

ENVIRONMENTAL TOXICANTS AND CHRONIC DISEASES: UNDERSTANDING THROUGH DOOSHIVISHA SIDDHANTA - AN INTEGRATIVE REVIEW

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Abstract:

Environmental pollution has emerged as a major global health concern, contributing significantly to the increasing burden of chronic non-communicable diseases through prolonged exposure to low-dose toxicants such as heavy metals, pesticides, industrial chemicals, and air pollutants, which exert cumulative toxicity via mechanisms including oxidative stress, endocrine disruption, immune dysregulation, mitochondrial dysfunction, and bioaccumulation; however, conventional toxicology largely focuses on acute exposure and often underestimates the long-term effects of chronic toxicity, whereas Ayurveda, particularly Agadatantra, provides a comprehensive understanding through the concept of Dooshivisha, defined as a weakened or partially detoxified poison that persists in the body in a latent state and manifests disease under favourable conditions, and this review analyses environmental toxicants and their role in chronic diseases through the framework of Dooshivisha Siddhanta by integrating classical Ayurvedic descriptions with modern toxicological concepts, including the ecological perspectives of Dushita Vayu (polluted air), Dushita Jala (contaminated water), and Dushita Desha (polluted land), thereby demonstrating that environmental toxicants closely resemble Dooshivisha in their chronicity, latency, and multisystem involvement and highlighting the need for an integrative approach for prevention and management.

Keywords: Dooshivisha, Environmental Toxicants, Chronic Diseases, Agadatantra, Bioaccumulation

1. Introduction

Environmental pollution is a major determinant of global morbidity and mortality, with nearly 9 million deaths annually attributed to pollution-related causes [1]. Chronic exposure to environmental toxicants such as heavy metals, pesticides, industrial chemicals, and particulate matter has been strongly linked to cardiovascular diseases, neurodegenerative disorders, metabolic syndrome, and cancers [1,2].

Unlike acute poisoning, these toxicants act insidiously at low doses, leading to cumulative toxicity and delayed clinical manifestation. Modern toxicology explains these effects through oxidative stress, endocrine disruption, immune dysregulation, and epigenetic changes [3,4], but lacks a holistic framework for chronic low-dose exposure.

Ayurveda provides such a framework through *Dooshivisha*, a latent toxin persisting in the body after incomplete elimination [5–7]. Additionally, ecological concepts such as *Dushita Vayu*, *Jala*, and *Desha* demonstrate the ancient understanding of environmental health.

2. Materials and Methods

This study is a narrative integrative review based on classical Ayurvedic literature and contemporary scientific evidence.

Sources:

- Classical Ayurvedic texts (Charaka Samhita, Sushruta Samhita, Astanga Sangraha, Ashtanga Hridaya) [5-7]
- Published literature on environmental toxicology, including standard toxicology textbooks and global health reports [8-13].
- Review articles on Dooshivisha and Agadatantra

Methodology:

Comparative analysis of Ayurvedic concepts and modern toxicology was undertaken.

3. Results

3.1 Sources and Types of Environmental Toxicants

Environmental toxicity refers to the adverse physiological and biochemical effects resulting from prolonged or acute exposure to harmful substances present in the environment. Environmental toxicants arise from industrial, agricultural, vehicular, domestic, and occupational sources[8-11].

Table 1: Types of Environmental Toxicants

Sl. No.	Category	Examples	Sources	Health Effects
1.	Heavy metals	Lead, mercury, arsenic, cadmium	Water, soil, industry	Neurotoxicity, nephrotoxicity
2.	Pesticides	Organophosphates, carbamates, organochlorines	Agriculture	Endocrine disruption, neurotoxicity
3.	Air pollutants	PM2.5, SO ₂ , NO ₂ , CO	Vehicles, industries	Respiratory, cardiovascular diseases
4.	Industrial chemicals	BPA, dioxins, PCBs	Plastics, factories	Endocrine disorders, cancer
5.	Plasticizers	Phthalates, microplastics	Packaging	Reproductive toxicity
6.	Volatile organic compounds (VOCs)	Benzene, formaldehyde	Paints, fuels	Carcinogenicity
7.	Persistent organic pollutants (POPs)	DDT, dioxins	Agriculture, waste	Bioaccumulation, immune toxicity
8.	Radiation	Ionizing radiation, radioactive waste	Nuclear plants	Cancer, genetic mutations
9.	Biological toxins	Bacteria, viruses, endotoxins	Water, food	Infectious diseases

10.	Nanoparticles	Engineered nanomaterials	Industry, cosmetics	Cellular toxicity (emerging risk)
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3.2 Mechanisms of Toxicity

Environmental toxicants induce disease through a variety of interconnected molecular and systemic mechanisms that ultimately disrupt normal physiological homeostasis:

- **Oxidative Stress:** wherein excessive generation of reactive oxygen species (ROS) leads to damage of cellular components such as DNA, proteins, and lipids. This process contributes to the development of cancer, accelerates aging, and plays a key role in neurodegenerative disorders [3,8].
- **Chronic inflammation:** characterized by sustained activation of pro-inflammatory cytokines such as interleukin-6 (IL-6) and tumour necrosis factor-alpha (TNF- α). Persistent inflammatory responses lead to tissue damage and are implicated in conditions like arthritis and cardiovascular diseases [8,9].
- **Endocrine Disruption:** interfering with hormonal balance by mimicking or blocking natural hormones. Chemicals such as bisphenol A (BPA) and phthalates alter endocrine signalling, resulting in disorders such as infertility, polycystic ovarian syndrome (PCOS), and thyroid dysfunctions [4,10,18].
- **Neurotoxicity:** particularly associated with exposure to heavy metals like lead and mercury. These substances damage neuronal structures and impair neurotransmission, contributing to neurological disorders such as Alzheimer's disease, Parkinson's disease, and developmental conditions like autism spectrum disorders [11,14,17].
- **Mitochondrial Dysfunction:** by impairing the production of adenosine triphosphate (ATP), the primary energy currency of the cell. This disruption leads to decreased cellular energy availability, manifesting clinically as chronic fatigue syndromes and various metabolic disorders [8].
- **Epigenetic Changes:** Altered gene expression leading to increase susceptibility to diseases and may even be transmitted across generations [12].
- **Bioaccumulation:** , particularly those that are lipophilic in nature. These substances accumulate in adipose tissues over time, leading to chronic, low-grade toxicity[8,13,15].
- These mechanisms correlate with *Ama*, *Dosha Dushti*, and *Dhatu Kshaya*.

3.3 Dooshivisha: Classical Perspective [5-7]

Dooshivisha is defined as any form of poison—whether *sthavara* (plant-derived), *jangama* (animal-derived), or *krित्रima* (artificial/toxic compounds)—that is not completely eliminated from the body and persists in a weakened, latent form.

Pathogenesis:

The pathophysiology of *Dooshivisha* involves a gradual and complex internal process.

- **Kapha avarana** → leads to encapsulation of the toxin, preventing its elimination and allowing it to remain hidden in the body.

- **Srotorodha** → obstruction of bodily channels, which interferes with normal physiological transport mechanisms.
- **Dhatu dushti** → indicating progressive vitiation and damage to body tissues.
- **Ojas kshaya** → reflecting a decline in immunity and vitality, making the individual more susceptible to disease.
- **Dooshivisha** can remain dormant for prolonged periods, even years, and manifests clinically only when triggered by specific internal or external factors.
- The aggravation or activation of **Dooshivisha (prakopa kala)** is influenced by various environmental and lifestyle factors. These include exposure to cloudy or damp weather conditions, contact with cold winds, habitual day sleep (*divaswapna*), indigestion (*ajirna*), and intake of improper or incompatible diet [5-7].

3.4 Clinical Features[6]

Clinically, **Dooshivisha** presents with a wide spectrum of symptoms that reflect systemic involvement.

- **Skin disorders** (exfoliation, urticaria, discoloration, several skin disorders)
- **Gastrointestinal symptoms** (indigestion, vomiting, diarrhoea, intoxication after meals, ascites)
- **Neurological manifestations** (syncope, stammering speech, altered mental status, confusion)
- **Reproductive dysfunction** (*shukra kshaya*, signifying reproductive impairment or infertility)
- Overall, these manifestations highlight the multisystemic nature of **Dooshivisha** and its resemblance to chronic toxicological disorders described in modern medicine.

3.5 Correlation between **Dooshivisha** and Environmental Toxicants [20-21]

Sl. No.	Modern Toxicology	Dooshivisha Siddhanta
1.	Chronic exposure	Alpa-matra visha
2.	Bioaccumulation	Sthayi visha
3.	Latency	Avyakta avastha
4.	Multisystem disease	Tridoshaja vyadhi
5.	Inflammation	Dosha prakopa

These similarities underscore the relevance of Ayurvedic toxicology in understanding modern environmental health challenges. The mechanisms through which environmental toxicants act—such as oxidative stress, chronic inflammation, and metabolic disruption—can be conceptually correlated with classical Ayurvedic principles like *Ama* formation, *Dosha dushti* (vitiation of functional bio-elements), and *Srotorodha* (obstruction of microchannels).

3.6 Dushita Vayu, Jala, Desha [6]

- **Dushita Vayu:** Air pollution → asthma, COPD
- **Dushita Jala:** Water contamination → infections, toxicity
- **Dushita Desha:** Soil pollution → food toxicity

3.7 Therapeutic Approaches

Management of *Dooshivisha* and environmental toxicant-induced disorders involves a combination of detoxification, elimination, and restoration strategies as described in *Agadatantra*.

Shodhana (Bio-purificatory Therapies)

Shodhana plays a central role in eliminating accumulated toxins from the body. Patient should be first fomented and then cleansed by procedures such as *Vamana* (therapeutic emesis), *Virechana* (purgation), and *Basti* (medicated enema) facilitate the expulsion of toxins through the gastrointestinal and systemic pathways. These interventions help in clearing *Srotorodha* (channel obstruction) and restoring *Dosha* balance, which is essential in chronic toxicity conditions resembling *Dooshivisha* [5-7].

Agada Therapy

Agada formulations are specific antidote preparations indicated in toxic conditions. The combination of herbs such as *Pippali*, *Pippalimula*, *Dhyamaka*, *Jatamamsi*, *Lodhra*, *Ela*, *Suvarchika*, *Shyonaka*, *Nata*, *Kusta*, *Yasti*, *Chandana* and *Gairika* is called as *Dooshivishari Agada*. This formulation when consumed with honey is useful in managing latent toxicity by neutralizing residual poisons and preventing disease progression. These formulations act at both systemic and cellular levels to counteract toxin-induced damage [7, 20,21].

Raktamokshana (Bloodletting Therapy)

Raktamokshana is indicated in conditions where toxins are localized in the blood and peripheral tissues. Techniques such as *Jalaukavacharana* (leech therapy) help remove vitiated blood and reduce inflammatory manifestations, especially in skin disorders and chronic inflammatory conditions associated with toxin accumulation [7].

Preventive strategies

Ayurveda places strong emphasis on *Dinacharya* (daily regimen) and *Ritucharya* (seasonal regimen) to maintain physiological equilibrium. These routines support *Agni* (digestive and metabolic fire), prevent *Ama* (undigested

metabolic residue), and improves *Ojas*, thus reducing accumulation of environmental toxins. Regular practices such as Abhyanga (oil massage), gentle sweating (*swedana*), *pranayama*, and sleep hygiene align with modern concepts of enhancing both detoxification pathways and immune resilience [21].

4. Discussion

Environmental toxicants act as chronic low-dose poisons producing cumulative systemic damage, closely resembling *Dooshivisha*. The concepts of *Dushita Vayu*, *Jala*, and *Desha* highlight the ecological basis of disease causation, aligning with modern environmental science.

Modern toxicology explains molecular mechanisms including oxidative stress, endocrine disruption, and inflammation [3,4,8–12], while Ayurveda provides a systemic framework involving *Ama* formation, *Dosha* imbalance, and *Srotorodha*. The integration of these perspectives emphasizes the need for preventive, detoxifying, and restorative approaches.

Ayurvedic therapies such as *Shodhana* and *Rasayana* complement modern strategies aimed at pollution control and exposure reduction, supporting an integrative model for managing chronic diseases.

5. Conclusion

Environmental toxicants significantly contribute to chronic diseases through cumulative toxicity. *Dooshivisha Siddhanta* provides a comprehensive framework to understand and manage such conditions. Thus, the convergence of Ayurvedic and modern scientific frameworks supports the development of integrative strategies for the prevention and management of chronic diseases associated with environmental toxicants.

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