PRESERVATION OF DRUGS

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ABSTRACT: In this article the factors likely to cause spoilage of the drugs of the Indian systems of medicine are reviewed. Methods for the prevention of spoilage are discussed. The results of a limited study carried out on the stability of a few selected drug preparations representing the main dosage forms are also presented.

The preservation of the drugs of the Indian systems of medicine is a matter of increasing concern. In the past, most medicines were prepared by the physician, either by himself or under his supervision, and they were used immediately. Only stable dosage forms like asavas, aristas and bhasmas were made and stored in bulk. The growing demand for drugs has necessitated production on a factor scale, with the attendant hazards of deterioration and loss of potency.

The drugs of modern medicine do not pose serious problems of storage. This is because they are mostly pure chemical compounds, the properties of which are known, including their sensitivity to light, heat, air, moisture and container materials, such data are not available for natural drugs and their formulations, and it is only by experimental studies on individual preparations that we can determine their shelf life and the optimum conditions for their storage.

Causes of Drug Spoilage

1. **Defective Raw Drugs**
   Raw drugs which are not collected at the proper stage of growth or during the proper season, or which have been stored too long will affect the quality of the final preparation, although they may not cause spoilage.

2. **Insect infestation**
   The practice of air-drying or sun-drying raw drugs is inadequate for preventing infestation by insect eggs and larvae. Infestation by insects can also occur during stored of raw drugs in premises which are not insect proof. Dosage forms like curmas which do no t undergo any
form of sterilization are the ones most susceptible to insect infestation.

3. Microbial decomposition
Raw drugs and finished products alike are susceptible to contamination by various ubiquitous organisms like fungi and bacteria. Contamination can occur at the packing stage unless it is done under aseptic conditions, and also after the package is opened, since many preparations are rich nutrients for microbial growth.

4. Self decomposition
Many natural products contain enzymes which bring about their decomposition during storage. Slow chemical reactions, or interactions, like hydrolysis and oxidation also take place; these are accelerated by moisture, air, heat, light and trace metals. The spoilage of fats and oils through hydrolysis and subsequent oxidation of the resulting free fatty acids is an example of self decomposition.

5. Container materials
Poor quality metallic containers may not only introduce traces of poisonous metals like lead and arsenic, but also catalyse self decomposition. Polythene containers must be of suitable grade. Not all grades of polythene are fit for packaging medicinal preparations. Undesirable physical and chemical reactions are possible with some grades of polythene.

Prevention of Spoilage

Physical and pharmacognostic examination could be used to detect grosser forms of deterioration. Quality control of drugs is generally dependent on assays. Assay procedures are yet to be evolved for most single drugs for the simple reason that their therapeutically active ingredients are yet to be identified and estimated. Pending such assays, the only practical means for the control of raw drug quality is their supply through a reliable central organisation.

Insect infestation can be prevented by careful screening of raw materials and their storage in insect-proof warehouses. Aseptic conditions should be insured as far as possible during preparation and filling. Premises should be scrupulously clean, utensils should be sterile and personnel should be educated in hygiene. Vacumisation, use of inert gases and encapsulation of sensitive materials like curcas are some modern techniques that could be profitably adopted.

Self-decomposition due to enzymes can be prevented by heating or blanching where possible. Oxidation of foils and fats which are used as vehicles can be minimised by the use of high grade oils, low in moisture and free fatty acid content. It is quite
possible that some of the ingredients of ghrtas and tailas possess antioxidant activity. This is a subject that calls for detailed study.

Microbial decomposition, i.e. spoilage by fungi, molds and bacteria can be prevented or delayed by:

i. Asepsis, i.e. keeping out micro-organisms.
ii. Filtration to remove micro-organisms (not feasible for most dosage forms).
iii. The use of low temperatures, drying and anaerobic conditions or chemicals which hinder the growth and activity of micro-organisms.
iv. Heat or radiation which kill micro-organism.

Preservatives

Preservatives are chemical agents which serve to retard, hinder or mask microbial damage. They are of two categories (i) Natural products, both organic and inorganic (ii) synthetic compounds.

The natural preservatives are organic acids such as lactic, malic and citric, and their salts; vinegars; sodium chloride; sugars, spices and essential oils from spices.

Sodium chloride caused high osmotic pressure, and hence plasmolysis of cell it dehydrates vegetable products by drawing out and tying up moisture. It is ionized to yield chloride ion which is harmful organisms.

Sugars, i.e. glucose and sucrose act by tying up moisture. High concentrations are necessary for preservative action.

Spices do not have any marked bacteriostatic effect in low concentrations, but may aid other agents, the essential oils of spices are more inhibitory than the corresponding spices. Cinnamon and cloves containing cinnamic aldehyde and eugenol respectively, are most bacteriostatic among spices; mustard, nutmeg and ginger less, black pepper weaker still. Horse radish, garlic and onion are not only bacteriostation but perhaps also germicidal.

Artificial preservatives

Artificial preservatives used in food and drug are sodium and calcium propionates, caprylic acid, sorbic acid and sorbates; benzoic acid and benzoates; derivatives of benzoic acid such as the parabens; sulphur dioxide and sulphites, sodium nitrite.

Artificial preservatives are not used in the Indian systems of medicine, their possible application will be a useful subject for investigation.

The following table summarises the types of spoilage to which the common dosage forms are susceptible and the protective action available in the traditional methods of preparation.
## TABLE – 1

|   | Nature             | Type of spoilage possible                                                                 | Means of inhibition in vogue                                                                 |
|---|--------------------|-------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| 1 | Raw drug           | Insect infestation, Microbial decomposition self-decomposition                              | Air drying                                                                                  |
| 2 | Asavas & Aristas  | Fermentation product Microbial decomposition                                               | Kashayams are sterilized by heating, organic acids sugars and alcohol present act as preservatives |
| 3 | Arkas              | Distillates Loss of volatile oil through evaporation                                       | No Satisfactory means                                                                        |
| 4 | Curna              | Herbal drugs in powder from with or without salts and sugars Insect infestation, Microbial decomposition self-decomposition | No Satisfactory means                                                                        |
| 5 | Ghrtas & Tailas    | Solution in ghee or oil of oil soluble principles extracted from herbal drugs Self-decomposition | Possible natural antioxidant activity of fat soluble principles                               |
| 6 | Guggulu            | Resin with vegetable ingredients or with inorganic ingredients Microbial decomposition, self decomposition | |


| Sl. | Type of Preparation | Composition | Method of Decomposition | Stability |
|-----|---------------------|-------------|-------------------------|-----------|
| 7   | Kwatha curna        | Mixed powder of herbal drugs for preparation of water extracts | Insect infestation, microbial decomposition, self decomposition | No satisfactory means |
| 8   | Vati, gutika, varti, netrabindu | Pills, tablets containing vegetable and mineral drugs | Microbial decomposition, self decomposition | No satisfactory means |
| 9   | Bhasmas, Rasa ausadhas | Predominantly mineral preparations | | Mostly stable |

**Studies on Preservation**

The texts have indicate the shelf life and methods of storage of the various dosage forms, for example the sarngadhara samhita states:

GUNAHINAM BHAVEDVARSADURDHVAM TADRUPAMAUSADHAM, MASADVAYATTATHACURNAM HINAVIRYATVAMAPNUYAT.

HINATVAM GUTKALEHAU LABHETE VATSARATPARAM,

HINASYURGHRTA TAILADYASCATURMASADHIKATTATAH.

AUSADHO LAGHU PAKASYURNIRVIRYA VATSARATPARAM,

PURANASYURGUNAIRYUKTA ASA VA DHATAVO RASAH.

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With the exception of certain drugs like vidanga which do not lose their guna even when kept for long, drugs lose their guna after one year. Powders lose their guna after two months, Gutika and Lehas lose their potency (virya) after one year. Ghrtas and tailas lose their guna after four months. Preparations which are laghu paka (light processed) lose their potency after one year.

Asavas, dhatus, rasas with gold or silver (e.g Mrganka Rasa) improve in their guna with age.

Studies extending over a period of one year were carried out in our laboratory on the stability of a few selected items belonging to the categories given in the accompanying table. The samples were prepared in the
laboratory, and aliquots of each were stored in different types of containers (1) Plain glass (2) Amber coloured glass (3) Tin and (4) Polythene, and studied at intervals. The results are given in the table, together with the shelf life and mode of preservation according to the texts.

| S. No | Category | Shelf life according to classical texts, and traditional method of storage | Experimentally findings |
|-------|----------|--------------------------------------------------------------------------|-------------------------|
| 1     | Asavas and Aristas | Can be kept indefinitely. They are kept in well stoppered bottles or jars | Can be kept indefinitely tightly stoppered bottles. |
| 2.    | Arka     | Should be preserved in tightly closed container to prevent loss of volatile matters and kept away from light. Can be preserved for 6 months. | |
| 3.    | Avalehas, leha & Paka | Kept in glass or porcelain jars, also in metal containers which do not react. Normally lehyas should be used within one year. | Glass containers most suitable No deterioration upto a months. |
| 4.    | Guggulu  | Kept in glass or porcelain jars free from moisture and stored in a cool place. The potency is maintained for 2 years when prepared with ingredients of plant origin and indefinitely when prepared with metals and minerals. | Stays fresh for only 2 months, kept in glass jars. |
| 5.    | Kwatha curna | Kwatha curna retains potency for one year. Kept in air-tight | Can be preserved for 4 months only, free or |
|   |   |   |
|---|---|---|
|   | containers. | insect infestation. Packed in glass containers, develop rancidity by 3rd month. |
| 6. | Ghrta | Are preserved in glass, polythene or aluminium containers. Ghrtas prepared for internal use keep their potency for about 16 months. Packed in glass containers, develop rancidity by 3rd month. |
| 7. | Curna | Powders should be at least 80 mesh fine free from moisture. They retain potency for one year, kept in air tight containers. Keeps good quality for at least 6 months, packed in glass or polythene containers. |
| 8. | Tailas | Are preserved in glass, polythene or aluminium containers. Preparations for internal use keep their potency for about 16 months. Becomes rancid by 3rd months, packed in glass bottle. |
| 9. | Dravaka | They are preserved in glass stoppered bottles. These preparations do not deteriorate by lapse of time. |
| 10. | Lavana Ksara | Should be kept in air tight bottles. They will last indefinitely. It kept in air tight containers could be preserved for long duration. |
| 11. | Lepa | Vegetable lepa curna will retain potency for 30 days if kept in air tight containers. Mineral and metallic preparations last indefinitely. Shelf life study of lepa in curna form showed it could be preserved for 3 months only free from insects. |
| 12. | Vati gutika | Pills made of plant drugs kept in air tight containers can be used for 2 years. Pills containing minerals can be kept for indefinite period. They should be lose their original colour, smell, taste and form. Vati-gutika containing plant drugs can be preserved for 6 months, in glass containers. |
When sugar, salt or ksara is an ingredient, moisture, should be excluded.

| No. | Name                  | Preservation Details                                                                 |
|-----|-----------------------|--------------------------------------------------------------------------------------|
| 13  | Varti-Netra bindu Anjana | Can be Preserved for one year if kept in air tight container. Mineral containing preparations are preserved indefinitely. |
| 14  | Sattva                | Can be preserved in closed containers.                                                |
| 15  | Kupipakva Rasayana   | To be kept in well stoppered bottles. Keep their potency indefinitely. Can be stored indefinitely. |
| 16  | Parpati               | Preserve their potency indefinitely, kept in glass bottles.                           |
| 17  | Pisti                 | They are as fine as bhasmas and preserve their potency indefinitely. Stored in glass stoppered bottles. Can be stored indefinitely |
| 18  | Bhasma                | Preserved in air tight glass or earthen containers. Maintain their potency indefinitely. Can be stored indefinitely |
| 19  | Mandura               | Preserve their potency indefinitely. Should be kept away from moisture. Can be stored indefinitely |
| 20  | Rasayoga              | Keep their potency indefinitely.                                                     |
| 21  | Lauha                 | When well protected from moisture and heat, keep their potency for a period of 2 years. Preparations containing Hg keep their potency indefinitely. Can be stored indefinitely |
Conclusion

Certain dosage forms are highly susceptible to spoilage. Extensive studies on more drugs are necessary to determine the specific factors responsible for the deterioration of individual medicines.

Investigation should be carried out on the application of the following measures for preventing spoilage, in so far as such measures are not repugnant to traditional methods of preparation. (1) Sterilisation by heat (2) Sterilisation by radiation (3) Aseptic preparation and packaging (4) Use of artificial preservatives.