Review Article

www.ijrap.net

(ISSN Online:2229–3566, ISSN Print:2277–4343)

A REVIEW ON EFFECTS OF VARIOUS PROCESSES ON MINERALS AND METALS OF THERAPEUTIC IMPORTANCE WITH SPECIAL REFERENCE TO SHODHAN AND MARANA IN AYURVEDA AND UNANI SYSTEMS OF MEDICINE

Sharma DK [1]*, Karunanidhi Sharma [2], Shamma [1], Amanullah Haji [3]
[1] Medical Officer, Directorate of Ayush, Jammu & Kashmir, India
[2] PhD Scholar, Department of Rasashastra and Bhaishajya Kalpana, National Institute of Ayurveda (DU), Jaipur, Rajasthan, India
[3] Associate Professor, Department of Moalajat, Govt. Unani Medical College & Hospital, Ganderbal, Kashmir, India

Received on: 16/8/24 Accepted on: 17/12/24

***Corresponding author**
E-mail: drdksmd2009@gmail.com

DOI: 10.7897/2277-4343.16256

ABSTRACT

Traditional systems of medicine like Ayurveda and Unani have utilized metals and minerals for their potent therapeutic properties for centuries. These systems emphasize the use of a diverse range of substances, including metals like gold, silver, iron, and mercury, as well as minerals such as arsenic, sulfur, and mica. Their therapeutic applications, including anti-inflammatory, antimicrobial, and rejuvenative effects, are achieved through meticulous processes such as Shodhan (purification) and Marana (calcination) in Ayurveda and Tasfiya (purification) and Tadbir (processing) in Unani medicine. These procedures transform raw, often toxic materials into safe, bioavailable forms suitable for medicinal use by removing impurities, enhancing therapeutic properties, and ensuring safety. The processes include heating, quenching, grinding, and treating with herbal decoctions, which detoxify and stabilize the substances while reducing particle size to improve bioavailability. These ancient methods, documented in branches like Rasashastra and Bhaishajya Kalpana in Ayurveda and Ilmul Saidla in Unani, reflect a sophisticated understanding of drug formulation. Modern scientific techniques such as XRD, HPTLC, ICP-MS, and SEM now complement these traditional practices, ensuring consistency and efficacy in therapeutic applications. This review explores the historical and scientific underpinnings of these methods, focusing on their role in transforming natural resources into effective medicines. By integrating traditional wisdom with modern validation, Ayurveda and Unani systems continue to provide relevant and innovative healthcare solutions, underscoring their enduring significance in contemporary medicine.

Keywords: Rasashastra, Bhasma, Kustha, Ayurveda.

INTRODUCTION

Traditional medicines have played a foundational role in global healthcare, serving as the primary form of treatment for centuries before the advent of modern medicine. Rooted in cultural heritage and local knowledge, traditional systems like Ayurveda and Unani exemplify the integration of natural resources and holistic approaches to health. These systems emphasize a balance between body, mind, and spirit, offering a preventative and therapeutic framework. Today, traditional medicines remain highly relevant, particularly in developing countries where they provide affordable healthcare solutions. Their principles are increasingly recognized for their potential to complement modern medicine, fostering integrative health approaches and inspiring new drug discoveries. The World Health Organization (WHO) recognizes traditional medicine as a vital component in achieving global health objectives, actively advocating for its regulation and integration into national healthcare systems. In a landmark move to advance this vision, the WHO established the Global Centre for Traditional Medicine in Jamnagar, India, in 2022.[1,2] This pioneering initiative serves as a global hub for promoting, researching, and preserving traditional medicine systems. It has catalyzed significant advancements in research and innovation, particularly in Ayurveda and the Unani systems of medicine, which are deeply entrenched in the rich historical and cultural heritage of the Indian subcontinent.

Ayurveda, originating in India over 3,000 years ago, is one of the oldest holistic healing systems. It is built on the principle of balancing the three doshas, Vata, Pitta, and Kapha to achieve optimal health.[3] Ayurvedic practices include herbal formulations, dietary adjustments, and detoxification methods such as Panchakarma.[4] Similarly, the Unani system, introduced to South Asia by Arab and Persian scholars, blends the teachings of Hippocrates and Galen with Islamic philosophy and traditional practices. It emphasizes the four humors, blood, phlegm, yellow bile, and black bile and their harmony within the body. Both systems offer a profound understanding of human health, disease prevention, and treatment, with a wealth of pharmacopoeias and clinical guidelines.[5] The increasing popularity of Ayurveda and Unani, both in their countries of origin and globally, highlights their enduring relevance. Research into their pharmacological basis continues to provide insights into their efficacy, further bridging traditional and modern medicinal paradigms.

In both Ayurveda and Unani, medicines derived from minerals and metals occupy a significant place in therapeutics. A wide variety of raw materials, including plant-based ingredients like *Phyllanthus emblica* and *Eclipta alba*, animal derivatives such as musk and ghee, marine products like coral and pearls, and mineral resources such as cinnabar and mica, are utilized.[6] Metals like gold, silver, and copper, as well as gemstones, are also used for their therapeutic properties. These substances undergo rigorous processing to render them safe, bioavailable, and effective. Ayurveda addresses these processes through branches like

Rasashastra and Bhaishajya Kalpana. Rasashastra focuses on the preparation and therapeutic application of metals, minerals, and other complex substances,[7] while Bhaishajya Kalpana deals with the development of various dosage forms to enhance drug palatability and efficacy.[8,9]

Similarly, in the Unani system of medicine, Ilmul Saidla (Unani Pharmacy) stands as one of its most crucial branches, focusing on the comprehensive study of drugs. This discipline encompasses the identification, procurement, processing, preparation, and therapeutic application of medicinal substances. Entirely devoted to the formulation of Unani dosage forms, Ilmul Saidla ensures the safe and effective utilization of natural and mineral resources in Unani therapeutics. The field also integrates the teaching of Murakkabat (Unani Compound Formulations), offering a systematic understanding of the development and application of compound medicinal preparations within the Unani framework.[10]

Both Ayurveda and Unani systems of medicine have long recognized the therapeutic potential of metals and minerals, incorporating them as integral components of their pharmacological frameworks. Metals such as gold, silver, iron, and mercury, along with minerals like arsenic, sulfur, and mica, are frequently utilized in their formulations for their diverse therapeutic properties, including anti-inflammatory, antimicrobial, and rejuvenative effects. The preparation of these medicines involves meticulous traditional methods, such as repeated calcination and trituration, to convert raw materials into bioavailable and safe forms. This ancient wisdom, preserved through generations, is now being complemented by modern scientific techniques to validate and enhance its therapeutic potential.[11,12]

The processes involved in preparing these substances are crucial not only for ensuring their safe use but also for achieving the desired therapeutic outcomes. This article delves into the foundational techniques employed in both systems, with a focus on Shodhana (purification) and Marana (calcination). These specialized procedures, including heating, quenching, boiling, roasting, melting, pouring, triturating, and wet grinding, are designed to eliminate impurities and transform raw mineral sources into bioactive medicinal forms. By examining the changes and observations associated with these processes, alongside their theoretical underpinnings, this paper aims to provide a comprehensive understanding of the traditional practices. The objective is to explore the utilization of metals and minerals in Ayurveda and Unani medicine, shedding light on the intricate methods these substances undergo before their therapeutic application.

METALS AND MINERALS USED

In both Ayurveda and the Unani system of medicine, metals and minerals hold a significant place due to their potent therapeutic properties. In Ayurveda, metals like gold (Suvarna), silver (Rajata), iron (Loh), copper (Tamra), and especially mercury (Parada) are widely used. Mercury is the chief material in Ayurveda, particularly in Rasa Shastra, and the entire practice revolves around its potentiation. To enhance mercury's properties, it is combined with various materials classified into several groups: Maha rasa, Uparasa, Sadharana rasa, Ratnas (gemstones), Dhatus (metals), Updhatus (sub-metals or minerals), Visha (poisons), and Upvisha (semi-poisons). These groups include not only metals and minerals but also certain animal and vegetable products. Most of these materials are inherently poisonous and cannot be administered without proper processing, as they may cause adverse effects. Therefore, rigorous purification processes like Shodhan and Marana are essential to transform these substances into safe, bioavailable forms suitable for therapeutic use.

Similarly, the Unani system employs metals like gold (Tila), silver (Nuchrah), iron (Fulad), and minerals such as arsenic (Zarnikh), sulfur (Gandhak), and mica (Abhrak). In Unani medicine, these substances are categorized based on their temperament (Mizaj) and therapeutic effects, aligning with the four humors: Dam (blood), Balgham (phlegm), Safra (yellow bile), and Sauda (black bile). Unani medicine also emphasizes detoxification processes, such as Tasfiya and Tadbir, to ensure the safety and efficacy of these materials.

Both systems underscore the importance of meticulous classification and processing, reflecting a sophisticated understanding of natural substances. This ancient knowledge, passed down through generations, is now being integrated with modern scientific techniques to validate its therapeutic potential. This integration highlights the profound, timeless wisdom inherent in Ayurveda and Unani medicine, continuing to offer unique and effective treatments for a wide range of health conditions.

PROCEDURES

In both Ayurveda and the Unani system of medicine, extensive and meticulous processes are carried out to prepare metals and minerals for safe and effective use in the human body. These processes transform raw, often toxic, substances into therapeutic forms suitable for medicinal purposes.

Ayurveda

In Ayurveda, the primary processes involved are Shodhan (purification) and Marana (calcination), both crucial procedures within Rasa Shastra. Shodhan and Marana are integral steps in the overall Marana (incineration) process, which transforms hard, solid, heavy, and compact minerals and metals into soft, smooth, loose, light, and voluminous forms suitable for therapeutic use. These meticulous procedures ensure that the metals and minerals used in Ayurveda are safe, effective, and optimized for their intended therapeutic applications. The integration of ancient wisdom and modern scientific validation underscores the significance and efficacy of these traditional practices in contemporary medicine.

Shodhan (Purification): Shodhan involves various techniques such as heating, boiling, dipping/quenching, roasting, and firing. These procedures detoxify and purify the raw materials, making them safe for consumption. During Shodhan, minerals and metals are treated with specific herbs or their extracts. The interaction with these organic substances induces chemical reactions that help purify the materials. For instance, when heated substances are suddenly quenched in herbal decoctions, microcracks develop, making the material brittle and easier to grind into fine particles. Shodhan is essential for detoxifying raw metals and minerals, removing impurities, and reducing toxicity. The following techniques are commonly used:

- **Swedana (Steam Boiling)**: Metals and minerals are boiled in specific herbal decoctions. For instance, Tamra (copper) is boiled in Triphala decoction to remove impurities.
- **Mardana (Grinding)**: The substances are ground with herbal juices or decoctions. For example, Abhraka (mica) is ground with aloe vera juice.
- **Bhavana (Levigation)**: This involves repeated grinding with specific liquids to enhance the potency of the substance. For

example, Shilajit is triturated with cow's milk.[13] (Figures 1-5)

Marana (Calcination): Marana further processes these purified materials through calcination. This involves controlled heating in earthen crucibles, often followed by quenching in herbal liquids. This repeated heating and quenching cycle transforms the material into a fine ash (Bhasma), ensuring it is bioavailable and safe for medicinal use. The material is repeatedly ground and triturated during this process, making it easy to incorporate into therapeutic formulations. Marana involves converting purified metals and minerals into fine, bioavailable ash (Bhasma), which is safe for human consumption. The steps include:

- **Heating**: The purified substance is subjected to controlled heating in a closed crucible (Sharava Samputa). For example, Suvarna (gold) is heated until it turns into ash.
- **Quenching**: The heated substance is repeatedly quenched in various herbal decoctions or liquids. For example, Parada (mercury) is repeatedly quenched in lemon juice.
- **Trituration**: The substance is ground into a fine powder to ensure complete conversion into ash. For example, Tamra Bhasma (copper ash) is finely ground after calcination.[14] (Figures 6-8)

Unani Medicine

In the Unani system, similar meticulous processes ensure the safety and efficacy of metals and minerals for medicinal use:

Tasfiya (Purification): Tasfiya involves cleaning and detoxifying the metals and minerals to make them safe for therapeutic use. The methods include:

- **Boiling**: Metals and minerals are boiled in water or specific herbal decoctions. For example, Fulad (iron) is boiled in vinegar to remove impurities.
- **Soaking**: Substances are soaked in liquids to leach out impurities. For example, silver is soaked in lemon juice for purification.

Tadbir (Processing): Tadbir encompasses various techniques to enhance the therapeutic properties and safety of the substances. These include:

- **Calcination**: Similar to Marana in Ayurveda, metals and minerals are heated to convert them into ash or calx. For example, Kushta-e-Sadaf (calx of pearl) is prepared by repeated calcination.
- **Levigation**: Substances are ground with liquids to create a fine powder. For example, Kushta-e-Fulad (calx of iron) is levigated with rose water.[15,16]

Common Techniques in Both Systems

Both Ayurveda and Unani share some common processes, such as:

- **Repeated Calcination and Trituration**: Ensuring that the metals and minerals are converted into fine, bioavailable forms suitable for therapeutic use. This involves multiple cycles of heating, quenching, and grinding.
- **Herbal Juices and Decoctions**: Using specific plant-based liquids to aid in detoxification and enhance the therapeutic properties of the metals and minerals. For example, the use of aloe vera juice in Ayurveda and rose water in Unani medicine.

Detailed Processing Techniques

Shodhan (Purification) in Ayurveda

- **Swedana (Steam Boiling)**: Substances are wrapped in cloth and boiled in a decoction of specific herbs to remove soluble impurities.
- **Mardana (Grinding)**: Substances are ground with herbal juices, enhancing their bioavailability and reducing toxicity.
- **Bhavana (Levigation)**: Substances are triturated with specific liquids for several hours or days to achieve the desired therapeutic properties.

Marana (Calcination) in Ayurveda

- **Controlled Heating**: The substance is placed in earthen crucibles and heated to high temperatures. This process may be repeated several times.
- **Quenching**: After heating, the substance is immediately quenched in herbal liquids to enhance its properties and reduce toxicity.
- **Grinding**: The resulting ash is finely ground to ensure uniformity and bioavailability.

Tasfiya (Purification) in Unani Medicine

- **Boiling**: Substances are boiled in water or herbal decoctions to remove impurities and enhance their therapeutic properties.
- **Soaking**: Metals are soaked in acidic or alkaline solutions to leach out impurities and make them suitable for medicinal use.

Tadbir (Processing) in Unani Medicine

- **Calcination**: The substance is repeatedly heated and quenched to produce a fine calx, ensuring safety and efficacy.
- **Levigation**: Substances are ground with liquids to create a fine powder, improving their bioavailability and therapeutic effects.

These purification and processing techniques are crucial in both systems to ensure that the metals and minerals are safe for human consumption and effective in treating various ailments. The detailed methods, grounded in ancient wisdom, are now being validated and refined through modern scientific research, demonstrating their enduring relevance and efficacy in traditional medicine. (table 1)

PROCESS EFFECTS

The processes of Shodhana (purification) and Marana (calcination) in Ayurveda, as well as the purification and processing techniques in Unani medicine, have profound effects on metals and minerals, transforming them into bio-consumable forms suitable for therapeutic use. These procedures ensure the safety, efficacy, and bioavailability of these substances. [17,18]

Effects of Shodhan and Marana in Ayurveda

Shodhan (Purification)

- **Detoxification:** Shodhan eliminates toxic impurities from metals and minerals. Techniques like boiling, steaming, and quenching in herbal decoctions neutralize harmful elements, making the substances safe for human consumption.

- **Softening and Brittleness:** Repeated heating and quenching cause the formation of microcracks in the dense structure of metals and minerals. This makes the materials brittle, facilitating their conversion into fine powders.
- **Herbal Integration:** Contact with herbal extracts during Shodhan leads to the incorporation of beneficial herbal constituents into the metals and minerals. This enhances their therapeutic properties and aids in detoxification.

Marana (Calcination)

- **Conversion to Bhasma (Ash):** Through controlled heating in earthen crucibles, metals and minerals are transformed into fine, bioavailable ash. This ash, known as Bhasma, is highly absorbable and easily assimilated by the human body.
- **Particle Size Reduction:** Repeated heating and grinding reduce the particle size to the nanoscale, increasing the surface area and bioavailability of the substances. Fine particles are more easily absorbed in the gastrointestinal tract.
- **Stabilization:** Marana stabilizes the metals and minerals, making them less reactive and safer for ingestion. The repeated calcination process ensures that the final product is inert, stable, and free from toxicity.

Effects of Purification and Processing in Unani Medicine

Tasfiya (Purification)

- **Removal of Impurities:** Techniques like boiling and soaking in acidic or alkaline solutions remove contaminants and impurities, rendering the substances safe for medicinal use.
- **Enhanced Solubility:** Purification processes increase the solubility of metals and minerals, improving their absorption in the body.

Tadbir (Processing)

- **Formation of Kushta (Calx):** Calcination in Unani medicine converts metals and minerals into a fine calx (Kushta). This process, similar to Marana, ensures the substances are bioavailable and easily absorbed.
- **Detoxification and Stabilization:** Processing methods detoxify and stabilize the materials, reducing their reactivity and enhancing their safety for consumption.

How They Become Bio-consumable

- **Increased Bioavailability:** The processes of Shodhan and Marana in Ayurveda, and Tasfiya and Tadbir in Unani, reduce the particle size of metals and minerals, making them more bioavailable. The fine powders and ashes produced are easily absorbed in the digestive tract.
- **Detoxification:** These procedures remove toxic impurities, ensuring that the final products are safe for human consumption. Detoxification is crucial to prevent adverse effects and enhance the therapeutic efficacy of the substances.
- **Enhanced Therapeutic Properties:** Interaction with herbal extracts during purification and processing imbues the metals and minerals with additional therapeutic properties. The incorporation of beneficial herbal constituents enhances the overall efficacy of the medicines.
- **Stabilization:** The repeated heating and quenching cycles stabilize the metals and minerals, making them less reactive and safer for ingestion. This stabilization is essential for ensuring the long-term safety and effectiveness of the medicines.

Overall, the meticulous procedures of Shodhan and Marana in Ayurveda, and the purification and processing techniques in Unani medicine, transform raw metals and minerals into bio-consumable forms. These processes ensure the safety, efficacy, and bioavailability of the substances, making them suitable for therapeutic use in these traditional medical systems.

In both Ayurveda and the Unani systems of medicine, the rigorous analysis, characterization, and standardization of prepared medicines, and raw metals and minerals, are essential to ensure their safety, efficacy, and consistency. These processes employ a variety of sophisticated analytical techniques, including qualitative and quantitative chemical analysis, UV-Visible Spectrophotometry, X-ray Diffraction (XRD), High-Performance Thin-Layer Chromatography (HPTLC), Fourier-Transform Infrared Spectroscopy (FTIR), Atomic Absorption Spectroscopy (AAS), Inductively Coupled Plasma Mass Spectrometry (ICP-MS), Scanning Electron Microscopy (SEM), Energy Dispersive X-ray Spectroscopy (EDX), and Thermogravimetric Analysis (TGA).[19] These methods provide critical insights into the chemical composition, physical properties, purity, and morphology of the substances, transforming raw, often toxic materials into bio-consumable therapeutic forms. Techniques like Shodhan (purification) and Marana (calcination) in Ayurveda, and Tasfiya (purification) and Tadbir (processing) in Unani medicine, involve detoxification, softening, and conversion to fine, bioavailable particles. The integration of traditional knowledge with modern scientific methods ensures that each batch of medicine meets stringent quality standards, maintaining the therapeutic efficacy and safety of these ancient medical practices.[20-23]

Minerals and Metals which are widely used for making Bhasmas[24] are as follows

Minerals	Metals
Abhraka (Mica, a silicate compound of iron, Aluminium, Magnesium, Potassium and Sodium)	Gold (Au)
Suvarna Makshika (Chalco pyrite a sulphide compound of copper and Iron)	Silver (Ag)
Rajat Makshika (Iron pyrite, a sulphide compound of Iron)	Copper (Cu)
Sasyaka (Copper sulphate, a sulphate compound of copper)	Zinc (Zn)
Rasaka (Zinc carbonate)	Iron (Fe)
Gandhaka (Sulphur)	Mercury (Hg)
Gairika (Haematite, an oxide compound of Iron)	Arsenic (As) etc.
Kasisa (green vitriol, a sulphate compound of ferrous)	Iron
Sphatika (Alum or Potash alum)	Potassium, Aluminum
Hartal and Manahshila (Orpiment and Realgar a sulphide compound of Arsenic)	Arsenic
Anjana (Collirium, a sulphide compound of lead or Antimony)	lead or Antimony
Gauri pashana (vitreous or white Arsenic an oxide of Arsenic)	Arsenic
Girisindura (montroydite, a red oxide compound of mercury)	Mercury
Hingula (Cinnabar,a red sulphide compound of Mercury)	Mercury

Figure 1: Distillation of mercury for Shodhana

Figure 2: Heating and quenching of Copper for Shodhana

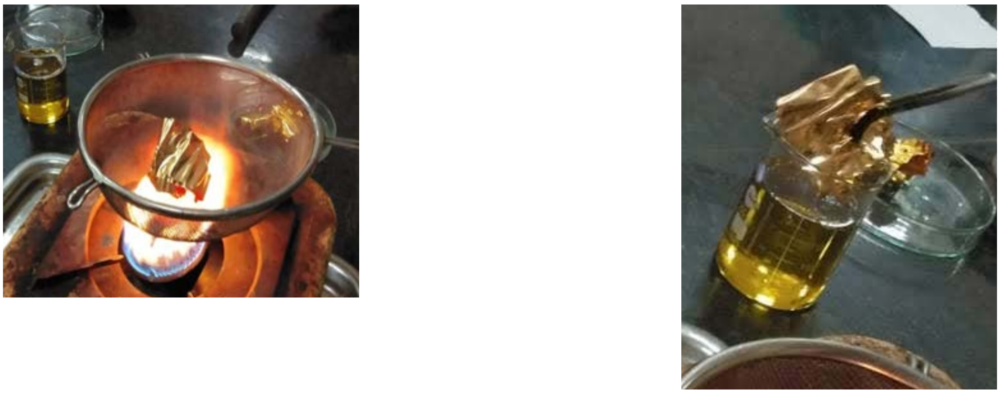

Figure 3: Heating and quenching of Gold for Shodhana

Figure 4: immersion of realgar for Shodhana

Figure 5: Sweating of Arsenic oxide in milk for Shodhana

Figure 6: Bhawana- Levigation with liquid medias

Figure 7: Creation of palates

Figure 8: Preparation of palates of metals and minerals for heating (Marana)

CONCLUSION

The establishment of the WHO Global Centre for Traditional Medicine in Jamnagar in 2022 marks a pivotal moment in advancing the research, validation, and global promotion of traditional medical systems such as Ayurveda and Unani. These time-honored systems, deeply rooted in cultural and historical contexts, utilize an extensive range of therapeutic substances, including metals and minerals, that are meticulously processed to ensure safety, efficacy, and bioavailability. Sophisticated methods such as Shodhan (purification) and Marana (calcination) in Ayurveda, and Tasfiya (purification) and Tadbir (processing) in Unani, exemplify the precision and scientific depth of these ancient practices. These processes transform raw materials, including toxic substances, into therapeutic forms, highlighting the systems' profound understanding of pharmacological science.

The seamless integration of traditional techniques with modern analytical tools, including UV-Visible Spectrophotometry, X-ray Diffraction (XRD), High-Performance Thin-Layer Chromatography (HPTLC), and Inductively Coupled Plasma Mass Spectrometry (ICP-MS), has ensured the standardization and quality control of these medicines. Metals such as gold, silver, iron, and mercury, alongside minerals like arsenic, sulfur, and mica, continue to play a critical role in these systems due to their potent therapeutic properties, such as anti-inflammatory, antimicrobial, and rejuvenative effects.

This enduring synthesis of traditional wisdom with contemporary scientific advancements not only ensures the safety and efficacy of these medicines but also underscores their ongoing relevance in addressing modern healthcare challenges. By bridging ancient practices with current scientific validation, Ayurveda and Unani systems demonstrate their lasting significance as integrative and effective approaches in global healthcare.

REFER ENCES

1. World Health Organization. WHO Traditional Medicine Strategy 2014-2023. Geneva: WHO Press; 2013. Available from: https://www.who.int/publications/i/item/9789241506096 (Last visited on December 8, 2024).
2. WHO Global Traditional Medicinal Centre. World Health Organization. Available from: https://www.who.int/initiatives/who-global-traditional-medicine-centre/about-us#:~:text=About%20us&text=The%20WHO%20Global%20Traditional%20Medicine,the%20world%20is%20one%20family (Last visited on December 8, 2024).
3. Sharma RK, Das B, editors. Charaka Samhita of Agnivesha, Sutrasthana; Khudakchatushpadam Adhyaya: Chapter 9, verse 4. Reprint ed. Varanasi: Chaukhamba Sanskrita Series Office; 2014. p. 184.
4. Jaiswal YS, Williams LL. A glimpse of Ayurveda - The forgotten history and principles of Indian traditional medicine. J Tradit Complement Med. 2016 Feb;7(1):50-53. DOI: 10.1016/j.jtcme.2016.02.002. PMID: 28053888; PMCID: PMC5198827.
5. Lloyd I. Traditional and complementary systems of medicine. In: Lloyd I, editor. The Energetics of Health. New York: Churchill Livingstone; 2009. p. 13-27. DOI: 10.1016/B978-0-443-06955-0.00002-6. Available from: https://www.sciencedirect.com/science/article/pii/B978044306955000002 6.
6. Dejouhanet L. Supply of medicinal raw materials: The Achilles heel of today's manufacturing sector for Ayurvedic drugs in Kerala. Asian Medicine. 2014;9(1-2):206-235. DOI: 10.1163/15734218-12341293.
7. Savrikar SS, Ravishankar B. Introduction to 'Rasashaastra' the Iatrochemistry of Ayurveda. Afr J Tradit Complement Altern Med. 2011;8(5 Suppl):66-82. DOI: 10.4314/ajtcam.v8i5S.1. PMID: 22754059; PMCID: PMC3252715.
8. Savrikar SS, Ravishankar B. Bhaishajya Kalpanaa - the Ayurvedic pharmaceutics - an overview. Afr J Tradit Complement Altern Med. 2010 Apr;7(3):174-84. DOI: 10.4314/ajtcam.v7i3.54773. PMID: 21461144; PMCID: PMC3025621.
9. Sharma RK, Das B, editors. Charaka Samhita of Agnivesha, Sutrasthana; Khudakchatushpadam Adhyaya: Chapter 4, verse 18. Reprint ed. Varanasi: Chaukhamba Sanskrita Series Office; 2014. p. 144.
10. Ali MA, Khalid M, Hamiduddin -, Zaigham -, Aslam M. History of Ilmul Saidala (Unani Pharmacy) through ages: A critical appraisal and current scenario. Bangladesh J Med Sci. 2022;21(1):24-36
11. Ruknuddin G. Metallic preparations of Ayurveda: A boon to the ailing humanity. Indian J Nephrol. 2014 Sep;24(5):332-3. DOI: 10.4103/0971-4065.133044. PMID: 25249731; PMCID: PMC4165066.
12. Kapoor RC. Some observations on the metal-based preparations in the Indian systems of medicine. Indian J Tradit Med. 2010 Jul;9(3):562-575. DOI: 10.47070/ayushdhara.v11i2.1523.
13. Magesh R, Jayalekshmi R. Review of Shodhana in Rasashastra. J Ayu Int Med Sci. 2023;8(4):155-157. Available from: https://jaims.in/jaims/article/view/2412.
14. Jayaswal S. The concept of Marana and Jarana – A review article. Int J Ayush. 2024;13(11):11-15.
15. Ansari TH, *et al.* Understanding the Unani concept of Amrāḍ-i-shakl (morphological diseases): A review. Acta Sci Med Sci. 2024;8(2):44-50.
16. Rahman S, Jahan N, Makbul SAA, Ahmad M, Gani MA. Scientific appraisal of Unani concept of islah-e-advia (rectification/purification of drugs) and its importance. J

Ethnopharmacol. 2020;258:112880. DOI: 10.1016/j.jep.2020.112880. Available from: https://www.sciencedirect.com/science/article/pii/S0378874119341170.
17. Acharya Sadananda Sharma. Rasa Tarangini. Translated by Shri Kashinath Shastri. 11th ed. Reprint 2004. New Delhi: Motilal Banarsidass; 2nd Taranga/52. p. 22.
18. Nagarjuna. Rasendra Mangalam. Translated by KVJ HS Sharma. 1st ed. Varanasi: Chaukhamba Orientalia; 2003;2/56-56 ½. p. 45.
19. Balekundri A, Mannur V. Quality control of the traditional herbs and herbal products: A review. Futur J Pharm Sci. 2020;6:67. DOI: 10.1186/s43094-020-00091-5.
20. Devipriya S, Ramesh NV, Vineeth PK, Arun M. A review on the inextricable relation of Ayurveda and analytical chemistry. Mater Today Proc. 2021;46(8):3089-3095. DOI: 10.1016/j.matpr.2021.02.591. Available from: https://www.sciencedirect.com/science/article/pii/S2214785321017363.
21. Verma N. Advances and trends in analytical techniques in natural product research: Challenges and future perspective. Indian J Nat Prod Resour. 2021 Dec;12(4):506-526.
22. Das C, Ghosh G, Bose A, Das D. Analytical methods for standardization of Ayurvedic Asava and Aristas: A review. Indian J Pharm Sci. 2024. DOI: 10.36468/pharmaceutical-sciences.523. Available from: https://www.ijpsonline.com/articles/analytical-methods-for-standardization-of-ayurvedic-iasavasi-and-iaristasi-a-review-3633.html (Last visited on December 9, 2024).
23. Joshi D, Joshi G. Quality and standards of Ayurvedic medicine. Varanasi: Chaukhamba Orientalia; 2017.
24. Mishra AS. Rasendra Chintamani. Hindi commentary. Reprint ed. Varanasi: Chaukhamba Orientalia; 2011.

Cite this article as:

Sharma DK, Karunanidhi Sharma, Shamma and Amanullah Haji. A review on effects of various processes on minerals and metals of therapeutic importance with special reference to Shodhan and Marana in Ayurveda and Unani systems of medicine. Int. J. Res. Ayurveda Pharm. 2025;16(2):127-133
DOI: http://dx.doi.org/10.7897/2277-4343.16256

Source of support: Nil, Conflict of interest: None Declared