

Scope of Agadtantra (Ayurvedic toxicology) in Environmental Pollution w.s.r to Janpadodhvansa & Dushi visha: A Review

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Abstract

Ayurveda is a holistic science that emphasizes preserving and promoting the fitness of healthy individuals, besides providing a method for the treatment of diseases. Environmental pollution is a very major & attention seeker problem in the present time. Pollution is the process whereby the natural environment is introduced with contaminants that later cause change it. Pollution is an issue that has to be considered serious because it hurts natural elements that are responsible for life on earth such as water and air. Indeed without it, or if they were present on undesirable quantities, animals – including humans – and plants could not survive. Environmental pollution consists of a basic type of pollution, namely, air, water, and soil. *Ayurvedic* toxicology (*Agadtantra*) is a special branch of *Astanga Ayurveda* which deals with the identification of poison, types of poison from minerals, plant and animal kingdoms as well as artificial poisons and their treatment. The concept of air, water, and land pollution has also been discussed under various classical books and their role in causing epidemics and ruining of civilizations has been informed. In *Ayurveda*, our *Acharyas* has already described environmental health in form of *Dincharya*, *Ritucharya*, and *Janpadodhvansa*. The concept of *Dushi visha* has also discussed the cumulative toxicity. Regular exposure of pollutants like dust, gases, metals, chemicals, etc. accumulate in our body and act like *Dushi visha*. This review article is a preliminary approach to find out solutions for emerging environmental pollution problems through our ancient Science.

Keywords: *Ayurveda*, Environmental pollution, *Agadtantra*, *Janpadodhvansa*, *Dushi visha*

INTRODUCTION

The term environment implies all the external factors living and non-living, material, and non-material which surround a man. The environment is made up of three components for descriptive purpose -

- 1. Physical:** Air, soil, water, housing, wastes, radiation, etc.
- 2. Biologic:** Plant and animal life including bacteria, viruses, insects, rodents, and animals.
- 3. Social:** Customs, culture, habits, income, occupation, religion, etc.

The key to man's health lies largely in his environment. Environmental factors such as water pollution, soil pollution, air pollution, poor housing conditions, presence of animal reservoirs, and insect vector of diseases continue to threaten to man's health. Pollution derived from Latin word *pollutioneum* which means to defile or make dirty. The pollution of the environment & its natural resources with different pollutants is known as environmental pollution. Globally, pollution is a problem and it causes hazardous effects on human & natural resources. The biggest & main harmful effect of pollution is on the environment, as it breaks up the environment & also the different ecosystem (a

combination of abiotic factors & communities in an environment) present in it. The widespread problem of pollution in the environment leads to the physical & biological effects that vary in their intensity. ^[1] The use of nano fertilizers is a newly emerging technique that could be useful to agriculture for plant growth. ^[2]

Janpada means by which mass people get afflicted with disease and destroy the whole region, the disease that spread in the form of epidemics is called "*Janpadodhvansa Rogas*". This has been described by *Acharya Charak in Vimana Sthan*

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chapter 3 in which *Vayu* (Air), *Desha* (Land), *Kala* (Season), and *Jala* (Water) all are affected (Fig.1), *Charaka* has also described symptoms of *Samanya vayu* (Normal Air), *Vikrutvayu* (Polluted air), and *Vishdushit vayu* (Poisoned air). *Poorvarupa* (Early Signs) of *Janpadodhvansa* are abnormal conditions of stars, planets, moon, sun, air, fire, and the environment which derange the seasons.^[1]

As per the modern view, we can understand that the above said four factors get vitiated due to pollution, destroying communities (Epidemics). Exposure of various pollutants regularly, accumulate in our body and produce pathogenic conditions like allergic skin disorders, asthma, hair loss, oligospermia, cardiac problems, neurological disorders, etc. which simulate with complications of *Dushivisha*.^[3]

Dushivisha is a poison whether animal, vegetable, or chemical, not fully eliminated from the system and partially inherent therein, enfeebled by anti-poisonous remedies, the sun, the fire, and the wind, which is having fewer properties or lesser potency of all the ten properties of *Visha*. Due to the coverage of bodily *Kapha*, *Dushivisha* retains in the system for some years.^[4] *Poorvarupa* and *Lakshana* of *Dushivisha* mention in table1.



Figure 1: Factors affected under *Janpadodhvansa*

Table 1: Poorvarupa and Lakshana of *Dushivisha*

Early signs of <i>Dushivisha</i> ^[5]	Symptoms of <i>Dushivisha</i> ^[6, 7]
Excessive sleep, heaviness, yawning, laxity of joints, horripilation & body ache	Looseness of stool (Diarrhoea), a discolored complexion, fetor in the body, bad taste in the mouth, thirst, epileptic fits, vomiting, lassitude, confused speech, and all the symptoms of <i>Dusyodara</i> (Ascites), the patient becomes rapidly atrophied and looks like a wingless bird. Its action on the body becomes aggravated on a cloudy day and by exposure to cold and wind. In <i>Charaka Samhita</i> , <i>Acharya</i> says that <i>Dooshivisha</i> vitiating <i>Rakta dhatu</i> causes skin lesions such as

Arunshika (Eczema) *Kitibha* (Psoriasis) and *kotha* (Urticaria) symptoms and vitiates the *doshas* one by one and at last cause death.

Types of Pollution and its Ayurvedic Perspective

1. Air pollution

The immediate environment of man comprises of air on which depends all forms of life. Human beings need a continuous supply of air to exist. Any chemical, physical (e.g. particulate matter), or biological agent that modifies the natural characteristics of the atmosphere (air) can be categorised as air pollution. Today air pollution is more subtle and recognizes no geographical or political boundaries. Air pollution is a silent killer that is found around us, and it preys on the young and old. Hygiene is an important link, not only in terms of health and production performance but also in terms of food safety ^[8]. An unhealthy environment not only causes damage to athletes but also is a barrier to individual motivations in prioritizing the exercises ^[9].

- **Current scenario ^[10]**
 - ✓ 4.2 million deaths every year as a result of exposure to ambient (outdoor) air pollution.
 - ✓ Due to household exposure to smoke from dirty cookstoves and fuels, 3.8 million die every year.
 - ✓ 91% of the world’s population lives in places where air quality exceeds WHO guideline limits.

▪ Sources ^[11]

- A) Automobiles:** One of the major sources of air pollution is Motor vehicles. These vehicles emit hydrocarbons, carbon monoxide, lead, nitrogen oxides, and particulate matter.
- B) Industries:** Industries emit large amounts of pollutants into the atmosphere. Combustion of fuel to generate heat and power produces smoke, sulphur dioxide, nitrogen oxides, and fly ash.
- C) Domestic Sources:** In domestic usage of coal, wood, or oil smoke, dust, sulphur dioxide, and nitrogen oxide are gotten.
- D) Miscellaneous:** These comprise burning refuse, incinerators, pesticide, spraying, natural sources (e.g. wind-borne dust, fungi, bacteria), and nuclear energy programs.
- E) Indoor air pollution:** Tobacco smoke, stove, Aerosol sprays, solvents, resin products, building material, etc.

▪ Health impacts

The health effects of air pollution are both immediate and delayed. Major air pollutants and their health effects are mentioned in table 2. ^[12]

Table 2: Major air pollutants and adverse effect

Pollutant	Adverse effect
Oxides of nitrogen	Respiratory tract irritation, bronchial hyperactivity, impaired lung defenses

Hydrocarbons	Lung cancer
Ozone discomfort	Cough, substernal broncho-constriction, decreased exercise performance, respiratory tract irritation
Sulphur dioxide	Exacerbation of asthma and COPD, respiratory tract irritation, death may occur in severe exposure
Lead	Impaired neuropsychological development in children
CO	CO poisoning cause cherry lips, unconsciousness, death by asphyxiation

▪ **Prevention and control of air pollution**^[13]

The following procedures for the prevention and control of air pollution were recommended by WHO –

- A) Containment** – Prevention of escape of toxic substances into the ambient air.
- B) Replacement** – Replace a technological process which causing air pollution, by a new process that does not affect the air.
- C) Dilution** – Establishments of ‘green belts’ between the industrial and residential areas for diluting the condense air.
- D) Legislation** – Air pollution is controlled in many countries by suitable legislation, e.g. Clean Air Acts.
- E) International action** – To deals with air pollution on a worldwide scale, the WHO has established an international network of laboratories for the monitoring and study of air pollution.

▪ **Ayurvedic view**

During ancient times, atmosphere poisoning was being done as a military operation to harm the enemy by fumigation of toxic substances.

- ✓ **Vikrita Vayu Lakshana**^[14] – Air of this type should be known as causing illness such as – not following the season, excessively moist, speedy, harsh, cold, hot, rough, blocking, terribly sounds; excessively clashing with each other and affected with an unsuitable smell, vapor, gravels, dust, and smoke.
- ✓ **Characteristics & Effects of polluted air**^[15] – When bird’s dropping of birds fall from the sky in a tired condition, it indicates that the wind and the smoke (of the atmosphere) with poisoned. It is further attended with an attack of cough, nasal discharge, headache, and of severe-eye-diseases among Persons in-hailing the same wind and smoke.
- ✓ **Purification of polluted air**^[16] – In the case of poisoned air, the atmosphere should be purified by burning herbal drugs mentioned in table 3 in the open ground. The fumes of these drugs would purify the poisonous air.

Table 3: Drugs mentioned for Air purification

S.N.	Ayurvedic name	Botanical name
1.	Laksha	Shellac
2.	Haridra	<i>Curcuma longa</i> L.
3.	Ativisha	<i>Aconitum heterophyllum</i> L.
4.	Abhaya	<i>Terminalia chebula</i> Retz.
5.	Musta	<i>Cyperus rotundus</i> L.
6.	Harenuka	<i>Vitex negundo</i> L.
7.	Ella	<i>Elettaria cardamomum</i> (L.)Maton
8.	Tamalapatra	<i>Cinnamomum Tamala</i> (Buch.-Ham.)T.Nees
9.	Vakra	<i>Valeriana officinalis</i> L.
10.	Kustha	<i>Saussurea lappa</i> C.B. Clarke.
11.	Priyangu	<i>Callicarpus macrophylla</i> Vahl.

Acharya charaka has mentioned some fuming process that detoxifies the environment, in Chikitsa sthan 23rd chapter.^[17]

- Powder of Yellow Mustard (*Brassica campestris* L.) and Chandana (*Santalum album* L.) + Ghrita (Clarified butter)
- Combination of Tagar (*Valeriana wallichii* DC.), Kusthha (*Saussurea lappa* C.B. Clarke), flower of Shirisha (*Albizia lebbek* Benth.)
- Combination of equal quantity of Laksha (Shellac), Usheer (*Vetiveria zizanioidis* L.), Tejpatra (*Cinnamomum tamala* Buch.-Ham. T.Nees), Guggula (*Commiphora mukul* Hook ex Stocks), Bhallatak (*Semicarpus anacardium* L.), flower of Arjuna (*Terminalia arjuna* Roxb.), Raal (Extract of *Shorea robusta* Gaertn.), White Aparajita (*Clitoria ternatea* L.)

Recent study

1. Medicinal smoke reduces airborne bacteria.^[18]

- This study shows the impact and ethnopharmacological aspects of medicinal smoke on aerial bacteria in an indoor environment. Smoke was originated by burning wood and a complex mixture of odoriferous and medicinal herbs (*havan* material) like *Aegle marmelos* (L.), *Cedrus deodara* (Roxb. Ex D. Don), etc. The obtained results show a 94% reduction on bacterial counts by 60 min and the effective time was up to 24 h in the closed room.

2. Agnihotra – A non-conventional solution to Air pollution.^[19]

- Under the natural lab conditions and local artificial indoor pollution obtained results show a noticeable reduction in SO₂ & NO₂ concentration by almost 51%, 60% respectively more by *Yagya* when was compared without *Yagya*. In this study materials used for *Yagya* (fire rituals) such as cow’s ghee (clarified butter), Pipal wood (*Ficus religiosa* L.), Guggula (*Commiphora mukul* Hook. ex stocks), etc.

3. In vivo studies on the effect of *Ocimum sanctum* L., leaf extract in modifying the genotoxicity induced by chromium and mercury in *Allium* root meristems.^[20]

➤ Heavy metals are non-degradable, they accumulate in the body and also disturb the food chains and biochemical cycles. The problem of heavy metals in modern conditions is global and is associated with contamination of soil and water with rare and scattered elements that have a biocidal effect. Hg and Cr are the important heavy metals that are widely used in various industries which produce a mutagenic and carcinogenic effect. In this study, it was found that the leaf extract treatment shows highly significant ($p < 0.001$) recovery in mitotic index (MI) and chromosomal aberrations (CA) as compared to pre-treated samples. The lower doses (5, 10, 20 %) were found more effective than higher doses.

4. Preparation and evaluation of Herbal *Dhoop* for cleansing the air.^[21]

➤ This study promotes the use of the natural herbal product for room purifiers and air freshener instead of using chemical sources and the harmful UV rays. The obtained results show that the growth of the most aerial micro-organism was inhibited. Microbiological evaluation of the cleansing activity of *dhoop* was conducted with Nutrient and Sabouraud Agar plates (in duplicates) which exposed to garbage area, the kitchen of the restaurant, washroom, and hospital laboratory for 10 mins. Herbal dhoop was prepared by using cow dung, cow ghee, cow milk, Camphor (*Cinnamomum camphora* (L.) J.Persl.), *Guggul* (*Commiphora mukul* Hook. ex stocks), *Dhoop* (*Boswellia serrata* Triana & Planch.), *Kapurkachri* (*Hedychium spicatum* Sm. In A.Rees) and *Anantmula* (*Hemidesmus indicus* (L.) R.Br.).

5. Study the Impact of Houseplant in the purification of Environment using Wireless Sensor Network.^[22]

➤ In this study, it was discovered how household plants help purify the environment. The air pollution monitoring system was developed by using a wireless sensor network (WSN) and tested in different tree cover area and non-tree cover area. The impact of tree cover area/non-tree cover area was co-related with due consideration of CO₂ depletion and O₂ emission concentration. The obtained results show that the concentration of CO₂ was decreased due to absorption by plants and O₂ concentration was increased. Plants were used in this study like *Tulsi* (*Ocimum sanctum* L.), *Aloe Vera* (*Aloe vera* (L.) Burm.f.), *Peace Lily*, *Devis Ivy*, *Snake Plant*, *Orchids*, etc.

2. Water pollution

The hydrosphere is more than 75% of the earth's surface. There can be no state of positive health and well being without safe water. Water is not only a vital environmental factor in all forms of life, but it has a great role to play in the socio-economic development of the human population.

When there is addition of large amounts of materials to water, pollution occurs.

Current scenario^[23]

Annually, safer water could prevent:-

- ✓ There is a report of 1.4 million child deaths from diarrhea
- ✓ 500 000 deaths from malaria
- ✓ 860 000 child deaths from malnutrition
- ✓ 280 000 deaths from drowning
- ✓ 5 million people can be protected from being seriously incapacitated from lymphatic filariasis and another 5 million from trachoma.

Sources^[23,24]

A) Organic – Detergents, insecticide, herbicide, lubricants, petroleum hydrocarbon, fuel (gasoline, diesel, fuel oil) volatile organic compounds, chlorinated solvents.

B) Inorganic – SO₂, NH₃, nitrates, and phosphate-fertilizer, heavy metals

C) Macroscopic – Garbage (paper, plastic, food waste)

D) Thermal pollutants – Includes wastes from atomic, nuclear & thermal power plants.

Health impacts –

Anemia, vomiting, loss of appetite, damage to liver and kidney, hepatitis A & E, diarrhea, GIT diseases, fever (typhoid), diseases of CNS, Carcinogenicity, skin problems, lead poisoning, SARS

Purification of water on a large scale^[25]

A) Storage – Water is drawn out from the source and impounded in natural or artificial reservoirs. When water is stored, it helps provides a reserve of water from which further pollution can be avoided.

B) Filtration – Filtration is a second stage in the purification of water, and quite an important stage because 98-99% of the bacteria are removed by filtration, apart from other impurities, e.g. 'biological or slow sand' filters, 'rapid sand or mechanical' filters.

C) Disinfection – For a chemical or an agent to be potentially useful as a disinfectant in water supplies.

Ayurvedic view –

✓ '**Praninam prana**' – Water is the life of all living beings.^[26]

✓ **Causes of water pollution** – Drinking water will be contaminated by decomposed dead bodies of aquatic animals (like an insect, snake, etc.), decomposed aquatic plant, unexposed to the sun, moon, air, micro-organism, mixed with rainwater.^[27]

✓ **Vikrita Jala Lakshana** – Water should be known as devoid of merits when it is excessively deranged in the six categories namely as *Sparsha* (touch), *Roopa* (sight/color), *Rasa* (taste), *Gandha* (odor), *Veerya* (potency), *Vipaka* (chemical transformation).^[28]

- ✓ **Characteristics & Effects of polluted water**^[29] – A sheet of poisoned water becomes slimy, strong-smelling, frothy, and marked with (black-colored) lines on the surface. Frogs and fish living in the water die without any apparent cause. In Birds and beasts that live in the water and on its shores, roaming about wildly in confusion can be seen as the effects of poison, and if a man, a horse or an elephant bathe in this poisoned water, they may suffer from vomiting, fainting, fever, a burning sensation and swelling of the limbs.
- ✓ **Diseases due to ingestion of contaminated water** – 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*), and Diseases due to contact of contaminated water – Contact of contaminated water using a bath or any other ways causes skin disorder (*Kustha*), itching (*Kandu*) & conjunctivitis (*Netrabhishyanda*)^[30, 31]
- ✓ **Purification of polluted water** – To purify the poisoned water, drugs mentioned in table 4 should be collected and burnt. The cold ashes should be then cast into the poisoned water, it will make the water pure (non-poisonous) or a handful (1 *Anjali* = 160 gm) of this ash should be put into the pot containing drinking water to be used when needed.^[32]

Table 4: Drugs mentioned for Water purification

S.N.	Ayurvedic name	Botanical name
1.	Dhava (dhaya)	<i>Anogeissus latifolia</i> Wall. EX.
2.	Ashwakarna	<i>Dipterocarpus alatus</i> Roxb.
3.	Asana	<i>Pterocarpus marsupium</i> Roxb.
4.	Paribhadra	<i>Erythrina variegata</i> L.
5.	Patala	<i>Stereospermum suaveolens</i> DC.
6.	Siddhaka (Nigundi)	<i>Vitex negundo</i> L.
7.	Mokshaka (Makha)	<i>Schrebera swietenoides</i> Roxb.
8.	Amalatas	<i>Casia fistula</i> L.
9.	Somavalka	<i>Acacia leucorrhoea</i> Roxb.

In *Ayurvedic* classics, there have been discussed some tools which can make *Kalushita Jala* (defected water) acceptable. They are as follow^[33, 34] –

- A) Impregnation of Kataka (*Strychnos Potatorum* L.), Gomeda (Hessonite), Bisagranthi (Root of Lotus), Shaivala moola (Root of Algae), *Vastra* (Cloth), *Mukta* (Pearl) and *Mani* (Potash alum).
- B) Heated by fire, exposure to sunlight, or by immersing red hot iron balls into it.
- C) It should be made clear by putting *Parnimula* (a kind of grass that has the property of diluting the water) and knots (tubers) of lotus plants into the water.

D) Bad smell being removed by putting the flowers of Naga (*Mesua ferrea* L.), Champaka (*Michelia chmpaca* L.), Utpala (*Nymphaea sellata* Willd.), Patala (*Stereospermum suaveolens* DC.), Karvira (*Nerium indicum* Mill.) and such other perfuming herbs into the water.

E) Water should be drunk perfumed in a golden, silver, copper, or an earthen goblet, or in a bowl made of bell metal or precious stones. Water stored in copper containers overnight and consumed the next day is believed to impart ‘health benefits’. According to the *Ayurveda* classics, copper produces a scrapping effect (*Lekhana*), heals and nourishes when administered in a small dose.

F) **Chandrakanta mani (moonstone)** – When exudates in water it removes harmful bacteria, insects, worms, and poison.

G) **Hanshodaka**^[35] - In *Sharada ritu* (autumn season) water which is exposed to sun rays during the day time and to the moon's rays at night is the ‘best’ quality water. It is *Rasayana* (rejuvenating), *Balya* (strength promoting), *Medhya* (intellect promoting), alleviates three *doshas*, *anabhishyandi* (which does not obstruct channels of circulation).

Recent Studies –

1. Storing drinking-water in Copper pots kills contaminating Diarrhoeagenic bacteria.^[36]

- This study was evaluated the effect of the copper pot against important diarrhoeagenic bacteria, including *Vibrio cholerae* O1, *Shigella flexneri* 2a, enterotoxigenic *Escherichia coli*, enteropathogenic *E. coli*, *Salmonella enterica* typhi, and *Salmonella paratyphi*. Study shows the merits of copper for their use in improving public hygiene for the purification of drinking water. In this experiment, bacteria *E. Coli* was completely killed by copper surfaces and none of the pathogens was recovered even after enrichment culture.

2. Study on the Antibacterial activity of selected Natural Herbs and its application in Water Treatment.^[37]

- This study emphasizes the uses of medicinal plants for purification of water. The authors attempted to find the antibacterial properties of selected herbs such as *Ocimum sanctum* Linn. (Krishna Tulsi), *Ocimum kilimandscharium* Guerke. (Karpooora Tulsi), *Azadirachta indica* A.Juss. (Neem), *Saraca indica* Linn. (Ashoka tree) etc. against different bacteria such as total coliforms, fecal coliforms, *Escherichia coli*, etc., determined by spread plate method, Kirby-Bauer disc diffusion method, most probable number (MPN) method and Petrifilm method. The obtained result shows *Ocimum sanctum* has the most efficient antibacterial activity in all herbs.

3. Experimental study of *Shushrutokta Jalaprasadana vidhi* wsr to *Gomeda*.^[38]

- The objective of this study was to discover the possibility of *Jalaprasadana vidhi* with help of *Gomeda* (Hessonite). Containers used for water in this study were made up of glass and earthen vessels. Values were

observed by applying the ANOVA test and Unpaired ‘t’ test and the obtained results show a very significant effect of *Gomeda* on water impurities. In this experiment, 1 carat of *Gomeda* was used against 1 liter of water. One carat is approximately equal to 200 mg.

4. An experimental study on the efficacy of *Vangbhatokta Jala Nirvishikarana Yoga* on polluted water.^[39]

➤ *Jala Nirvishikarana Yoga* was prepared according to the classical method. Optimum dose and period were found three drops per 100 ml for 30 min of contact time. The sample was analyzed for various physical, chemical, and microbiological parameters before and after treatment. *Jala Nirvishikarana Yoga* shows efficient antimicrobial activity and effectiveness for at least 1 year at room temperature.

5. Effect of soaking of *Phyllanthus emblica* wood in drinking-water for purification.^[40]

➤ 1.5 L of water was taken in two different containers one was controlling the other was a testing container. *Phyllanthus emblica* Linn. wood pieces (75gm) were soaked in test containers for 48 hrs. Samples were filtered and investigated for physical properties, elements, and levels of organisms. pH, total hardness, sulphate, and magnesium levels were decreased and the level of *Escherichia coli*, total coliforms, and fecal coliforms was reduced in test containers.

3. Land pollution

Land pollution means undesirable physical, biological, and chemical factors introduced by human activities inland.

▪ **Sources** – Increased mechanization & urbanization, pesticides, increased leisure and available wealth, increased waste disposal, and increased military presence.

▪ **Health impact** –

Cancers, skin diseases, respiratory disorders, birth defects, liver-kidney & lung disease, landfills become breeding grounds for mice, rodents, flies, and birds that can transmit diseases.

▪ **Ayurvedic view** –

Vikrita Bhumi/Desha lakshan^[41] – The *desha (bhumi)* of the following description is to be known as unwholesome; having color, odor, taste, and touch that are unnatural; excessively damp; abounding in serpents, beasts of prey, mosquitoes, locusts, flies, mice, owls, birds and animals such as the jackal and abounding in woods of weeds and *Ulupa* grass; abounding in creepers where crops have either fallen, withered or been destroyed in an unprecedented manner; where the winds are smoky; where the sound of birds is unceasing; where the baying of dogs always assails the ears; where herds of animals and flocks of birds of various kinds are always in a state of alarm and pain.

Characteristics & Effects of polluted ground^[42] – A poisoned ground or stone slab, landing stage, or desert country gives rise to swellings in those parts of the bodies of men, bullocks, horses, asses, camels, and elephants that may chance to come in contact with them. In such cases, a burning sensation is felt in the affected parts, and hair and nails (of these parts) fall off.

Purification^[43] – The poisoned surface should be purified by sprinkling it over with a solution of drugs mentioned in table 5 along with wine (*Suraa*) or with (an adequate quantity of) black clay dissolved in the water Or sprinkling with a decoction of drugs mentioned in table 6.

Table 5: Sprinkling agents for polluted land purification

S.N.	Ayurvedic name	Other names
1.	Ananta (Sariva)	<i>Hemidesmus indicus</i> (L.) R.Br.
2.	Sarva-gandha	Group of scented drugs (<i>Eladi gana</i>)

Table 6: Decoction agents for the treatment of the affected surface of the body

S.N.	Ayurvedic name	Other names
1.	Vidanga	<i>Embelia ribes</i> Burm.f.
2.	Pathaa	<i>Cissampelos pareira</i> L.
3.	Katabhi	<i>Albizia procera</i> Benth.

▪ **Recent studies** –

1. Reclamation of tannery polluted soil through Phytoremediation.^[44]

➤ Phytoremediation is a new technology that employs plants for reclamation of the contaminated soil strewn with heavy metals (metalloids) and toxic compounds. This study was explored the impact of the application of tannery sludge on biochemical properties of 6 months old tree saplings of *Azadirachta indica* A. Juss. (Neem), *Melia azedarach* Linn. (Wild neem) and *Leucaena leucocephala* (Lam) de wit (Subabool). The Control Plants was raised over the garden soil and Tested Plants was raised over the tannery sludge for phytoremediation. The result showed significant uptake and transport of chromium in all three tree species, so these plants could be employed in phytoremediation of soils contaminated with heavy metals.

2. Extraction of cadmium and tolerance of three annual cut flowers on Cd-contaminated soils.^[45]

➤ The main objective of this study was to find out the production potential and Cd removal by three flower crops namely marigold (*Tagetes erecta* L.), chrysanthemum (*Chrysanthemum indicum* L.), and gladiolus (*Gladiolus grandiflorus* L.), an experiment was conducted on differentially contaminated soils. The

obtained results show Cd removal was the maximum with chrysanthemum and gladiolus with the highest tolerance and Cd-content in the saleable part holds the potential to clean up the moderately contaminated soils.

3. Phytoaccumulation of chromium by some multipurpose-tree seedlings.^[46]

➤ To study the potential of chromium (Cr) phytoaccumulatory capabilities of four agroforestry tree species namely *Albizia amara* (Roxb.) Boiv., *Casuarina equisetifolia* L., *Tectona grandis* L.f., and *Leucaena leucocephala* (Lam.) de wit, a pot culture experiment had to be done in the greenhouse. The obtained results show *Albizia amara* is a potential Cr accumulator with citric acid as a soil amendment.

Management of Janpadodhvana according to Acharya Charaka^[47]

Panchkarma therapy (*Vamana-Emesis*, *Virechana-Purgation*, *Niruha*, *Anuvasanam*, *Nasya-Errhines*) is the best treatment. Thereafter proper use of *Rasayan* (Rejuvenative therapy/Immuno-modulator) measures and management with the drugs collected in a normal environment is recommended. *Sadvritta & Aachar Rasayan* (Good behavioral activity and personal hygiene) is also helpful for reducing the effect of *Adharma* (i.e. not following the rules & regulations said by ancestors) which is the main reason of *Janpadodhvana* (Imbalance of ecosystem).

Treatment of Dushi visha (Cumulative toxicity)^[48]

Acharya Sushruta has described that, if a person suffering from *Dushivisha* then the first line of treatment should be *Swedana Karma* followed by *Vaman & Virechana Karma* according to dosha predominance. After purification (*Shodhan*) of the body, the anti-toxic drugs (*Agadapaan*) like *Dushivishari Agada* mix with honey should be consumed daily by the affected person. *Acharya Charaka* has specifically mentioned that if *Dushivisha* is present in *Rakta dhatu* (Blood) should be treated with *Raktamokshana* (Blood-letting) by *Shira* (Viens). *Dushivisha treatment* is given in table 7 according to *Brihatrayee grantha*.

Table 7: *Dushivisha* treatment comparison according to *Brihatrayee grantha*

S.No.	Treatment	Charak Samhita	Sushruta Samhita	Astang Hridaya
1.	Swedan	No	Yes	Yes
2.	Vamana	No	Yes	Yes
3.	Virechan	No	Yes	Yes
4.	Dushivishari Agada	No	Yes	Yes
5.	Raktamokshana	Yes	No	No
6.	Sudha Kalpa ^[49]	Yes	No	No

▪ *Dushivishari Agada*^[50]

Dushivishari Agada is a compound Herbo-mineral preparation which is explained in the context of *Dushivisha*. Ingredients of *Agada* is mentioned in Table 8.

Table 8: Ingredients of *Dushivishari Agada*

S.NO.	Ayurvedic Name	Botanical Name	Part Used
1.	Pippali	<i>Piper longum</i> Linn.	Phala (Fruit)
2.	Pippalimula	<i>Piper longum</i> Linn.	Moola (root)
3.	Jatamamsi	<i>Nardostachys jatamansi</i> DC.	Mula (Root)
4.	Dhyamaka	<i>Cymbopogon martinii</i> (Roxb.) Wats.	Patra (Leaves)
5.	Lodhra	<i>Symplocos racemosa</i> Roxb.	Twak (Stem Bark)
6.	Ela	<i>Elettaria cardamomum</i> Maton.	Phala (Fruit)
7.	Suvarchika	<i>Tribulus terrestris</i> Linn.	Phala (Fruit), Mula (Root)
8.	Katunnatum	<i>Oroxylum indicum</i> (Linn) Benth. ExKurz.	Mulatwak (Root bark)
9.	Natam	<i>Valeriana wallichii</i> D.C.	Mula (Root)
10.	Kusta	<i>Saussurea lappa</i> C.B. Clarke.	Mula (Root)
11.	Yastimadhu	<i>Glycyrrhiza glabra</i> Linn.	Mula (Root)
12.	Rakhtachandana	<i>Pterocarpus santalinus</i> Linn. f.	Khandasara (Heartwood)
13.	Gairika	Red ochre	

SUMMARY AND CONCLUSION

The environment is the most necessary factor for a healthy life as well as the socio-economic growth of society and the nation. Will of indiscriminately progress in today's era gradually destroys our ecosystem in the form of pollutions, which is the most burning problem for all the countries in the world. The present scenario will be more frightening in the future if we will not take it seriously. In contemporary science, our *Acharyas* has well described the treatment of *Dushi visha* as well as *Janpadodhvana* associated conditions and diseases which can prove to be very effective in the pollution associated problems. *Agad Tantra* is one of the most significant branches of *Ayurveda* which deals with different types of toxicity and their treatment, so basically, environmental toxicology comes under in it. Various researches showed that some of these methods of *Ayurveda* have the potential to detoxify the environment from various pollutants. To prove the potency of these methods of *Ayurveda* for detoxifying the body as well as the environment, more research has to be carried out. Experimental researches can be done to prove the efficacy of these precious methods of *Ayurveda*, through which they will detoxify the body and environment without causing any harm to other essentials factors.

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