil and other materials. Sealing material [44] for crucibles and earthen pots get strength by its use.

(iii) Scrape of Gems

In Rasa Shastra, gems are also described in various texts. Here gems and semiprecious stones are used for medicinal purpose [45]. Whole intact gems are not used rather than scrape of gems are more suitable for making its medicine [46]. It is used for making Bhasma, Pisti & Druti. In Unani system of medicine Pisti preparation of this group is used in various kinds of disorders.

(iv) Different kinds of soils

Soil obtained from termite mound is categorized under Panchmritika [47]. The mound is constructed out of a mixture of soil, termite saliva and dung. Termite's activity induced significant chemical changes in the soil possible due to the material used in their nests. There was increase in concentrations of nitrogen, phosphorous, potassium, calcium and magnesium higher in the termite's mounds, while the micro-nutrients (zinc, iron, and copper) except sulphur and manganese lower in soil infested by termites [48]. Istika Curna is also one the constituents of panchmritika. It is also used for the removal of impurities and toxicity of Marking nut [49] (*Semicarpus anacadium*) and Naga (Lead) Dosa [50] of Parad (Mercury).

2. CONCLUSION

Ayurvedic medical science is originates in India. Indian economy is principally based on agriculture. In tradition agriculture, nothing is useless for farmer i.e., it utilize the every part of plant from grain to fodder. Besides farming, other allied works like metallurgy & metal molding, wood work, cloth weaving and leather processing are seen in most of the villages. So to boost up the economy of India and provide clean environment to the countrymen it is the need of hour to uplift the cottage based industry. To this spread & popularize the tradition textual and non-textual knowledge of Ayurvedic pharmaceutics after scientific verification and validation. So this way not only micro-economy of the India increases but like way goal of health for all will be also achieves. Based on this study, a policy roadmap may be made to promote alternative use of waste residue into an asset to boost micro-economy of Nation. In our classics and Ayurvedic compendium myriad of these kinds of esoteric pragmatic examples are exist.

ACKNOWLEDGEMENT

I am very thankful to Dr Usha Sharma, Sushma Rawat, & Dr Shuchi Mitra for providing valuable suggestion and helping in preparation of this manuscript.

CONFLICT OF INTEREST

Nil.

REFERENCES

1. [https://www.conserve-energy-future.com/various-waste-disposal-problems-and_solutions.php, visited 05-04-19.
2. Shastri K N & Chaturvedi G N, Hindi commentary on Charka Shamhita Part 1, Sutrasthana Chaukhambha Bharti academy, Varanasi, Edition-2005, verse-26/12, pp-492.
3. Garg R A, Manual on drugs & Cosmetics, Commercial Law publishers Pvt. Ltd., Delhi, 9th edition 2016, pp-310.
4. Shastri K N & Chaturvedi G N, Hindi commentary on Charka Shamhita Part 1, Sutrasthana Chaukhambha Bharti academy, Varanasi, Edition-2005, verse-1/68, pp-41.
5. Salah M, El Haggag, Sustainability of Agriculture and Rural waste management, sub stainable Industrial design and waste management 2007.
6. Martin M. -Luengo, M. Yates, Ramos M. et al., “Renewable raw materials for advanced applications,” in Proceedings of the World Congress on Sustainable Technologies (WCST '11), pp. 19–22, IEEE, 2011.
7. Rivera E. M., Araiza M., Brostow W. et al., “Synthesis of hydroxyapatite from eggshells,” Materials Letters, vol. 41, no. 3, pp. 128–134, 1999.
8. Mulijani S. and Sulistyso G., “Formation and characterization of hydroxyapatite/chitosan composite: effect of composite hydroxyapatite coating and its application on biomedical materials,” in Chemistry of Phytopotentials: Health, Energy and Environmental Perspectives, L. D. Khemani, M. M. Srivastava, and S. Srivastava, Eds., Springer, Berlin, Germany, 2012.
9. Hari Sharanan V, editor Bhasma Vigyaniam, Chapter- 4, part-1, 2nd edition 1954 Krishan Gopal Ayurved Bhawan, pp-53.
10. Krishna D. Siva Rama, A. Siddharthan, S. K. Seshadri, and T. S. Sampath Kumar, “A novel route for synthesis of nanocrystalline hydroxyapatite from eggshell waste,” Journal of Materials Science: Materials in Medicine, vol. 18, no. 9, pp. 1735–1743, 2007.
11. Groot K. de, “Clinical applications of calcium phosphate biomaterials: a review,” Ceramics International, vol. 19, no. 5, pp. 363–366, 1993.
12. Anonymous, Rasa Tantra Sara & Siddha Proyoga Sangraha, Part-1, Krishana Gopal Ayurved Bhawan, rajasthan, 15th edition 2001, pp-225.
13. Shastri K N & Chaturvedi G N, Hindi commentary on Charka Shamhita Part 1, Sutrasthana Chaukhambha Bharti academy, Varanasi, Edition-2005, verse-1/96-100, pp-44.
14. Shastri Ambikadutta Hindi commentary on Susruta Samhita Part 1, Chikitsasthana Chaukhambha Sanskrit Sansthan, Varanasi, Edition- 2006, verse-46/217-228. pp-186.
15. Shastri K N & Chaturvedi G N, Hindi commentary on Charka Shamhita Part 2, Chaukhambha Bharti academy, Varanasi, Edition-2005, verse-16/64, pp-497.

16. Acharya Chakrapanidutta, Chakradutta, Kushta Roga Prakaranam - 50/71-72, Vaidhavaprabha Hindi Commentary By Indradeva Tripathi, Chaukhambha Sanskrit Bhawan, Varanasi, Edition 2010, pp-286.
17. Shastri Kashinath, Hindi commentary of Rasa Tarangini of Sadanand Sharma, 11th edition 2004, Motilal Banarsidas. New delhi, Taranga-2/22.
18. Shastri Ambikadutta Hindi commentary on Susruta Samhita Part 1, Chaukhambha Sanskrit Sansthan, Varanasi, Edition- 2006, verse-37/10. pp-138.
19. Sastri Laxmipati, 'Vidyotini' Hindi commentary on Yogaratnakara, Chaukhambha Prakashan, Varanasi, edition 2010. Pp-425.
20. Mishra Bramha Shankar, hindi commentary on Bhavprakash Nagantu of Bhava Mishra, Chaukhambha Sanskrit Sansthan, Varanasi, Part-1, edition 2004, (verse-6/21/29-30) pp-791.
21. Shastri Kashinath, Hindi commentary of Rasa Tarangini of Sadanand Sharma, 11th edition 2004, Motilal Banarsidas. New delhi, Taranga-4/59-63.
22. Shastri Kashinath, Hindi commentary of Rasa Tarangini of Sadanand Sharma, 11th edition 2004, Motilal Banarsidas. New delhi, Taranga-17/117-118, pp-433.
23. Tripathi Indradev, Vaidyaprbha hindi commentary on Chakradatta, Chaukhambha Sanskrit Bhawan, Varanasi, edition 2010, pp-388.
24. Shastri Ambikadutta Hindi commentary on Susruta Samhita Part 1, Chikitsasthana Chaukhambha Sanskrit Sansthan, Varanasi, Edition- 2006, verse-1/102-103, pp-11.
25. www.nhb.gov.in > report_files > BANANA, visited on 16/03/19.
26. Sharma Gulraj, hindi commentary on Ayurveda prakesh of Madawa Uppadaya, Chaukhamba Bharti Akadami, Varanasi, edition 2014. (verse-3/50-54), pp-356.
27. Shastri Laxmipati, Vidyotini hindi commentary on Yogratnakara, Chaukhambha Prakashana, edition 2010, pp-403.
28. Poulit, Rao, McCarty & Soja, Development of the crop residue and rangeland burning in the 2014 National emissions inventory using information from multiple sources, JAWMA, May 2017, pp 1-22.
29. Shastri Kashinath, Hindi commentary of Rasa Tarangini of Sadanand Sharma, 11th edition 2004, Motilal Banarsidas. New delhi, Taranga-14/62-63.
30. Shastri Ambikadutta Hindi commentary on Susruta Samhita Part 1, Chaukhambha Sanskrit Sansthan, Varanasi, Edition- 2006, verse-38/8. pp-138.
31. Shastri K N & Chaturvedi G N, Hindi commentary on Charka Shamhita Part 2, Chaukhambha Bharti academy, Varanasi, Edition-2005, verse-30/90-95, pp-854.
32. Shastri K N & Chaturvedi G N, Hindi commentary on Charka Shamhita Part 2, Chaukhambha Bharti academy, Varanasi, Edition-2005, verse-30/116, pp-858.

33. Shastri K N & Chaturvedi G N, Hindi commentary on Charka Shamhita Part 2, Chaukhambha Bharti academy, Varanasi, Edition-2005, verse-7/135, pp-269.
34. Shah Nagindas Chaganlal, Bharat Bhaisjaya Ratanakar, part -2, B Jain Publisher pvt ltd, new Delhi, Edition -2005. Pp-183.
35. Shastri Kashinath, Hindi commentary of Rasa Tarangini of Sadanand Sharma, 11th edition 2004, Motilal Banarsidas. New Delhi, Taranga-20/13. pp- 493.
36. Shastri Kashinath, Hindi commentary of Rasa Tarangini of Sadanand Sharma, 11th edition 2004, Motilal Banarsidas. New Delhi, Taranga-20/15. pp- 494.
37. Yadav Yadevendra, Kumar Vipin, Sharma Usha, Sharma Khem Chand, Ayushdhara, Analogy of modernchemical processwith principles of 'Rasa Shastra' of Ayurvedic medicine system.
38. <https://en.wikipedia.org/wiki/Xenobiotic>, Visited 06-04-2019.
39. Paz, Zach, Hazon, Kolusheva, Porat, Zeiri, Green Synthesis of gold nano particles using plant extract as reducing agents, International journal of nanomedicine. 2014; 9: 4007-4021.
40. Ansari, Satar, Jufri, Rasool, Ahmed & Zeidi, Role of Nanodiamonds in Drug Delievery and stem cell therapy; Iranian J of Biotechnology: 2016 sep: 14(3), 130-141.
41. Prof. D. A. Kulkarni, Rasaratansamuccaya, vijnana Boddhini commentary, Meharchand Laxmandas Publication, Newdelhi, Ed-2006; (verse- 5/140).
42. <https://en.wikipedia.org/wiki/Slag>, visited 06-04-2019.
43. Shastri Kashinath, Hindi commentary of Rasa Tarangini of Sadanand Sharma, 11th edition 2004, Motilal Banarsidas. New Delhi, Taranga-20/123. pp- 123.
44. Shastri Kashinath, Hindi commentary of Rasa Tarangini of Sadanand Sharma, 11th edition 2004, Motilal Banarsidas. New Delhi, Taranga-3/5. pp- 28.
45. Shastri Ambikadatta hindi commentary on Rasa Ratna Samuchya of Vagbhatacharya, Chaukhamba AmaraBharati Prakashan, Varanasi, Edition 1995, (verse-4/1), pp-85.
46. Sharma Gulraj, hindi commentary on Ayurveda prakesh of Madawa Uppadaya, Chaukhamba Bharti Akadami, Varanasi, edition 2014. (verse-5/157-158), pp-477.
47. Shastri Ambikadatta hindi commentary on Rasa Ratna Samuchya of Vagbhatacharya, Chaukhamba AmaraBharati Prakashan, Varanasi, Edition 1995, (verse-10/81), pp-85.
48. Dhembare A. J., Physico-chemical properties of termite mound soil, Archives of Applied Science Research, 2013, 5 (6):123-126.
49. Shastri Kashinath, Hindi commentary of Rasa Tarangini of Sadanand Sharma, 11th edition 2004, Motilal Banarsidas. New Delhi, Taranga-24/477-478. pp- 735.
50. Shastri Kashinath, Hindi commentary of Rasa Tarangini of Sadanand Sharma, 11th edition 2004, Motilal Banarsidas. New Delhi, Taranga-5/22. pp-78.