



Review Article

Scientific validation to Shodhan concept of Ayurvedic Pharmaceutics

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ABSTRACT:

Shodhan, unique concept of purification & potentiation in Ayurvedic pharmaceutics, specially mentioned for metals and minerals which have been indicated in range of disorders from common (fever etc.) to serious (cancer etc.) disorders. *Shodhan* of metals and minerals is extremely depending up on its physico-chemical properties. The metals & minerals having melting point more than 500 °C (*Swarna*-Gold, *Lauha*-Iron, *Tamra*-Copper etc) subjected to *Shodhan* by *Nirvapa* (Heating and dipping into liquid medium) whereas *Dhalana* (Heating, melting and dipping into liquid medium) process is applied to the substance having melting point in range of 100 to 500 °C (*Naga*-Lead, *Vanga*-Tin, *Yasad*-Zinc etc.). Furthermore substances of organic origin like *praval* (coral), *mukta* (pearl), *shankha* (conch shell) etc. and metals/ mineral having melting point less than 100 °C like *parad* (mercury) is mainly subjected to *shodhan* either by *swedan* (Boiling or Fomentation with liquid) or *bhavana* (Trituration with small quantity of liquid) process.

KEY WORDS: *Shodhan, Nirvapa, Dhalana, Swedan, Bhavana*

INTRODUCTION

Health is always bothered to human beings and depends upon the natural resources for nutrients as well as medicine. The nutrients have been basically divided in two broad category like macronutrients (carbohydrates, protein and fat) and micro nutrients (minerals and vitamins). Micronutrients are essential nutrients that are required by the body in trace amounts/tiny quantities on a day to-day basis in order to proper function of body. Iron (Fe) is required to improve anemia, insomnia and other health related complications

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¹, Copper is a coenzyme and crucial cofactor in Fe utilization, collagen amalgamation and concealment of free radicals ^{2 3} Zinc, manganese, serving as a cofactor in a number of enzymatic reactions ⁴, with this manganese help in blood clotting and hemostasis ⁵. In addition to macro and essential trace elements, fruit and vegetables also contain high concentrations of essential oils, phenolics, antioxidants and pharmacologically active agents used in treatment of cancer, diabetes, ulcers, asthma, common cold and gastrointestinal diseases⁶.

Although these element are surplace in nature but we cannot used them in therapeutics in their natural form. *Ayurveda*, known to be the oldest system of medicine had mentioned the use of plenty of metals and minerals on health. Although properties of metals and minerals are well described in ancient literature but their frequent used is only possible by development of Rasa Shastra and Bhaishjaya Kalpana (Ayurvedic Pharmaceutics) and by applying its principle these metals and minerals are converted in to such form which is easily administrable and therapeutically efficacious. During analysis of subject it was observed they are classified in groups like *Maharasa*, *Uparasa* etc. but their basis of classification is lacking.

Shodhan (Purification & Potentiation)

Ancient scholars encouraged the use of metals or mineral drugs in the therapeutics and also recognized the toxicity of respective metals/minerals. That's why they adopted a number of measures to purify the metals and minerals (Table 1) with a view to remove or minimize their toxicity completely to least possible level by physical, chemical and biological changes and also enhancing the therapeutic efficacy. The Physical changes include elimination of impurities, reduction in Hardness, increased brittleness (due to repeated heating and quenching) reduced particle size (trituration), whereas chemical changes include formation of chemical compounds (during *Shodhan & Marana* process) and ultimately affect the biological changes occurring inside body in form of absorption, distribution and bioavailability. Number of *Shodhan* methods were discovered and adopted by our legends of *Ayurveda* and their therapeutic application

should be done after the purification & potentiation technique, which involve more than 90% of metals and minerals and may be one of the basis of their classification for scientific study.

Concept of Shodhan

Shodhan include removal of unwanted part of the drug; control/ eradicate toxic ingredients, potentiate and regulate the action of the drug which has been mentioned below:

- *Nirvapa* (Heating and dipping into liquid medium- heating till red hot then suddenly dip into liquid)
- *Dhalana* (Heating, melting and dipping into liquid medium- heating till melt then dip in to liquid)
- *Swedana* (Boiling or Fomentation with liquid-mild heating within liquid medium)
- *Bhavana* (Trituration with small quantity of liquid)

Nirvapa/ Quenching (Heating and dipping into liquid medium)

It is applied to metals & minerals having melting point more than 500 °C [Table 1]. In this process, these metals like Biotite, Iron, Copper, gold etc. is heated till red hot then suddenly dip in to liquid media like decoction of *Triphala* (acidic), lime-water (alkaline), sesame oil, milk etc.⁷ and it is repeated until the material becomes brittle. During red hot, impurities/metal react with atmospheric oxygen forming compounds on surface and generally expansibility of compounds are less than metals which leads to separation of impurities. After this, immediate cooling in liquid media leads to decrease in tension and increase in compression force, so media immediately penetrates inside and soluble impurities get dissolved. During instant cooling, it may be possible that recrystallization occurs along with reformation of grain boundaries and each grain is surrounded by the molecules of liquid media imposing its properties on that purified metals. The insoluble atoms may not be able to migrate out of the solution. This is called “diffusion less transformation” and crystal matrix changes to its low temperature arrangement, the atoms of the solute become trapped within the lattice.

The trapped atoms prevent the crystal matrix from completely changing into its low temperature allotrope, creating shearing stresses within the lattice, which may be similar to martensitic transformations. Repetition of these process causes disruption in equilibrium, leads to increased brittleness, reduction in hardness and finally particle size get reduced.

Phases of *Nirvapa*

It include three phase viz. phase of heating, phase of quenching and phase of interaction[8]

Phase of Heating

Solid has packed particles which are closed together and vibrate in their fixed position, when temperature increases, the particle gain energy, vibrate more strongly and occupy more spaces which is responsible for its expansion. Increase in intra-atomic distance leads to weakening of electrostatic forces. Due to continuous heating, particles get enough energy to break forces holding.

Phase of Quenching

Red hot metals & minerals were dip in liquid media immediately, so liquid may penetrate inside and liquid soluble impurities get dissolved. Sudden change in temperature causes breaking of other strong bonds and this destroys its flexibility and makes it more brittle.

Phase of Interaction

During heating and dipping metal/mineral particles come in contact with liquid media, each molecule get surrounded by liquid and in self-cooling forming grain containing liquid media. This may be the reason of imposing of properties of *Nirvapa Dravya* (Liquid media). In this phase, three distinct stages like film boiling, nucleate boiling and convective heat transfer take place.

Film boiling, also known as "vapor blanket" stage, occurs upon initial immersion i.e. contact between the hot metal surface and liquid, creates a layer of vapor (known as the Leidenfrost phenomenon). It depends on the metal's surface irregularities, oxides, surface-wetting additives (which accelerate wetting and destabilize the layer) and molecular

composition liquid media. Cooling in this stage is a function of conduction through the vapor envelope and relatively slows since the vapor blanket acts as an insulator. As the part of cooling, the vapor blanket collapses at point's causes nucleate boiling (violent boiling of the quenchant) and heat transfer is fastest during this stage and it depends on molecular composition on by convection and conduction method, exponentially dependent on viscosity of liquid media. That's why ancient scholars used different liquid media in process of *nirvapa* [Table 1] Figure 1 shows- Typical cooling curves and cooling-rate curves for new oils.

Dhalana (Heating, melting and dipping into liquid medium)

It is used for metal/non-metal having melting point in between 200 °C - 500 °C [Table 1]. In this process material is heated till melting and then immediately poured into the liquid medium. When any substance is heated it molecule get energy and expansion taken place when this expansion is more than certain limit phase change may take place. In *Dhalan* metal/nonmetal is heated till its melting and then suddenly dip in to liquid media, after dipping in liquid, metals is exposed to lower temperature below its melting point, so metal/non-metal further resume solid state. In between it is possible that some liquid media trapped between metals / non-metal during solidification. We also assume that undesired substances which present either outer surface and in between metal/ non-metal particle may react with liquid media and separated from it either in the form of soluble material or new compound which is easily detached and trapped substances between the metals may be beneficial.

Swedana (Boiling or Fomentation with Liquids)

It is mainly used for substance either from animal origin, volatile or having low melting points. In this materials are purified with steam of water or milk or any other liquid media suitable for those substances. The external/physical impurities of substances are softened/dissolve which are further removed by cleansing. The phenomenon like Natural Convection⁸, like dissolve like, Heat manifestation and Corrosion may occur in this process.

Natural Convection

It is defined as fluid circulation caused by temperature difference. In this fluid comes in contact with a heated surface and will tend to rise and be replaced by colder fluid. In the *Swedan*, materials (braked in to small pieces) are placed in the middle of fluid so that medium temperature is maintained during process. In this process the materials are braked in to small pieces to increase the surface area so that maximum surface will be exposed to the reaction to liquid. Heat particles may penetrate through porous space without bringing any chemical or physical change in molecular collocation ⁹.

Like Dissolve Like

Polar solutes dissolve in polar solvents and non-polar dissolve in non-polar solvents. Mostly non-polar liquid media is used because most of the materials are non-polar in nature. In this way impurities get dissolved in their particular solvents and media may act as solvent and helps to eradicate toxic substance, reduces toxicity and induces desired qualities ¹⁰

Corrosion

Corrosion of metals causes destruction by the action of surrounding media such as water, steam liquid having acidic or basic nature. Corrosion increases the surface area due to which micro cracks formed resulting in fluid particle interaction ⁸. Which provide easy and greater efficiency of liquid media responsible for *Shodhan*. From table 1, we observed that mostly *Kanji* has been indicated as liquid media used for *Swedana* which may be due to its corrosive properties.

Bhavana (Trituration)

Pharmaceutical process in which metals, mineral as well as herbal powders are subjected to either *mardan* (grinding without liquid) or *Bhavana* (grinding liquid) till complete absorption of liquid ¹¹. It is mainly applicable for *Shodhan* of substance of herbal, animal origin and volatile substances [Table 1]. Grinding, the central manufacturing process involved in particle size reduction, production of large surface area and also responsible for liberation of valuable chemical from their matrices. In

this way forcing each particle to come in contact with the purifying materials (herbs juice or decoction) and purifying substances may be incorporated in it. In the *bhavana* process, addition of small quantity of liquid may change the pulp fluidity, which further helps in particle size reduction. All reaction occurs between atoms and molecules or between nuclei there, is a conversion of mass into energy or the conversion according to whether energy is given out or absorbed during the reaction. The mass changes occurring during the reaction are so small as to be immeasurable, but at nuclear level they are large enough to be detected.

Grinding involves two major processes namely stress application and pulp flow ¹². Stress application includes ¹³ force application which may cause heat production and pulp flow includes transfer of mass and energy. Three types of force occur in stress application namely *Nodana* (due to weight of pestle), *Abhighata* (due to pressure exercised over the pestle) and *vega* (pressure during motion) leading to possible propagation and initiation of cracks and increases surface area. Larger surface areas lead to higher reaction rates as in grinding process particle size reduction takes place as a result of production of large surface area and larger surface area is responsible for more reaction. Stress application increases heat production, change in its energy component, liberates energy in liquid media present to prevent increase in temperature and avoid the burning of beneficial substances.

Conclusion

Shodhan process is liable for cataloguing of materia medica of Iatrochemistry of Ayurveda (Rasa Shastra) for better understanding in relation pharmacaceutics and therapeutics. Metals with melting point more than 500 °C may be kept in *Nirvapa* group whereas melting point in range of 100-500 °C goes in to *Dhalan* group. Furthermore, organic as well as substance having low melting point in has been placed in *Swedan/ Bhavana* group.

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