

QUALITY CONVERGENCE IN AYURVEDA: REVIEWING SIDDHI LAKSHANA AND MODERN CONTROL METHODS FOR LIQUID DOSAGE FORMS

Dr. R. Avinaash Bharadhwaj^{1*}, Dr. Chandramohan T.², Dr. Saravanan B.³,
Dr. K. L. Virupaksha Gupta⁴

^{1,2}MD Scholar, ³Professor & HOD, ⁴Professor,

Department of Rasasastra Evam Bhaishajya Kalpana, Sri Jayendra Saraswathi Ayurveda
College and Hospital, Nazarathpettai, Chennai – 600123.

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*Corresponding Author

Dr. R. Avinaash Bharadhwaj

MD Scholar, Department of Rasasastra
Evam Bhaishajya Kalpana, Sri
Jayendra Saraswathi Ayurveda College
and Hospital, Nazarathpettai, Chennai
– 600123.



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ABSTRACT

Ayurvedic Liquid dosage forms of have quality control parameters explained in Ayurvedic Pharmacopeia etc. and as well as classical *Ayurveda Siddhi Lakshanas*. An effort is planned to review the convergence of classical and contemporary parameters are studied. The review seeks to identify overlaps, gaps, and potential integration strategies that can enhance holistic quality assurance. This review centers on parameters of market available formulations like *Kwatha*, *Sneha*, *Sandhana*, *Sharkara*, and *Arka*. For example, traditional evaluation of *Sneha* involves tests such as the formation of a *Varti* and the absence of sound when burnt, whereas modern QC applies measures like Total fat count and peroxide levels. Similarly, in fermented *Sandhana* preparations, classical indicators such as the sinking of *Prakshepa dravyas* and cessation of effervescence denote completion, while modern methods assess alcohol content and microbial safety. Findings

suggest that *Siddhi Lakshanas* remain valuable as baseline tools for in-process validation, yet they are limited in detecting contaminants such as heavy metals, pesticides, and microbial growth. Conversely, modern QC methods often overlooks the sensory validation emphasized in Ayurveda. The review concludes that developing Standard Operating Procedures (SOPs)

which integrate classical sensory traits with advanced analytical techniques can address these gaps. Such convergence enhances the global credibility, safety, and efficacy of Ayurvedic liquid formulations.

KEYWORDS: *Ayurveda*, Liquid Dosage forms, Quality control, *Siddhi Lakshana*, Standardization.

INTRODUCTION

Ayurveda is based upon *pada chatushkas* where *aushadam* plays an important role. It should have the qualities of *Bahukalpa*, *Bahuguna*, *Sampanna* and *Yogya*.^[1] *Aushada nirmana* in Ayurveda is described in two parts i.e *Rasa shastra* and *Bhaishajya Kalpana*. *Bhaishajya kalpana* deals with process of preparation of *kalpa*. These *kalpa* will be solid, liquid and semi-solid forms^[2] Liquid dosage forms of Ayurveda mentioned are *Swarasa*, *Kwatha/Kashaya*, *Pramathya*, *Paniya*, *Ushnodaka*, *Ksheerapaka*, *Laksha rasa*, *Mamsa rasa*, *Mantha*, *Udaka*, *Panaka*, *Hima*, *Phanta*, *Arka*, *Sarkara*, *Sneha* and *sandhana kalpa*. Among these, most of them are prepared on spot and given as *sadhyosevana*. Among these preparations, there are only few market available dosage forms namely *Kwatha/Kashaya*, *Arka*, *Sneha*, *Sharkara* and *Sandhana kalpa*.^[3]

Pharmaceutical Liquid dosage forms are categorized into Monophasic and Biphasic forms. Monophasic includes Syrups, Elixirs, Tinctures, Drops, Gargles, Mouthwashes, Douches, Throat paints etc., and Biphasic includes Emulsions and Suspension.^[4] They are the preparations which contains active pharmaceutical ingredients along with excipients like emulsifying, dispersing, solubilizing, stabilizing, suspending, wetting, thickening, preservative, sweetening, flavouring, and colouring agents which are later dissolved or suspended with appropriate solvents and used as a formulation.^[5] The involvement of excipients are examined to ensure the formulation isn't compromised on quality by methods of quality control. They are the group of methods to evaluate and maintain the quality of the formulation or dosage forms during its development and end process by implementing a series of systematic and technical actions. These actions helps in identifying errors, inconsistencies, and omissions to ensure that the data and methodologies applied are accurate, consistent, and reliable. These processes contribute to the overall integrity, quality with its accurate standards and practices.^[6] Parallel in Ayurveda, *Kalpa* is tested with *Siddhi Lakshana*. It refers to the distinctive characteristics that indicate the proper preparation of medicinal products. These qualities such as colour, fragrance, taste, and consistency serve as

signs of completion and ensure the product's quality. Observing these traits is essential, as they validate authenticity of the product, emphasizing their importance in the preparation process.^[7]

OBJECTIVE

This review aims for the plausible convergence of modern pharmaceutical quality control (QC) practices with traditional *Siddhi Lakshana* in liquid dosage forms currently available in the market. It focuses on identifying points of alignment, recognizing the lacuna, and outlining integrative strategies to strengthen holistic quality assurance.

METHODOLOGY

Information on *Siddhi Lakshana* has been compiled from Classical Ayurveda texts like *Sharangadhara samhitha*, *Arka Prakasha* and *Bhaishajya rathnavali*. Complementary insights on modern practices were derived from contemporary pharmaceutical quality control (QC) methodologies, API standards, FSSAI regulatory guidelines and established pharmacopeial references. In addition, relevant data on in process and finished product quality parameters were gathered from scholarly databases such as Google Scholar, PubMed etc.

RESULT

Quality control measures helps in identify and eliminate contaminants such as pesticide, Heavy metals and Microorganisms which possess significant health risks. The other protocols of scanning methods like Chromatography and spectrometry can detect the above mentioned contaminants to ensure the safe consumption of the formulation. Moreover, they help in identifying adulterants and misidentified materials in a particular sample. For plant based medicines, DNA barcoding is also done to ensure the correct species is used for the preparation ensuring safety and consistency.^[8]

Kwatha Siddhi Lakshana

Supachita kwatha means "*gandha varna rasanvitam*" i.e. the well prepared decoction should possess smell, colour and taste as per the ingredient/s used. The *kwatha* should have a distinct colour based on the herbs used, ranging from light to dark depending on the concentration. The taste can vary from bitter, astringent, sweet, or a combination based on the herbal composition. It may have a characteristic herbal aroma. Especially noticeable in single herb Kwatha preparations.^[9]

Sneha Siddhi Lakshana

Sneha Siddhi Lakshana include *Vartivat sneha kalka syat* (If the paste is taken and rubbed in between thumb and index fingers, it should form a varti), *Shabdaheeno agni kshipta* (When a sample of sneha is kept in fire, there should not be any cracking or hissing sound). *Yata phena udgama taile phena shanthishcha sarpishi* (Froth upcoming in oil and subsiding in Ghee), *Gandha Varna rasaotpatti* (Smell, Taste and Colour of the sneha has to be observed). These are the characters explained for *Madhyama paka*, where *Mrudu* and *Khara paka* Lakshana varies.^[10]

Sandhana Siddhi Lakshana

Prakshepa dravya will sunk completely, Fermented material will possess alcoholic odour, No formation of froth (No effervescence), No hissing sound, neither it is too sweet nor too spicy. These above characters explains about the completion of *asava/arishta*.^[11]

Arka Siddhi Lakshana

The *Siddhi Lakshana* of *Arka Kalpana* include the proper extraction of essential oils, the characteristic smell and colour based on the herbs used, clarity, and preservation of active compounds. Characteristics of *Arka* includes taste as per original drug, Transparent and clear. Odour as per original drug.^[12]

UNIVERSAL QUALITY CONTROL CHECKS FOR LIQUID DOSAGE

Commonly, there are categories of modern method testing which includes organoleptic properties, Physico - chemical parameters, Purity and safety etc. These are used to examine the quality of a particular dosage forms. Determination of pH, Specific gravity, Boiling point, Optical rotation, Viscosity, Volume, Density, Total acidity, Refractive index, Specific assays with their specific description on taste, colour and smell are the basic tests done. Further quality control parameters will be done to check the purity and safety which includes microbiological criteria like total viable bacterial count, Total fungal count etc., Alfa toxin study, Test for heavy metals, Pesticide residues followed by Chromatography and spectroscopy for clear identification and understanding. Shelf life will be studied with tests like accelerated stability testing etc. to know the stability and longevity of the formulation. For each and every liquid dosage form tests, there are some uniqueness. Test for alcohol includes the total alcohol percentage, Total phenolic compounds, Total yeast and mold presence. For Syrups, It includes the reducing and non-reducing sugars.^[13, 14] For *Arka* – Estimation of volatile oil, Total suspended solid analysis etc.^[15] there are over 42 varieties of

tests for oils and fats mentioned in FSSAI guidelines to maintain quality during preparation and finished products.^[16]

DISCUSSION

Classical and modern methods can be categorized into three stages: raw material standardization, in-process standardization, and finished product standardization. Classical raw material standardization is guided by *grahya* and *agrahyatva Lakshana* as mentioned in the Ayurvedic Pharmacopoeia of India (API), while modern approaches emphasize organoleptic and microscopic evaluation. In-Process standardisation is defined in Ayurveda under *Siddhi Lakshana* which is done during the preparation of the formulation. For finished product standardization, the Central Council for Research in Ayurveda Sciences along with the Pharmacopoeial Laboratory for Indian Medicine have established official protocols to ensure quality control.^[17]

In Process Quality Control (IPQC) involves many testing procedures during the preparation and processing of the formulation. The control of external environment will also be considered as IPQC. Finished Product Quality Control (FPQC) tests are carried out after the manufacturing process is complete. They evaluate both qualitative and quantitative characteristics, using defined test procedures and acceptance limits, to ensure the product meets required standards and remains compliant throughout its shelf-life.^[18]

In some cases, the modern methods explained in other indices like FSSAI can be adopted for performing the quality checks to check the nutritive level and its applications apart from therapeutic uses. For example, in oils and fats, there are tests with unique determination and findings of different components of oils and fats to ensure its Nutritive value, Purity, edibility and to avoid adulteration which can be used in *sneha* preparations. For low alcoholic percentage related beverages, there are some standardized requirements given to ensure the quality which can be implemented in *asava* and *arishta* preparations.^[16, 19] In *Sharkara Kalpa*, Proper *Siddhi Lakshana* is not explained in the classical texts and is co related to the present day syrup dosage form. The QC parameters explained in the syrup form can be adopted to standardize *Sharkara Kalpa*.

In modern times, quality control measures such as standardized distillation processes, quality assessment of the distillate, and packaging innovations may be applied to ensure the safety, quality, and efficacy of preparations.^[20] Standard operating procedures (SOPs) has to be

established based on *Siddhi Lakshana* to validate the Ayurveda way of examining the quality of a particular product. There are more common quality control protocols which are mentioned in both Ayurveda/Classical as well as Modern methods.^[21] From the above results, it is observed that there are some unique *Siddhi Lakshana* mentioned in the classical methods. These methods may be useful if innovated and modified without changing the ways of measure for qualitative, quantitative and standardization purpose of market available Ayurveda liquid dosage forms.

CONCLUSION

The *Siddhi Lakshana* way of examining the in process and final product of the *kalpa* is still reliable and relevance today as a basic form of quality control parameter. But to enhance the validity of the *kalpa*, Modern methods along with *Siddhi Lakshana* can be taken. These way of validating may help in filling up the Co – Existing lacunas of *Siddhi Lakshana* and modern methods.

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