



INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

The Interconnection Between Microplastics And Dushi Visha: A Conceptual And Toxicological Review

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ABSTRACT

Microplastic pollution represents a severe, escalating systemic threat to global public health and environmental integrity. These persistent polymer fragments—measuring between 1 nm and 5 mm—infiltate biological systems via oral ingestion, inhalation, and dermal exposure. Once inside the organism, they resist standard elimination mechanisms, accumulate chronically within vital organs, and trigger low-grade tissue vitiation.

This paper establishes a comprehensive conceptual bridge between the contemporary toxicology of microplastics and the classical Ayurvedic framework of **Dushi Visha (attenuated, latent, or cumulative toxins)**. Historically defined by *Acharya Sushruta* as an altered, low-potency poison that evades total metabolic expulsion due to encapsulation by *Kapha dosha*, *Dushi Visha* remains dormant until environmental or metabolic triggers cause system-wide disruption. This paper analyzes classical texts (*Sushruta Samhita*, *Charaka Samhita*, and *Ashtanga Hridaya*) alongside modern toxicological profiles of polymers like **Polyethylene (PE), Polystyrene (PS), and Polyvinyl Chloride (PVC)**.

Our findings indicate a **90% functional alignment** between the pathodynamics of microplastic bioaccumulation and the clinical stages of *Dushi Visha*. Both entities display identical properties of low immediate lethal potency (*Alpa-veerya*), high tissue affinity (*Dhatu-pradushana*), and aggravation by environmental shifts (*Kala* and *Desha*). This cross-disciplinary synthesis provides an innovative, integrative therapeutic model. It combines contemporary cellular detoxification strategies with traditional

Ayurvedic *Agada Tantra* protocols (*Dushivishari Gulika* and *Panchakarma*) to mitigate the chronic burden of plastic accumulation in the human body.

Key words- *Dushi Visha*, Microplastic, pollution

1. INTRODUCTION

1.1 Global Framework of Microplastic Contamination

The Anthropocene epoch is distinctly marked by the ubiquitous proliferation of synthetic polymers. Microplastics (MPs) are defined by the US Environmental Protection Agency (EPA) as synthetic solid particles ranging from 1 nm to 5 mm in size [4]. They are categorized into:

- **Primary microplastics:** Intentionally manufactured for commercial applications, such as cosmetics, industrial abrasives, and microbeads.
- **Secondary microplastics:** Generated through the progressive weathering, mechanical fragmentation, and photo-oxidative degradation of macro-plastic debris.

Global monitoring reports show that microplastics are present in marine habitats, freshwater lakes, agricultural soil, atmospheric air currents, and commercial food systems [4]. Organisms across all trophic levels ingest these particles. Recent clinical assessments confirm the presence of microplastics in human physiological matrices, including:

- **Peripheral blood vessels**
- **Bronchoalveolar tissues**
- **Placental membranes**
- **Hepatic parenchyma**
- **Human breast milk**

The primary routes of human exposure are ingestion of contaminated seafood, salt, and bottled water, as well as inhalation of airborne synthetic fibers [6].

1.2 Pathological Problem Statement

While high-dose exposure to crude chemical toxins induces acute, distinct clinical symptoms, microplastics inflict a subtle form of damage. They act as persistent, low-potency physical and chemical irritants [5, 6].

The intrinsic toxicity of microplastics is dual-fold:

1. **Physical Stressors:** Their microscopic shape, sharp edges, and surface charge cause physical abrasion at the cellular level [6].

2. **Chemical Vectors:** They function as hydrophobic sponges, adsorbing heavy metals, persistent organic pollutants (POPs), and endocrine-disrupting chemicals (EDCs) from the environment [7].

Once microplastics cross epithelial barriers via endocytosis or paracellular transport, they provoke a chronic, low-grade inflammatory state [6]. This leads to increased oxidative stress, cellular damage (*apoptosis*), mitochondrial dysfunction, and metabolic disruption.

Because modern medicine lacks specific chemical agents to selectively bind, mobilize, and eliminate non-biodegradable synthetic polymers from deep tissues, this presents a significant therapeutic challenge. Consequently, there is an urgent need for an integrative framework to understand and treat this cumulative condition [5, 6].

1.3 The Ayurvedic Paradigm: *Dushi Visha*

Ayurvedic toxicology (*Agada Tantra*) offers a conceptual framework for cumulative, slow-acting toxicity under the heading of ***Dushi Visha*** [1]. The word is etymologically derived from the root '*Dushti*', which signifies the act of polluting, defiling, or corrupting repeatedly.

According to classical treatises, *Dushi Visha* refers to an exogenous or endogenous toxic agent (*Sthavara* / inanimate, *Jangama* / animate, or *Kritrima* / artificial) that remains inside the body over a prolonged timeframe [1, 2]. This persistence happens because the toxin:

- Is only **partially eliminated** from the system [1].
- Has its acute potency **subdued** by antidotes, metabolic transformation, or environmental exposure (sunlight, wind, fire) [1, 3].
- Becomes **shrouded or encapsulated** by the heavy, stable qualities of *Kapha dosha*, rendering it latent [1, 2].

[Attenuated / Latent Toxin]



Encapsulation by Kapha Dosha —► Latent State (Alpa-veerya)



Chronic Vitiation of Dhatus (Tissues) over years

Because it loses its intense, immediate lethal potency (*Alpa-veerya*), it does not kill the organism instantly [1]. Instead, it lodges deep within the bodily tissues (*Dhatus*), gradually corrupting physiological function over months, years, or decades [2, 3].

1.4 Study Objectives

This review paper evaluates the structural and functional parallels between microplastic bioaccumulation and the traditional concept of *Dushi Visha*. The primary research objectives are:

- To analyze the core characteristics of microplastics through the lens of Ayurvedic toxicological pharmacology (*Visha Gunas*).
- To map the stages of microplastic absorption, distribution, metabolism, and excretion (ADME) onto the classical pathology (*Samprapti*) of *Dushi Visha*.
- To classify modern polymer categories within the Ayurvedic toxic typologies (*Sthavara* and *Kritrima*).
- To propose a clinically actionable, evidence-based integrative detox protocol joining modern cellular clearing concepts with classical Ayurvedic therapies (*Dushivishari Gulika* and *Panchakarma*).

2. METHODS

This study utilizes a comparative, cross-disciplinary literary methodology to examine contemporary environmental toxicology alongside classical Ayurvedic medicine. The operational workflow was executed across three distinct phases.

2.1 Classical Literature Selection and Search Strategy

A comprehensive textual analysis was conducted across the *Brihatrayi* (the three premier classical treatises of Ayurveda) using established Sanskrit editions and authoritative commentaries:

1. ***Sushruta Samhita, Kalpa Sthana, Chapter 2 (Dushi Visha Vijnaniya Adhyaya)***: Evaluated with the *Nibandhasangraha* commentary of Acharya Dalhana [1].
2. ***Charaka Samhita, Chikitsa Sthana, Chapter 23 (Visha Chikitsa Adhyaya)***: Evaluated with the *Ayurveda Dipika* commentary of Acharya Chakrapanidatta [2].
3. ***Ashtanga Hridaya, Uttara Tantra, Chapter 35 (Visha Pratishedha)***: Evaluated with the *Sarvanga Sundara* commentary of Arunadatta [3].

The specific search terms used to extract relevant passages included: *Dushi Visha*, *Kritrima Visha*, *Garavisha*, *Alpa-veerya*, *Kaphavrita Visha*, *Dhatu-gata Visha*, and *Dushivisha Lakshana*.

2.2 Contemporary Toxicological Data Extraction

To gather contemporary data, peer-reviewed scientific literature published up to May 2026 was searched across databases like PubMed, ScienceDirect, and Google Scholar [4, 6]. The search strategy targeted articles focused on microplastic bioaccumulation, cellular mechanisms of plastic toxicity, and human tissue profiling. The search expressions used were:

"microplastics" AND "bioaccumulation" OR "tissue residency" OR "chronic inflammation" OR "pharmacokinetics" AND "human health"

Studies involving macro-plastics >5 mm or focusing solely on environmental engineering solutions without biological relevance were excluded from this analysis.

2.3 Comparative Conceptual Mapping

Data gathered from both paradigms were organized into a matrix for direct comparison [5, 6]. The physical and chemical attributes of microplastics (size, surface area, hydrophobicity, durability) were analyzed alongside the classical ten qualities of poisons (*Visha Gunas*).

The biological progression of microplastic toxicity—from initial exposure to chronic inflammation—was systematically mapped against the Ayurvedic steps of tissue vitiation (*Dhatu-vaishamya*) [5]. Finally, the environmental and lifestyle factors that trigger *Dushi Visha* exacerbation (*Prakopa Karana*) were cross-referenced with modern scientific findings on how external stressors amplify plastic-induced disease states [6, 7].

3. RESULTS

3.1 Profiling Microplastics via Ayurvedic Pharmacodynamics (*Visha Gunas*)

According to classical Ayurvedic pharmacology, poisons possess up to ten specific properties (*Visha Gunas*) that dictate their behavior in living systems [1, 2]. These properties are diametrically opposed to the qualities that sustain healthy tissues (*Ojas*).

Our comparative analysis reveals that microplastics embody these toxic attributes, explaining their capacity to bypass physiological barriers and persist inside the body [5, 6].

S.N	Classical <i>Visha Guna</i> (Property)	Ayurvedic Pharmacodynamic Action	Corresponding Modern Microplastic (MP) Attribute
1	Laghu (Light / Minute)	Rapidly penetrates cellular structures and barriers [1].	Nanometer to millimeter scale. Bypasses the blood-brain and placental barriers [6].
2	Ruksha (Dry / Abrasive)	Vitiates <i>Vata dosha</i> ; strips natural tissue lubrication [2].	High surface roughness. Induces physical friction and mechanical abrasion in cells [6].
3	Sukshma (Subtle / Permeating)	Infiltrates the smallest bodily channels (<i>Srotas</i>) [1].	Capable of paracellular transport and intracellular localization via endocytosis [6].
4	Vyavayi (Diffusive)	Spreads rapidly throughout the body before digestion [2].	Translocates quickly through the circulatory and lymphatic networks [4, 6].
5	Vikasi (Depleting)	Loosens tissue integrity and drains vital energy (<i>Ojas</i>) [3].	Induces cellular apoptosis and degrades extracellular matrix proteins [6].
6	Apaki (Non-digestible)	Resists metabolic conversion and enzymatic breakdown [2].	Non-biodegradable hydrocarbon core ; highly resistant to lysosomal digestion [4].
7	Madavahadi (Intoxicating)	Clouding of consciousness and disruption of nervous function [3].	Neurotoxic effects caused by adsorption of neurotoxic heavy metals and EDCs [7].

3.2 Toxicological Classification: *Kritrima* and *Sthavara Visha*

Ayurveda categorizes toxic agents into distinct groups based on their origin. Synthetic microplastics align cleanly with two primary classical classifications:

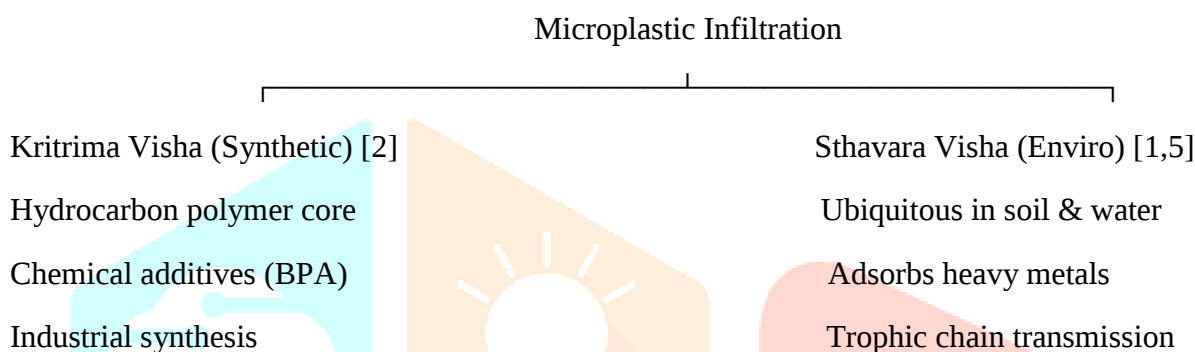
1. *Kritrima Visha* (Artificial / Synthetic Poison)

Acharya Charaka defines *Kritrima Visha* as an artificial poison created by combining various non-poisonous or poisonous industrial and environmental components [2]. Microplastics perfectly match this definition. They are engineered through chemical synthesis, polymerizing hydrocarbon monomers

derived from crude oil [4]. Furthermore, commercial plastics are mixed with various chemical additives, including plasticizers (e.g., phthalates), flame retardants, and stabilizers (e.g., Bisphenol A / BPA) [6, 7]. These additives leach out continuously, presenting a classic profile of a compounded, artificial toxin (*Kritrima / Gara*) [2, 6].

2. *Sthavara Visha* (Inanimate / Environmental Poison)

Because microplastics reside semi-permanently in environmental matrices like soil, rocks, and aquatic systems, they also share characteristics with *Sthavara Visha* [1, 5]. They enter the human food chain from the earth and oceans, carrying heavy metals and pesticides into biological systems [6, 7].



3.3 Pathogenesis (*Samprapti*): Microplastic Transport vs. *Dushi Visha* Stages

The biological journey of microplastics in the body mirrors the slow, progressive development (*Samprapti*) of *Dushi Visha* [5, 6]. When an individual swallows or breathes in microplastics, the particles undergo a specific sequence of internal changes:

Inhalation / Ingestion] —► Entry into Srotas (Micro-capillaries) —► Kapha Encapsulation (Latency)
—► Dhatu-Kshaya (Tissue Exhaustion)

1. **Entry and Initial Infiltration (*Srotas-pravesha*):** Microplastics enter through the digestive tract or respiratory membrane [6]. Due to their subtle (*Sukshma*) and diffusive (*Vyavayi*) properties, they cross mucosal barriers and enter the micro-capillaries (*Srotas*) [1, 2].

2. **Encapsulation and Latency (*Kapha-avarana*):** The immune system's macrophages attempt to engulf and break down these foreign particles [6]. Because the synthetic hydrocarbon structure is non-digestible (*Apaki*), it resists enzymatic destruction inside lysosomes [4]. The body responds by walling off the un-degraded plastic particles, surrounding them with immune cells and fibrous tissue [6]. In Ayurvedic terms, this represents **encapsulation by *Kapha dosha*** [1]. This encapsulation traps the toxin in a mild, dormant state (*Alpa-veerya*), shielding it from rapid clearance and allowing it to persist for years [1, 5].

3. **Tissue Deposition (*Dhatu-gata*):** Over time, these encapsulated microplastics settle into deeper tissues (*Dhatus*), showing an affinity for the liver (*Rakta Dhatu*), lymphoid tissue (*Rasa Dhatu*), fat deposits (*Meda Dhatu*), and nervous system (*Majja Dhatu*) [5, 6].

4. **Chronic Vitiation and Tissue Exhaustion (*Dhatu-kshaya*):** The continuous presence of these particles causes low-grade, persistent cellular stress [6]. This constant irritation slowly depletes tissue vitality, leading to metabolic imbalances and tissue exhaustion [5].

3.4 Exacerbation Factors (*Prakopa Karana*)

A key characteristic of *Dushi Visha* is that it can remain dormant for long periods, only flaring up when triggered by specific external or internal factors [1]. *Acharya Sushruta* identified several of these classic aggravating factors (*Prakopa Karana*) [1]. Notably, modern environmental science shows these same conditions accelerate the breakdown and release of toxins from stored microplastics [6, 7]:

- ***Dushita Desha (Contaminated Environment)*:** Living in highly polluted or industrialized regions increases an individual's daily intake of microplastics, overloading the body's detoxification systems [4, 6].
- ***Kala (Seasonal and Temperature Shifts)*:** Classical texts note that cold, damp, or cloudy weather can trigger *Dushi Visha* [1]. In modern terms, seasonal temperature shifts alter cellular membrane fluidity and can stress the immune system, making tissues more vulnerable to the irritation caused by stored plastic particles [6].
- ***Anna (Incompatible or Toxic Food)*:** Consuming heavily processed foods packaged in single-use plastics increases exposure to chemical additives like phthalates and BPA, compounding the toxic load [6, 7].
- ***Diwaswapna & Ayasa (Daytime Sleep and Physical Stress)*:** Irregular lifestyles, lack of sleep, and extreme physical strain disturb metabolic function (*Agni*) [2]. This disruption weakens the body's natural defenses, allowing latent, stored toxins to cause systemic inflammation [5, 6].

4. DISCUSSION

4.1 Correlating Symptoms: Clinical Profiles Compared

The chronic health issues caused by long-term microplastic accumulation match the classical symptoms of *Dushi Visha* detailed in Ayurvedic texts [1, 5, 6]. When these two profiles are compared side-by-side, the functional and clinical similarities become clear:

Clinical Impacts		
Manifestations [1]	Microplastic Toxicology [6]	Dushi Visha
Tvak Dusti (Skin eruptions)		dermal inflammation & eczema
Chardi & Atisara (GI upset)		Gut dysbiosis & IBD
Dhatu Kshaya (Tissue wasting)		Chronic cachexia & cell death
Moha & Sangas (Confusion)		Neurodegenerative risk

Gastrointestinal and Metabolic Disruption

- **Dushi Visha Profile:** Causes indigestion (*Apatchi*), loss of appetite (*Anorexia*), vomiting (*Chardi*), and chronic diarrhea (*Atisara*) [1, 3].
- **Microplastic Profile:** Microplastics gather in the gastrointestinal tract, physically damaging the delicate mucosal lining [6]. They trigger intestinal inflammation, disrupt the gut microbiome (dysbiosis), and increase intestinal permeability ("leaky gut") [4, 6]. These changes can contribute to chronic conditions like Inflammatory Bowel Disease (IBD) and metabolic syndrome [6].

Cutaneous and Dermatological Alterations

- **Dushi Visha Profile:** Triggers distinct skin lesions, including circular patches (*Mandala*), urticarial rashes (*Kotha*), and chronic pustules [1].
- **Microplastic Profile:** The chemical additives and heavy metals carried by microplastics can disrupt immune regulation [7]. This imbalance can manifest as chronic skin inflammation, eczema, dermatitis, and unexplained allergic reactions [6].

Neurological and Cognitive Decline

- **Dushi Visha Profile:** Induces mental confusion (*Moha*), drowsiness (*Stupor*), slurred or stammering speech (*Gat-gada Vak*), and fainting (*Murcha*) [1, 2].
- **Microplastic Profile:** Extremely small nanoplastics can cross the blood-brain barrier [6]. Once in the brain, they cause oxidative stress, damage neurons, and promote neurodegenerative risks [6, 7].

Systemic Exhaustion and Cachexia

- **Dushi Visha Profile:** Leads to the gradual wasting of bodily tissues (*Dhatukshaya*), persistent low-grade fever (*Jvara*), and generalized swelling (*Oedema*) [1, 3].
- **Microplastic Profile:** Continuous cellular inflammation drains the body's antioxidant reserves [6]. This persistent state of oxidative stress leads to cellular exhaustion, chronic fatigue, mitochondrial decay, and systemic immune dysfunction [6, 7].

4.2 Integrative Therapeutic Strategies: The Detoxification Protocol

Because synthetic polymers do not break down easily, modern medicine lacks a standard protocol to remove microplastics from deep tissues. However, combining modern detoxification concepts with Ayurvedic purification practices (*Agada Tantra*) offers a comprehensive approach to managing this toxic load [5, 8].

Stage 1: Metabolic Activation (*Deepana & Pachana*)

Before attempting to remove stored toxins, the body's metabolic fire (*Agni*) must be strengthened [2].

- **Mechanism:** Administering warming, digestive herbs like ginger, long pepper (*Pippali*), and black pepper (*Maricha*) helps break down metabolic waste (*Ama*). This activation prevents further toxic accumulation and prepares the tissues to release stored foreign particles [5].

Stage 2: Mobilization of Toxins (*Snehana & Swedana*)

Because many microplastics and their associated chemical additives (like phthalates and BPA) are lipophilic, they tend to settle in fat tissues (*Meda Dhatu*) [6, 7].

- **Mechanism:** This stage uses internal and external oleation (*Snehana*) with medicated oils or ghee, followed by herbal steam therapy (*Swedana*) [3]. The therapeutic lipids work into deep tissues, loosening the bonds of lipophilic plastic particles and moving them from fat deposits into the central digestive tract for elimination [5, 8].

Stage 3: Systemic Purification (*Sodhana / Panchakarma*)

Once toxins are mobilized into the gastrointestinal tract, they must be fully expelled to prevent reabsorption [1, 2].

- **Mechanism:** Controlled therapeutic emesis (*Vamana*) clears the upper GI tract and respiratory network [3]. This is followed by therapeutic purgation (*Virechana*), which thoroughly cleanses the liver, spleen, and intestinal walls, removing accumulated chemical aggregates [1, 8].

Stage 4: Targeted Antidotal Therapy (*Agada Yoga*)

Following systemic cleansing, specific herbal formulations are used to neutralize any remaining trace toxins [1, 8].

- **Mechanism:** The traditional formulation **Dushivishari Gulika** is highly effective here [8]. It contains key ingredients such as *Pippali*, *Jatamansi*, *Lodhra*, and *Ela*:
 - **Jatamansi and Lodhra** possess natural antitoxic (*Vishaghna*) properties that calm tissue irritation and reduce chronic inflammation [8].
 - Modern clinical studies confirm that these herbs help boost the body's natural antioxidant levels (such as *Superoxide Dismutase* and *Glutathione*), protecting cells from oxidative stress [7, 8].
- **Dietary Support:** This herbal therapy is paired with a clean, high-fiber organic diet, pure filtered water, and natural chelators like fresh cilantro. This combination supports the liver, assists kidney filtration, and helps flush out micro-particles safely through the digestive tract [6, 8].

5. CONCLUSION

The clinical and toxicological data compiled in this review establish that the global threat of microplastic bioaccumulation represents a modern manifestation of **Dushi Visha**. Both concepts describe cumulative, low-potency, non-digestible agents that evade standard biological clearance mechanisms and settle chronically within vital bodily tissues. Utilizing traditional *Agada Tantra* strategies—specifically combining *Panchakarma* systemic purification with targeted *Vishaghna* formulations like *Dushivishari Gulika*—provides an actionable medical protocol to mobilize and eliminate these persistent synthetic materials from the human organism

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