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Definition and Scope of Pharmacy

The word 'pharmacy' is derived from the Greek word *pharmakon*, meaning medicine or drug. Pharmacy was considered as an art of compounding and dispensing of medicines at the counter. With the advancement of science and growing needs of people for quality products, a lot of progress has been made in the profession of pharmacy. The drugs handled by present day pharmacist differ greatly from those used by his predecessors fifty years back. Now the drugs are manufactured in bulk by the pharmaceutical industry and are distributed or sold among the consumers by the pharmacist.

Pharmacy is now defined as that profession, which is concerned with the art and science of preparing from natural and synthetic sources, suitable and convenient materials for distribution and use in the treatment and prevention, of disease. It provides a knowledge of the identification, selection, synthesis, pharmacological action, formulation, preservation, analysis and standardisation of drugs and medicines. It also includes their proper and safe distribution and use of drugs.

Dispensing means to prepare and supply of medicine to an individual patient, in accordance with the prescription of practitioner. For proper dispensing of medicines, it is essential that present day pharmacist should have a sound knowledge of various branches of pharmacy, such as, pharmaceutics, pharmaceutical chemistry, pharmacognosy, pharmacology, microbiology, pharmaceutical technology and forensic pharmacy. For compounding, stability during storage, packaging, physical incompatibilities of drugs need a background of pharmaceutical chemistry. Pharmaceutical dosages, uses and therapeutic incompatibilities are explained only if a pharmacist has complete knowledge of pharmacology. Preservation of drugs during storage requires a complete knowledge of microbiology. A knowledge of pharmaceutical technology is essential to understand the basic principles of various techniques of dispensing such as, size reduction, size separation, mixing, solution and filtration. The study of forensic pharmacy is helpful in understanding the condition

under which a prescription can be dispensed, labelling of the containers and to maintain the records of prescriptions which are dispensed.

Nowadays, an art of compounding and a high degree of skill is not needed to dispense the drugs. Extemporaneous dispensing has been greatly reduced in favour of medicaments presented in unit dosage forms.

Scope of Pharmacy

There is a wide scope of pharmacy profession. A pharmacist is a specialist in medication, custodian of medical information, companion of the physician, counsellor to the patient and guardian of the public health. Since he can perform a number of roles, so he can adopt any one of the following fields of pharmacy to earn his livelihood:—

1. Community pharmacy : A pharmacist having an aptitude for business can open a retail drug store to serve the community. Some big drug stores engage number of pharmacists, so as to run them smoothly. Community pharmacist is a unique hybrid of businessman and professional. He is usually the best educated and informed person, so he holds a unique position in the community. He is the most available professional. No pre-appointments are needed to talk with him. He does not charge for his professional advise. So he has more intimate contact with the patients than a doctor.

2. Wholesale pharmacy : It offers opportunities to a limited number of pharmacist to run wholesale business of drugs and medicines. The wholesaler serve as a middleman between manufacturer and retailer. The wholesalers buy goods in large quantities from the producer and sell them to the retailers. They keep huge stock of goods to meet the requirements of retailers without delay. They also provide credit facilities to the retailers and thus finances the retail trade.

3. Industrial pharmacy : Pharmaceutical industry offers opportunity to pharmacist of all educational levels. It provides job to a pharmacist in the following fields:—

(i) Production
(ii) Analytical and quality control
(iii) Research and development
(iv) Marketing and sale

(i) Production : In production, the pharmacist work as manufacturing chemist. He has to supervise the production of various types of pharmaceutical formulations, packaging, labelling and storage. Nor-

mally a single manufacturing chemist look after the production in a small scale unit, but in big concerns a separate manufacturing chemist is employed to look after an individual formulation section, such as, tablet section, syrup section, capsule section, ointment section etc. Generally pharmacist with bachelor degree in pharmacy are absorbed as manufacturing chemist.

(ii) Analytical and quality control : A manufacturing unit needs the service of analytical chemists in its analytical laboratory to do the testing of raw materials and finished goods manufactured by it. The requirements of number of analytical chemist depends on the work load in the analytical laboratory. Those manufacturing units which cannot afford to maintain analytical laboratory of their own, can get their products tested from private analytical laboratories or from state drug control laboratories. Normally pharmacist with bachelor degree in pharmacy get the job of analytical chemist.

(iii) Research and development : The big pharmaceutical houses have their own separate research and development unit. A pharmacist having doctorate degree or master degree in pharmacy is ideally suited for product development in pharmaceutical industry.

Research and development unit is generally engage in the following fields:—

(a) The synthesis of new compounds to be used as drugs, cosmetics, excipients, industrial chemicals and preservatives.

(b) Research on cultivation of medicinal plants.

(c) The isolation and purification of the active principles of plant and animal tissues, the determination of their chemical composition and further its synthesis.

(d) The preparation of drugs in suitable dosage forms designed and its testing to find the bio-availability of drug.

(e) The physical, chemical and biological standardisation of drugs.

(f) Research on the pharmacodynamics and toxicology of new drugs.

(g) The stability of dosage form during its storage and finding its date of expiry.

(h) The investigation of the suitability of proposed packaging materials and containers.

(iv) Pharmaceutical marketing and sales : Pharmaceutical marketing means the performance of pharmaceutical business activities that direct the flow of pharmaceutical formulations and services from pro-

ducer to the consumers. The pharmaceutical marketing is an indirect marketing where consumers have no choice to buy the medicines of its own. He has to purchase the drugs, which is prescribed by the physician. So the main job in pharmaceutical marketing is to influence the physician. Pharmaceutical industry engage medical representatives or detailmen to make contact with individual physician, at regular intervals for the purpose of product promotion. This can be rewarding career for persons with right personality and motivation. Sale team consists of medical representatives (detailmen), sale representatives, field officers, area managers, regional managers and sales managers. Pharmacist with bachelor degree in pharmacy, having an aptitude for sale, is best fitted in this field, because there is lot of scope of promotion.

Many pharmacists in industry work in various areas such as drug material procurement, professional information specialists' in liaison work with Governmental agencies, educational or research institutions or professional organisation or in marketing, advertising promotion or pharmaceutical sale.

4. Pharmacy education : Due to rapid growth of pharmaceutical industry and expansion of health services in the country, the demand of pharmacists have increased many a times. In order to fulfil the demand, there is steep increase in the number of pharmacy teaching institutions in the country. There is a need for qualified and experienced faculty members. So there is a big scope for fresh pharmacy post graduates to be absorbed as faculty members in these new institutions.

5. Hospital pharmacy : The practice of pharmacy within the hospital under the supervision of a professional pharmacist, is known as hospital pharmacy. The hospital pharmacy is organised in an integrated manner and consists of various divisions like compounding and dispensing, manufacturing of transfusion fluids and its quality control, supply of drugs to various indoor wards, research, education, training and library. The head of pharmacy is the chief hospital pharmacist. There may be one or more assistant chief pharmacist. The dispensary is run by pharmacists. The number of pharmacist required in a hospital is calculated on the number of beds available in the hospital and its occupancy rate. As a rule there must be minimum of 3 pharmacists for a small hospital. A 100 bedded hospital, however, should have at least 5 pharmacists.

The manufacturing unit of the hospital pharmacy is under the charge of manufacturing chemists approved by drug control authority to manufacture transfusion fluids and other dosage forms. The analytical chemist

maintain the quality control of the manufactured products. The drug stores of the hospital are under the charge of store officer. A large number of pharmacists can be suitably absorbed in a hospital pharmacy.

6. Drug control administration : Drug administration is run both at the level of central government as well as at state government. The drugs and cosmetics act provides for the establishment of following agencies to maintain drug control administration:—

(i) Advisory agency : Advisory agency includes Drugs Technical Advisory Board and Drugs Consultative Committee, to advise central and state Governments on technical matters related to drugs and cosmetics.

(ii) Analytical agency : Analytical agency includes Central Drugs Laboratories and State Drugs Control Laboratories. The main function of these laboratories are to do the analysis and testing of drugs and cosmetics manufactured or sold within their respective areas. Samples of drugs are taken by drug inspectors during the course of inspection of the licensed manufacturing houses and retail establishments, are required to be analysed in these laboratories, in order to ascertain whether they come up to the prescribed standard or not. The analysis in these laboratories are done by Government analyst.

(iii) Licensing authority : Licensing authorities are appointed by the Central Government to issue licences for the import of drugs. The State Governments appoint licensing authorities for their respective territories to issue licences for the manufacture and sale of drugs and cosmetics. State drug controller or director drug control administration is the licensing authority. The state drug controller is assisted by deputy drug controller, assistant drug controller, senior drug inspectors and drug inspectors.

In drug control administration, there is ample scope of graduate and post graduate pharmacists to be suitably absorbed in different capacities.

7. Pharmaceutical journalism : Pharmaceutical journalism offers rewarding experiences for a limited number of pharmacists with writing and editing skill.

8. Radiopharmacy (Nuclear pharmacy) : This is the new field of pharmacy. Radio pharmacy applies the principles and practices of pharmacy and radiochemistry to produce radio active drugs used for diagnosis and therapy. Radio active compounds used in human therapy and diagnosis are radio active drugs. The pharmacists are trained to handle and properly store these radio active drugs.

9. Organisational management : Organisational management offers an opportunity for pharmacist, who wish to serve national and state pharmaceutical associations and boards of pharmacy in various capacities. Pharmacy Council of India and All India Council of Technical Education are other bodies where service of experienced pharmacists are needed at various levels. There is less demand of pharmacy persons. But persons with organisational interests and talents will be in great demand and will play an important roles in the future development of pharmacy profession in the country.

Future of Pharmacy Profession

The pharmacist of the future must emerge as a consultant of drugs to the public as community pharmacist. Pharmacist can take an active role in health education of the public, because pharmacy is the health profession that concerns itself with the knowledge system that results in the discovery, development and use of medication and medication information in the care of patients. It encompasses the clinical, scientific, economic and educational aspects of the profession's knowledge base and its communication to others in the health care system. Pharmaceutical care is a necessary element of health care.

The pharmaceutical care involves the process through which a pharmacist cooperates with a patient and other professionals in designing, implementing and monitoring a therapeutic plan that will produce specific therapeutic outcomes for the patient.

Pharmaceutical care is the responsible provision of drug therapy for the purpose of achieving definite outcomes that improve a patient's quality of life. These outcomes are:—

(i) cure of disease

(ii) elimination or reduction of patient's symptoms

(iii) arresting or slowing of a diseased process

(iv) preventing a disease or symptoms

The pharmacist should take full advantage of his potential to be of assistance to nursing homes which are coming up in large number in the country. Clinical pharmacy service is another field in which pharmacist can help the members of medical faculty, the nursing staff and other health care professionals.

Private consultancy is another new field where there is lot of scope for pharmacist.

2

Prescription

Prescription is a written order from a registered medical practitioner, or other properly licensed practitioners, such as dentist, veterinarian etc. to a pharmacist to compound and dispense a specific medication for the patient. The order is accompanied by directions for the pharmacist to prepare a specific type and quantity of preparation for a patient. The prescription also include the directions for the patient regarding the mode of administration of drugs, which is dispensed for him. Thus prescription is a media through which treatment is provided for a patient by the combined skill and services of both the physician and the pharmacist.

The prescriptions are generally written in the English language but Latin words or abbreviations are frequently used in order to save time. So it becomes necessary for a pharmacist, to become familiar with the common Latin terms and abbreviations used by the prescriber while writing the prescription.

PARTS OF A PRESCRIPTION

Prescriptions are generally written on a typical format which are usually kept as pads. A typical prescription consists of following parts:—

1. Date
2. Name, age, sex and address of the patient
3. Superscription
4. Inscription
5. Subscription
6. Signatura
7. Renewal instructions
8. Signature, address, and registration number of the prescriber.

1. Date : It helps a pharmacist to find out the date of prescribing and date of presentation for filling the prescription. The prescription which prescribe narcotic or other habit forming drugs, must bear the date, so as to avoid the misuse of prescription if it is presented by the patient, a number of times for dispensing.

2. Name, age, sex and address of the patient : Name, age, sex and address of the patient must be written in the prescription because it serves to identify the prescription. In case, if any of these information is missing in the prescription, the same may be included by the pharmacist after proper enquiry from the patient. Age and sex of the patient, especially in case of children, help the pharmacist to check the prescribed dose of medication.

3. Superscription : It is represented by a symbol ℞ which is written before writing the prescription. ℞ is an abbreviation of the Latin word recipe, meaning 'You take' (Take thou). In olden days, the symbol was considered to be originated from the sign of Jupiter, God of healing. This symbol was employed by the ancient in requesting God for the quick recovery of the patient.

4. Inscription : This is the main part of the prescription order, contains the names and quantities of the prescribed ingredients. The names of ingredients are generally written in English language but common abbreviation used can be written both in English and Latin languages.

Extreme care should be taken by the pharmacist in interpreting the abbreviations, otherwise it can lead to serious errors.

The medicament may be prescribed as an official preparation, a proprietary product, a non-proprietary product (generic), not official or a special or individual formula. In case of special or individual formula, the quantity of each ingredient will be stated together with a description of the type of the preparation, e.g., cream, mixture, lotion etc.

The name of each ingredient is written on a separate line along with its quantity. In complex prescriptions containing several ingredients the inscription is divided into following parts:—

(a) *Base* : The active medicaments which are intended to produce the therapeutic effect.

(b) *Adjuvant* : It is included either to enhance the action of medicament or to improve the palatability of the preparation.

(c) *Vehicle* : It is included in the prescription either to dissolve the solid ingredients or to increase the volume of the preparation.

Nowadays, the majority of the drugs are prescribed which are already in a suitable formulation. The pharmacist is required to dispense the readymade form of drugs. So, compounding of prescription is almost eliminated.

5. Subscription : This comprises direction to the pharmacist for preparing the prescription and number of doses to be dispensed. These

days, the prescribers are omitting the specific instructions to the pharmacist because the majority of the prescriptions are not compounded and dispensed.

6. Signatura : This consists of the direction to be given to the patient regarding the administration of the drug. It is usually written as 'Sig' on the prescription. The instructions given in the prescription are required to be transferred to the label of the container in which the medicament is to be dispensed, so that the patient can follow it. The instructions may include:

(a) The quantity to be taken or amount to be used.
(b) The frequency and timing of administration or application.
(c) The route of administration.
(d) The special instructions such as dilution direction.

7. Renewal instructions : The prescriber indicate on every prescription order, whether it may be renewed and if so, how many times. It is very important particularly in the prescription containing the narcotic and other habit forming drugs to prevent its misuse.

8. Signature, address and registration number of the prescriber : The prescription must bear the signature of the prescriber along with its registration number and address. It is very important particularly in the prescription containing the narcotic and other habit forming drugs, to prevent its misuse. An example of a typical prescription is given below:—

SHARMA NURSING HOME Ph: 7122248
Model Town, Delhi

Date : 8-1-2000

Name : Mr. Nand Lal *Age* : 45 Yrs *Sex* : Male

Address : 48, Azad Nagar, Delhi.

℞ *(Superscription)*

(Inscription)

Sodium bicarbonate	3 g
Compound tincture of cardamom	2 ml
Simple syrup	6 ml
Water q.s.	90 ml

Fiat mistura *(Subscription)*

Cochleare magnum ter in die post cibos sumenda. *(Signatura)*

Sd/-
Dr Aswani Sharma
M.B.B.S., M.D.
Regd. No. 14328

Refill : _____

HANDLING OF PRESCRIPTION

The following procedure should be adopted by the pharmacist while handling the prescription for compounding and dispensing:—

1. Receiving
2. Reading and checking
3. Collecting and weighing the materials
4. Compounding, labelling and packaging

1. Receiving : The prescription should be received from the patient by the pharmacist himself. While receiving a prescription, a pharmacist should not change his facial expression which gives an impression to the patient that he is surprised or confused after seeing the prescription.

2. Reading and checking : On receiving a prescription, always check it that it is written in a proper format i.e. doctor's pad or OPD slip of the hospital/nursing home and signed by the prescriber along with date.

A prescription should always be screened behind the counter. In case of any difficulty in reading or any doubt regarding the prescription ingredients or directions, the pharmacist should consult the other pharmacist or the prescriber. But under no circumstance patient should come to know about it. Pharmacist should never guess about the meaning of any illegal or confused word. It may lead to serious consequences.

Sometimes prescription is received on telephone by senior pharmacist. In such case, after taking down the prescription, it should be verified by repeating it on phone to the prescriber. It is very important because nowadays, the number of drugs with almost the same pronunciation and spelling are available in the market. For example:

Acidin (R)	Apidin (R)
Prednisone	Prednisolone
Digoxin	Digitoxin
Althrocin	Eltroxin

If there is any omission of any important particulars, such as the dose, the prescriber should be contacted.

3. Collecting and weighing the material : Before compounding the prescription, all the materials required for it, should be collected on the left hand side of the balance. After weighing the material it should be shifted to right hand side of the balance. This gives a check of ingredients which have been weighed. While compounding, the label of every stock bottle should be read at least three times in order to avoid

any error:—

(a) When taken from the shelf or drawer.

(b) When the contents are removed for weighing and measuring.

(c) When the containers are returned back to its proper place.

4. Compounding, labelling and packaging : Compounding should be carried out in a neat place. All the equipment etc. required should be thoroughly cleaned and dried. Only one prescription should be compounded at one time. All the ingredients should be compounded according to the directions of the prescriber or according to pharmaceutical art. The compounded medicaments should be filled in suitable containers depending on its quantity and use. The filled containers are suitably labelled. White plain paper of good quality should be used for labelling the containers. The size of the label should be proportional to the size of the container which is written or typed, giving all the desired information. The label should be fixed with a good quality of adhesive, almost in the centre leaving equal space from the bottom and top of the container. The container is polished so as to remove the finger prints. While delivering the prescription to the patient, the pharmacist should explain the mode of administration, direction for use, and storage.

Latin Terms and Abbreviations Commonly Used in Prescription Writing

Latin Term	*Abbreviation*	*Meaning in English*
	KINDS OF THE PREPARATION	
Auristille	auristill	Ear drops
Capsula	caps	A capsule
Cataplasma	cataplasm	A poultice
Charta	chart	A powder
Collutorium	collut	A mouth wash
Collyrium	collyr	An eye wash
Cremor	crem	A cream
Emulsio	emul	An emulsion
Haustous	ht	A drought
Injectis	inj	An injection
Insufflatio	insuff	An insufflation
Linctus	lin	A linctus
Linimentum	lin	A liniment

Latin Term	*Abbreviation*	*Meaning in English*
Liquor	liq	A solution
Lotio	lot	A lotion
Mistura	m, mist	A mistura
Naristillae	narist	Nasal drops
Nebula	neb	A spray solution
Pasta	past	A paste
Pilula	pil	A pill
Pulvis	pulv	Powder
Solutio	sol	A solution
Suppositorium	suppos	A suppository
Tabella	tab	A tablet
Unguentum	ung	An ointment

METHOD OF ADMINISTRATION OR APPLICATION

Addendus	addend	To be added
Applicandus	applicand	To be applied
Applicat	—	Let (him) apply
Capiendus	capiend	To be taken
Dandus	dand	To be given
Deglutiendus	deglut	To be swallowed
Infricandus	infricand	To be rubbed in
Inhaletur	inhal	Let (it) be inhaled
Miscendus	miscend	To be mixed
Signa	sin	Label
Sumendus	S or sum	To be taken
Utendus	U or utend	To be used

TIME OF ADMINISTRATION

(a) Times per day

Semel in die	sem in die	Once a day
Bis in die, Bis die	b.i.d., b.d.	Twice a day
Ter in die	t.i.d., t.d.	Three times a day
Quater in die	q.i.d., q.d.	Four times a day
Sexies in die	sex.i.d.	Six times a day

Latin Term	*Abbreviation*	*Meaning in English*
(b) Different time of the day		
Primo mane	prim. m	Early in the morning
Mane	m	In the morning
Omni mane	o.m.	Every morning
Omni nocte	o.n.	Every night
Inter nocte	inter nocte	During the night
Nocte	n	At night
Inter noctem	inter nocte	During the night
Jentaculum	jentac	Breakfast
Nocte et mane	n.et.m	Night and morning
Nocte maneque	n.m.	Night and morning
(c) Hour time		
Omni hora	o.h.	Every hour
Omni quarta hora	o.q.h.	Every fourth hour
Singulis horis	sing. hora	Every hour
Alternis horis	alt. hor.	Every two hours
Tertis horis	tert. hor.	Every three hours
Quartis horis	quart. hor.	Every four hours
Sextis horis	sext. hor.	Every six hours
(d) Correlated time		
Anti cibos	a.c.	Before meals
Post cibos	p.c.	After meals
Inter cibos	i.c.	Between meals
(e) Other terms		
Dolore urgente	dol.urg.	When the pain is severe
Frequenter	freq	Frequently
Lente	—	Slowly
More dicto	m.d.	As directed
Mode dicto	m.d.	
Si opus sit	s.o.s.	When required or When necessary
Statim	stat.	Immediately
Tussi urgent	tuss. urg.	When the cough is troublesome

Latin Term	*Abbreviation*	*Meaning in English*
VEHICLE USED AND MEANS OF APPLICATION		
Cochleare amplum	amp	One tablespoonful
Cochleare magnum	coch—mag	
Cochleare maximum	max	
Cochleare medium	coch. med.	One dessertspoonful
Cochleare minimum	coch. min.	One teaspoonful
cum	c	With
Cum duplo	c. dup.	With twice as much
Cum parte aequale	c. pt. aeq.	With an equal quantity
Cum tanto	c. tant.	With as much
Cyathus amplus	cyath. amp.	A tumbler
Cyathus magnus	cyath. mag.	A tumbler
Cyathus vinosus	cyath. vin.	A wine glass
E.lacte	e. lact.	With milk
Ex.aqua	ex. aq.	With water
PARTS OF THE BODY		
Auris dexter	a.d.	To right ear
Auris laevus	a.l.	To left ear
Brachis	brach.	To the body
Jugulo	jug.	To the throat
Naso	—	To the nose
Oculis dexter	o.d.	To right eye
Oculis laevus	o.l	To left eye
Os, oris	o.s.	To mouth
Pro oculus	pro.ocul.	For the eyes
Sterno	stern	To the chest
MISCELLANEOUS		
Ad	ad.	To, upto
Ana	ãã, aa	Of each
Ante	a	Before
Aqua	aq	Water
Aqua distillata	aq. dest.	Distilled water
Cibos	cibos	Meals, food
Fiat	ft.	Make, let it be made

Latin Term	*Abbreviation*	*Meaning in English*
Gutta, guttae	gtt.	A drop, drops
Hora	h	An hour
Laevo	l	Left
Misce	m	Mix, let it be mixed
Mitte	mitt.	Send
Mitte tales	mitt tal	Send such
More dicto	m.dict.	In the manner prescribed
Omni	omn	Every
Pro dosi	—	As a dose
Quantum sufficiat	q.s.	As much as is sufficient
Recipe	℞	Take
Semi	ss	Half
Solve	—	Dissolve
Talis, tales	tal	Such

NUMERALS

Latin word	*Roman symbol*	*Meaning in English*
Unus	I	One
Duo	II	Two
Tres	III	Three
Quatuor	IV	Four
Quinque	V	Five
Sex VI	Six	
Septem	VII	Seven
Octe	VIII	Eight
Novem	IX	Nine
Decem	X	Ten
Undecim	XI	Eleven
Duodecim	XII	Twelve
Quatuordecim	XIV	Fourteen
Quindecim	XV	Fifteen
Viginti	XX	Twenty
Quinguaginta	L	Fifty
Centum	C	One hundred

MODERN METHODS OF PRESCRIBING

Nowadays, the majority of the drugs are available in the market as readymade formulations manufactured by different pharmaceutical companies. There is no need to dispense the drugs by the pharmacist. In the present days, the role of pharmacist is to hand over the readymade preparations to the patients and provide advice if demanded regarding its mode of administration, dose schedule, drug interactions and adverse reactions etc. The practice of writing long, complicated prescriptions containing several ingredients, adjuvants, vehicles is not required.

In the present day set up, the writing of prescription is more significant. The prescription should be precise, accurate, clear and easily readable. As far as possible, the Latin terms should be avoided. In olden days the Latin language was used to conceal certain facts from the patient. But nowadays, the prescriptions are written in English language and dose is prescribed in metric system for the convenience of the patients.

The drugs should be prescribed by its official (generic) name and not by its proprietary or trade name. There are certain advantages and disadvantages of prescribing the drugs by its proprietary names, which are as under:—

Advantages

(1) It is easy to remember proprietary names because they are very catchy e.g., Librium (chlordiazepoxide), Calmpose (diazepam), and Crocin (paracetamol).

(2) It is easy to communicate with the patient.

(3) The continuity can be maintained by prescribing the same proprietary name every time.

(4) The bioavailability of drugs changed with the change of adjuvants used in drug formulations manufactured by different manufacturers. So only those proprietary drugs can be prescribed which have a better bioavailability.

Disadvantages

(1) It is cheaper to prescribe the drugs by its official name.

(2) It becomes difficult for a pharmacist to dispense the substitute of the drug which is available in the stock.

There are four types of prescriptions which are generally received by the retail drug store:—

(a) Prescription in general practice
(b) Private prescriptions
(c) Hospital prescriptions meant for 'out patients'
(d) Hospital prescriptions meant for 'in patients'

A typical modern prescription is given below:—

RADHIKA NURSING HOME
Asaf Ali Road, Delhi
Tel. : 3233218, 3239345

Date : 20-1-99

Name : Mrs. Madhulika *Age* : 37 Yrs *Sex* : Female

Address : 42, Mayur Vihar, Phase-I, Delhi.

℞
Cap. ampicillin 500 mg
Dispense 20 capsules.
One capsule to be taken with water
four times a day for five days.

Refill : _____

Sd/-
Signature of the prescriber
Regd. No. :

CARE REQUIRED IN DISPENSING PRESCRIPTION

Following precautions should be taken while dispensing a prescription.

(1) Always keep the prescription before you. Take the prescription with you while taking out the medicine from the shelf. It will serve as a constant reminder of the name and strength of the preparation required and help to avoid mistakes.

(2) Always check the dispensing balance before weighing the ingredients which are required during dispensing.

(3) Replace containers of stock preparations or drugs in their proper position after use.

(4) Keep the label in upper position during weighing solid ingredients especially the potent drugs such as morphine hydrochloride to serve as a constant reminder that the correct drug is being used.

(5) When pouring or measuring the liquid ingredients, keep the label upward in order to prevent surplus liquid running down of the bottle and staining the label.

(6) Care should be taken to keep the dispensing balance clean. The powder should be transferred from the stock container by using a clean spatula. The scale pan should be cleaned immediately after use.

(7) Medicines which are used externally such as lotions, liniments, paints etc. should be supplied in vertically fluted or ribbed bottles in order to distinguish it by touch. They must be labelled in red or against a red background.

FOR EXTERNAL USE ONLY

(8) Before handing over the medicine to the patient, again check that the correct preparation, in the correct strength, has been supplied and correct direction has been stated on the label.

Sources of Error in Prescription

1. Abbreviation : Abbreviation presents a problem in understanding parts of the prescription order. Extreme care should be taken by a pharmacist in interpreting the abbreviation. Pharmacist should not guess at the meaning of an ambiguous abbreviation e.g., to dispense Achromycin for "Achro" may cause difficulty when the intention of the prescriber is to dispense Achrostatin. The abbreviation "SSKI" represents the use of a short hand for saturated solution and chemical symbols for potassium iodide.

2. Name of the drug : There are certain drugs whose name look or sound like those of other drugs. Some of the examples of such drugs are as under:—

Digitoxin	Digoxin
Prednisone	Prednisolone
Indocin	Lincocin
Doridon	Doxidan
Pabalate	Robalate
Ananase	Orinase

Name of the pharmaceutical products have been changed on certain occasion due to the possible confusion with the name of the other product e.g. the name of potassium supplement was changed from Kalyum to Kolyum because of the possible confusion of the former designation with valium.

3. Strength of the preparation : The strength of the preparation should be stated by the prescriber. It is essential when various strengths of a product are available in the market. For example, it will be a wrong decision on the part of a pharmacist to dispense paracetamol tablet 500 mg when prescription for paracetamol tablet is received with no specific strength.

4. Dosage form of the drug prescribed : Many medicines are available in more than one dosage form e.g., liquid, tablet, capsule and suppository. The pharmaceutical form of the product should be written on the prescription in order to avoid ambiguity.

5. Dose : Unusually high or low doses should be discussed with the prescriber. Paediatric dosage may present a problem. So pharmacist should consult paediatric posology to avoid any error. Sometimes a reasonable dose is administered too frequently e.g., a prescription for sustained release formulation to be administered after very four hours should be thoroughly checked because such dosage forms are usually administered only two or three times a day.

6. Instructions for the patient : The instructions for the patient which are given in the prescription are incomplete or omitted. The quantity of the drug to be taken, the frequency and timing of administration, and route of administration should be clearly given in the prescription so as to avoid any confusion.

7. Incompatibilities : It is essential to check that there are no pharmaceutical or therapeutic incompatibilities in a prescribed preparation and that different medicines prescribed for the same patient do not interact with each other to produce any harm to the patient. Certain antibiotics should not be given with meals since it significantly decrease the absorption of the drug.

5

Posology

The word posology is derived from the Greek words 'posos' meaning how much and 'logos' meaning science. So posology is a branch of medical science which deals with dose or quantity of drugs which can be administered to a patient to get the desired pharmacological actions. The dose of a drug cannot be fixed rigidly because there are so many factors which influence the doses. These factors are age, condition of the patient, severity of the disease, tolerances both natural and acquired, idiosyncrasy, route of administration, formulation used, drug interactions and rate of elimination.

The official doses (doses which are given in pharmacopœia) represent the average range of quantities suitable for adults which administered orally within 24 hours. When other routes of administration are followed the relevant appropriate dose is given. It is the responsibility of the prescriber regarding the amount of the drug to be prescribed or the frequency at which the drug to be administered. But before dispensing any prescription, it becomes the duty of the pharmacist to satisfy himself that the overdose has not been prescribed. This can be confirmed either from the prescriber or by consulting the pharmacopœia.

Factors Influencing Dose

The optimum dose of a drug which produces the desired therapeutic effect varies from person to person, because every individual varies both in the degree and character of the response produced by the drug. Due to this reason the doses of official preparations of drugs are expressed in the form of a range which gives the therapeutic effect. The dose range is usually based on the average requirements of an adult patient.

The following are some of the factors which influence the dose:—

1. Age : The pharmacokinetics of many drugs changes with age. So while determining the dose of a drug, the age of an individual is of great significance. Children and old people need lesser amount of drug

than the normal adult dose, because they are unable to excrete drugs to that extent as adults. Children can tolerate relatively larger amounts of belladonna, digitalis and ethanol, whereas, elderly patients are more sensitive to some drug effects e.g. hypnotics and tranquillizers which may produce confusion states in them.

2. Sex : Women do not always respond to the action of drugs in the same manner as it is done in men. Morphine and barbiturates may produce more excitement before sedation in women. Special care should be taken when drugs are administered during menstruation, pregnancy and lactation. The strong purgatives such as aloes should be avoided during menstruation. Similarly the drugs which may stimulate the uterine smooth muscle e.g. drastic purgatives, antimalarial drugs and ergot alkaloids are contra indicated during pregnancy. There are certain drugs which on administration to the mother are capable of crossing the placenta and affecting the foetus e.g. alcohol, barbiturates, narcotic and non narcotic analgesics etc. During lactation, the drugs like antihistamines, morphine and tetracycline which are excreted in milk should be avoided or given very cautiously to the mothers who are breast feeding the babies.

3. Body weight : The average dose is mentioned either in terms of mg per Kg body weight or as a total single dose for an adult weighing between 50-100 Kg. However, the dose expressed in this fashion may not apply in cases of obese patients, children and malnourished patients. It should be calculated according to body weight.

4. Route of administration : Intravenous doses of drugs are usually smaller than the oral doses, because the drugs administered intravenously enter the blood stream directly. Due to this reason the onset of drug action is quick with intravenous route and this might enhance the chances of drug toxicity. The effectiveness of drug formulation is generally controlled by the route of administration.

5. Time of administration : The presence of food in the stomach delays the absorption of drugs. The drugs are more rapidly absorbed from the empty stomach. So the amount of drug which is very effective when taken before a meal may not be that much effective when taken during or after meals. The irritating drugs are better tolerated if administered after meals e.g. iron, arsenic and cod-liver oil should always be given after meals.

6. Environmental factors : Daylight is stimulant, enhancing the effect of stimulating drugs and diminishing the effect of hypnotics.

Darkness is sedative. Hypnotics are more effective at night. The amount of barbiturate required to produce sleep during day time is much higher than the dose required to produce sleep at night. Alcohol is better tolerated in cold environments than in summer.

7. Emotional factors : The personality and behaviour of a physician may influence the effect of drug especially the drugs which are intended for use in a psychosomatic disorder. The females are more emotional than males and requires less dose of certain drugs. Inert dosage forms called placebos which resemble the actual medicament in the physical properties are known to produce therapeutic benefit in diseases like angina pectoris and bronchial asthma.

8. Presence of disease : Drugs like barbiturates and chlorpromazine may produce unusually prolonged effect in patients having liver cirrhosis. Streptomycin is excreted mainly by the kidney may prove toxic if the kidney of the patient is not working properly. During fever a patient can tolerate high doses of antipyretics than a normal person.

9. Accumulation : The drugs which are slowly excreted may built up a sufficient high concentration in the body and produce toxic symptoms if it is repeatedly administered for a long time e.g. digitalis, emetine and heavy metals. This occurs due to accumulative effect of the drug. The cumulative effects are usually produced by slow excretion, degradation and rapid absorption of drugs. Sometimes, a cumulative effect is desired in drugs like phenobarbitone in the treatment of epilepsy.

10. Additive effect : When the total pharmacological action of two or more drugs administered together is equivalent to sum of their individual pharmacological action, the phenomena is called as an additive effect. For example, combination of ephedrine and aminophylline in the treatment of bronchial asthma.

11. Synergism : When two or more drugs are used in the combination form, their action is increased. The phenomena is called synergism. Synergism is very useful when desired therapeutic result needed is difficult to achieve with a single drug e.g. procaine and adrenaline combination, increases the duration of action of procaine.

12. Antagonism : When the action of one drug is opposed by the other drug on the same physiological system is known as drug antagonism. The use of antagonistic responses to drugs is valuable in the treatment of poisoning e.g. milk of magnesia is given in acid poisoning

where alkaline effect of milk of magnesia neutralise the effect of acid poisoning. When adrenaline and acetylcholine are given together, they neutralise the effect of each other due to antagonism because adrenaline is vasoconstrictor and acetylcholine is vasodilator.

13. Idiosyncrasy : An extraordinary response to a drug which is different from its characteristic pharmacological action is called idiosyncrasy. The word idiosyncrasy has now been replaced by the term drug allergy. For example, small quantity of aspirin may cause gastric haemorrhage and a small dose of quinine may produce ringing in the ears. Some persons are sensitive to penicillin and sulphonamide because they produce severe toxic symptoms.

14. Tolerance : When an unusually large dose of a drug is required to elicit an affect ordinarily produced by the normal therapeutic dose of the drug, the phenomenon is termed as drug tolerance. e.g., smokers can tolerate nicotine, alcoholic can tolerate large quantity of alcohol. The drug tolerance is of two types:—

(i) True tolerance, which is produced by oral and parenteral administration of the drug.

(ii) Pseudo tolerance, which is produced only to the oral route of administration.

15. Tachyphylaxis : It has been observed that when certain drugs are administered repeatedly at short intervals, the cell receptors get blocked up and pharmacological response to that particular drug is decreased. The decreased response cannot be reversed by increasing the dose. This phenomenon is known as tachyphylaxis or acute tolerance. For example, ephedrine when given in repeated doses at short intervals in the treatment of bronchial asthma may produce very less response due to tachyphylaxis. Similarly, drugs like amphetamine, cocaine and nitrates behave in this ways.

16. Metabolic disturbances : Changes in water electrolyte balance and acid base balance, body temperature and other physiological factor may modify the effects of drugs. Salicylates reduce body temperature only in case an individual has rise in body temperature. They have no antipyretic effect if the body temperature is normal. The absorption of iron from G.I.T is maximum if the individual has an iron deficiency anaemia.

CALCULATIONS OF DOSES

The doses of a drug given in the appendix-I, represent the average maximum quantity of drugs which can be administered to an adult orally within 24 hours. When other routes of administration are followed, the dose is adjusted accordingly. The doses are also calculated in proportionate to age, body weight and surface area of the patient.

1. Doses proportionate to age : There are number of methods by which the dose for a child can be calculated from the adult dose.

(i) Young's Formula:

$$\text{Dose for the child} = \frac{\text{Age in years}}{\text{Age in years} + 12} \times \text{Adult dose}$$

The formula is used for calculating the doses for children under 12 years of age.

(ii) Dilling's Formula:

$$\text{Dose for the child} = \frac{\text{Age in years}}{20} \times \text{Adult dose}$$

The formula is used for calculating the doses for children in between 4 to 20 years of age. This formula is considered better because it is easier and quick to calculate the dose.

2. Doses proportionate to body weight : Clark's formula is used to calculate the dose for the child according to body weight.

Clark's Formula:

$$\text{Dose for the child} = \frac{\text{Child's weight in Kg}}{70} \times \text{Adult dose}$$

3. Doses proportionate to surface area : The calculation of child dose according to surface area is more satisfactory and appropriate rather than the method based on age. The method is more complicated than the method based on age. The method is based on the following formula:—

$$\text{Percentage of adult dose} = \frac{\text{Surface area of child}}{\text{Surface area of adult}} \times 100$$

The body surface area is calculated from the height and weight of the child. It is better to depend on a handy reference book rather than on one's memory while prescribing a dose for a child. Table 5.1 shows the determination of children doses from adult doses on the basis of body surface area.

TABLE 5.1

Determination of Children's Dose from Adult Dose on the Basis of Body Surface Area

S.No.	*Weight (Kg)*	*Approx. Surface Area in Square Metres*	*Approx. Percentage of Adult Dose*
1.	2	0.15	9
2.	4	0.25	14
3.	6	0.33	19
4.	8	0.40	23
5.	10	0.46	27
6.	15	0.63	36
7.	20	0.80	46
8.	25	0.95	55
9.	30	1.08	62
10.	35	1.20	70
11.	40	1.30	75
12.	45	1.40	81
13.	50	1.51	87
14.	55	1.58	91

The doses of different drugs, their route of administration and uses are given in Appendix I for the reference of the students.

VETERINARY DOSES

A practising pharmacist (running chemist shop) is considered to be responsible for supplying correct doses in any type of prescription. Therefore it is required that he should have complete knowledge of posology which pertains to animal medication.

The doses required for animals are more or on higher side in comparison to human beings because the weight and surface area of animals is normally more than that of human beings. Doses for animals are normally mentioned on body weights. Doses are normally applicable to all species' except in certain cases, where it is specifically mentioned. The doses of different drugs, their route of administration and uses are given in Appendix II for the reference of the students.

Factors Influencing Dose of a Drug in Animals

1. Age : Young animals need less dose of a drug as compared to adults, because young animals are more susceptible than adults.

2. Sex : Sex plays an important role while prescribing the dose for an animal. The female may require less dose than the male animals. Certain drugs are contra-indicated in pregnant animals because of hazards of inducing abortion. Some drugs have tendency to pass into milk which becomes unfit for human consumption. Such drugs must be used carefully when administered in milch animals.

3. Body weight and size : The dose of the drug in case of animals depend on their body weight and size. The size of animals varies according to its breeds. For example, in case of dogs, a dose which may be harmless for a heavy breed of dog may be dangerous to dogs of lighter breed.

4. Time of administration : A small dose of a drug may be more effective if given in an empty stomach rather than the same when given after meals. Purgatives and anthelmintics are more effective when given in empty stomach. Similarly, the hypnotics are more effective when given after sunset than given early in the morning.

5. Route of administration : The dose of the same drug varies with the use of different routes of administration. The maximum dose is required when the drug is given orally. The minimum dose is needed when the drug is administered by intravenous route. The following order is observed while administering the dose of same drug by different routes:—

$$\text{oral} > \text{s/c} > \text{i/m} > \text{i/v}$$

6. Environmental conditions : The atmospheric moisture and temperature have a great influence on the tissues of the animals. In rainy season, when the climate is quite humid and hot, less dose is required than in winter when climate is dry and cold.

7. Habit : An animal which is constantly under the influence of a drug may develop tolerance for that drug. In such animals the normal dose may fail to produce the desired effect. Hence, larger doses are required to produce the required effect.

8. Rate of elimination : The rate of excretion of drug has marked effect on the dose of the drug. The drugs which are excreted at a faster rate require large doses than those drugs which are excreted at a slow rate.

9. The effect of drug : When two drugs having the similar type of pharmacological action are given in combination, the effect will become more powerful than the individual drug even given in equivalent dose. But many a times, when two or more drugs are combined together, they oppose the effect of each other and ultimate therapeutic effect is decreased.

10. Purpose of medication : The dose of drug varies with the purpose for which it is used. For example, magnesium sulphate act as purgative in large doses but in smaller doses it acts as antacid and laxative.

11. Species : The dose of a drug varies from species to species. The dose of a drug for a cow will be different from horse, sheep, pig, cat etc. Opium is a narcotic even than it produces excitement in horse and cattle. But it shows narcosis in dog. These differences in action are due to anatomical and physiological peculiarities.

12. Character of the drug : Larger doses of drug are required if it given in crude form to the animals. For example, nux vomica powder is required to be given in large doses than its active constituent strychnine alkaloid which is given in smaller doses.

8

Monophasic Liquid Dosage Forms

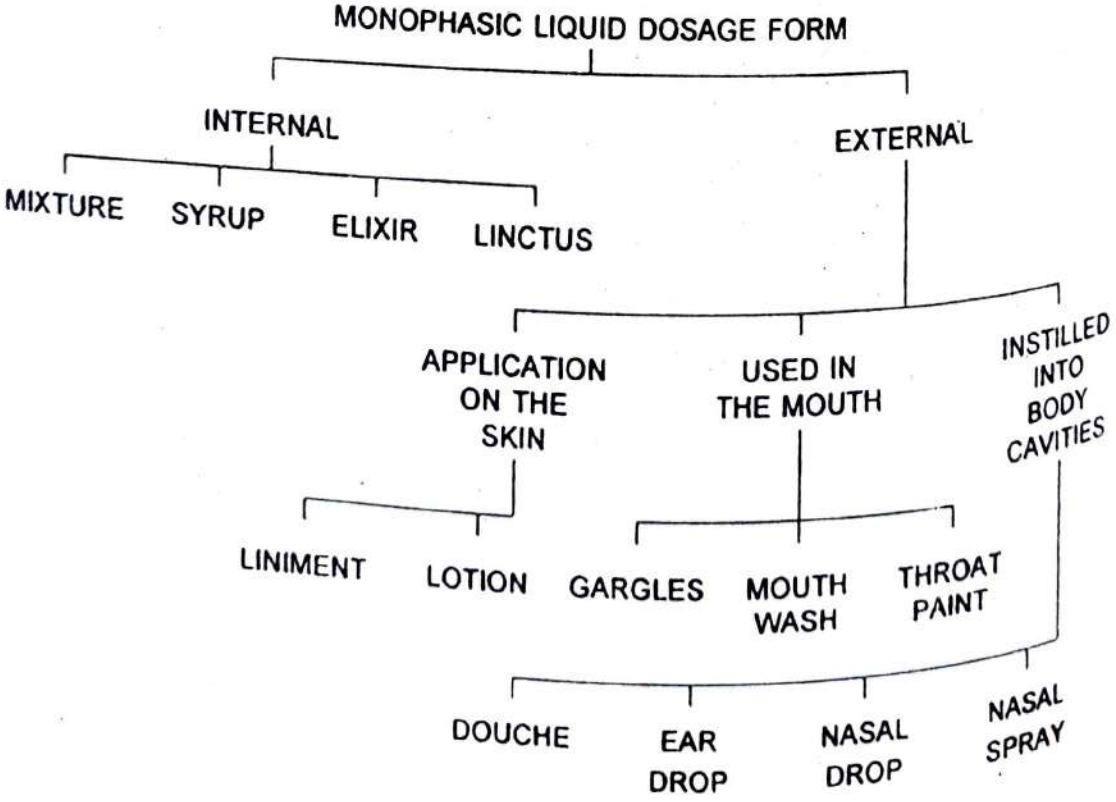
Liquid dosage forms commonly used in pharmacy are either monophasic or biphasic. Monophasic liquid dosage form refers to liquid preparation in which there is only one phase. It is represented by true solution. A true solution is a clear homogenous mixture that is prepared by dissolving a solid, liquid or gas in a liquid. The component of solution present in large amount is known as 'solvent' and the component present in small amount is known as 'solute'.

Classification

Monophasic liquid dosage forms are classified into two groups:—

(i) Liquids meant for internal administration, for example, mixtures, syrups and elixirs.

(ii) Liquids meant for external administration, for example, gargles, mouthwashes, throat paints, douches, nasal drops, eye drops, ear drops, liniments and lotions.



LIQUIDS MEANT FOR INTERNAL ADMINISTRATION

Liquid preparations for internal administration includes following categories of preparations:—

(1) Mixtures
(2) Syrups
(3) Elixirs
(4) Linctuses

MIXTURES

A mixture is a liquid preparation meant for oral administration in which medicament or medicaments are dissolved or suspended in a suitable vehicle. Generally, several doses are dispensed in a bottle. In case, a bottle contain one dose, it is called draught.

Mixtures are not prepared to keep them for a long period because they are mainly prescribed for acute conditions such as cough, indigestion, diarrhoea, constipation etc. So the mixtures should be extemporaneously prepared and supplied only for small number of doses which can be used up within a short period. In case further need arises, then a fresh mixture is prepared for the patient.

Classification of mixtures Mixtures are classified into:—

(i) Simple mixtures containing soluble substances
(ii) Mixtures containing diffusible solids
(iii) Mixtures containing indiffusible solids
(iv) Mixtures containing precipitates forming liquids
(v) Mixtures containing slightly soluble liquids

(i) Simple mixtures containing soluble substances : Simple mixtures contains only soluble ingredients e.g., carminative mixture, diarrhoea mixture and expectorant mixture.

Method of dispensing

(1) Dissolve the solid substances in 3/4th of the vehicle.
(2) Examine the solution critically by holding it against the light. If foreign particles are visible, strain it through a cotton wool.
(3) Add any liquid ingredients.
(4) Add more of vehicle to produce the final volume.
(5) Transfer the mixture into the bottle. Cork it and then thoroughly polish the bottle to remove finger prints. Attach the label, wrap the bottle and dispense.

Example 8.1 Prepare and dispense 90 ml of the following mixture.

℞

Potassium bromide	4.0 g
Tincture nux vomica	4.0 ml
Chloroform water	add up to 90 ml

Prepare a mixture.

Direction : One tablespoonful to be taken three times after meals.

Method : Dissolve potassium bromide in 3/4th of chloroform water. Filter the solution to remove foreign particles. Add tincture nux vomica. Incorporate more of chloroform water to make required volume. Transfer the mixture to a bottle. Cork, label and dispense.

(ii) **Mixtures containing diffusible solids :** Diffusible solids are those which do not dissolve in water, but may be mixed there with so that, upon shaking, the powder drug is evenly diffused throughout the liquid for sufficient time to ensure uniform distribution in each dose. The commonly used diffusible drugs are bismuth carbonate, bismuth subnitrate, magnesium carbonate (heavy or light), magnesium oxide (heavy or light), quinine sulphate, light kaolin etc.

Method of dispensing

(1) Finely powder the drug in a mortar. Add any soluble drug and mix.

(2) Measure 3/4th of the vehicle. Make a smooth cream by using a portion of the vehicle and then add the remaining portion of the measured vehicle.

(3) Transfer the content of mortar into a measure. Rinse the mortar with a little of vehicle and transfer it into a measure.

(4) Add any liquid ingredient.

(5) Add more of vehicle to produce the required volume.

(6) Transfer the mixture to the dispensing bottle, cork, label and dispense. Apply the secondary label — "Shake the bottle well before use".

Example 8.2 Prepare and dispense the following mixture.

℞

Magnesium sulphate	15.0 g
Magnesium carbonate	2.0 g
Peppermint water add up to	90.0 ml

Prepare a mixture.

Direction : One tablespoonful to be taken two hours before breakfast.

Method : Mix the required quantity of magnesium sulphate and magnesium carbonate in a mortar. Measure the 3/4th of the peppermint water. Add the small quantity of it to the powder. Triturate thoroughly so as to form a smooth cream. Then add the remaining quantity of peppermint water. Strain through a muslin piece if foreign particles are present. Incorporate more of peppermint water to produce the final volume. Transfer the mixture to a bottle, cork and label.

(iii) Mixtures containing indiffusible solids : Indiffusible solids are those solids which are not soluble in water and do not remain uniformly distributed in the vehicle for sufficiently long time. Therefore, to suspend the drug, suspending agents are added. The commonly used indiffusible drugs in mixtures form are acetylsalicylic acid, quinine salicylate, calomel, phenacetin, benzoic acid, phenobarbitone prepared chalk etc.

The suspending agents which are commonly used in mixtures containing indiffusible solids are:—

(a) *Compound tragacanth powder* : In the proportion of 2g/100 ml (10 grains/ounce) of the mixture.

(b) *Tragacanth mucilage* : In the proportion of 1/4th of the volume of the mixture.

Compound tragacanth powder is used when the vehicle is other than water or chloroform water but tragacanth mucilage is used when the vehicle is water or chloroform water.

Method of dispensing (using compound tragacanth powder)

(1) Finely powder indiffusible solids. Add any soluble or diffusible solids and compound tragacanth powder. Mix them uniformly.

(2) Measure about 3/4th of the vehicle. Triturate the powder with a portion of it until a smooth cream is formed. Then add remainder of the vehicle.

(3) Examine the contents of the preparation. If any foreign particle is visible, pass the contents through the muslin cloth. Rinse the mortar with little of vehicle.

(4) Add any liquid ingredients if present and transfer the mixture into a measure.

(5) Add more of the vehicle to produce the required volume.

(6) Transfer the mixture into the bottle. Then thoroughly clean the

bottle. Attach the label with a direction "Shake the bottle well before use". Dispense the bottle.

Method of dispensing (using tragacanth mucilage)

(1) Finely powder the indiffusible solids. Add any soluble or diffusible solids. Mix them uniformly. Triturate the material with tragacanth mucilage (1/4th of the volume) to form a smooth cream. Then gradually dilute with 1/2 of the vehicle. The product will thus measure about 3/4th of the finished volume.

Step 3, 4, 5, 6 are the same as described above in compound tragacanth powder method.

Example 8.3 Prepare and dispense the following mixture.

℞

Acetyl salicylic acid	1.5 g
Oxyphenbutazone	0.25 g
Simple syrup	15.0 ml
Water add up to	90.0 ml

Prepare a mixture.

- *Direction* : Two tablespoonful to be taken three times a day.

Finely powder acetyl salicylic acid and oxyphenbutazone. Mix and add 20.0 ml of mucilage of tragacanth until a smooth cream is formed. Diluted with 45.0 ml of water. Add 15.0 ml of simple syrup in the centre of the mixture and triturate. Transfer the mixture into a measure. Rinse the mortar with a little portion of remaining water and add the rinsing to the mixture. Add more of water to make the final volume. Transfer the mixture to a bottle. Cork, label and dispense.

(iv) Mixture containing precipitate forming liquids : Certain liquid preparations contain resinous matter, when mixed with water, the resin is precipitated which may adhere to the sides of the bottle or form a clotted precipitate which will not re-diffuse upon shaking. To prevent this compound tragacanth powder or tragacanth mucilage are used.

Method of dispensing (using compound tragacanth powder)

(1) Finely powder the indiffusible solid and diffusible solid in the mortar. Mix them with compound powder of tragacanth in a mortar.

(2) Measure 3/4th of the vehicle and to this add a portion of it and triturate to form a smooth cream. Add the remaining part of the vehicle.

(3) Measure the precipitate forming liquid in a dry measure and add it in a slow stream in the centre of the cream with rapid stirring.

(4) Dissolve the soluble ingredient (if present) in sufficient amount of vehicle. Add it slowly with constant stirring to the cream to avoid local high concentrations that may neutralise the effect of suspending agent.

(5) Step 3, 4, 5, 6 are the same as described in case of mixture containing indiffusible solids.

Method of dispensing (using tragacanth mucilage)

Tragacanth mucilage is used when the vehicle is water or chloroform water.

(1) Mix the tragacanth mucilage with an equal volume of the vehicle.

(2) Measure the precipitate forming liquid in a dry measure and pour slowly into the centre of the mucilage with constant stirring.

(3) Dissolve any solid substance in about $^1/_4$th of the vehicle and mix it with the above mixture.

(4) Step 3, 4, 5, 6 are the same as described in case of mixture containing indiffusible solid.

Example 8.4 Prepare and dispense the following mixture.

℞

Potassium iodide	2.0 g
Tincture lobelia ether	4.0 ml
Tincture stramonium	16.0 ml
Chloroform water add up to	90.0 ml

Prepare a mixture.

Direction : One desert-spoonful to be taken four times a day.

Method : Mix 20.0 ml of mucilage of tragacanth with equal volume of water. Measure tincture lobelia ether and tincture stramonium separately in a dry measure and pour slowly into the centre of the mucilage with constant stirring. Dissolve potassium iodide in water and mix it with above mixture. Strain the mixture through muslin piece if foreign particles are present. Add more of chloroform water to produce the required volume. Transfer the mixture into the bottle, cork, label and dispense.

(v) **Mixtures containing slightly soluble liquids** : The insoluble portion of slightly soluble liquids is not readily diffusible. So a sus-

pending agent is needed to dispense such mixtures. Compound tragacanth powder and tragacanth mucilage are used in the same proportion as discussed in mixture containing indiffusible solids.

Example 8.5 Prepare and dispense the following mixture.

℞ Paraldehyde	4.0 ml
Syrup	8.0 ml
Liquid extract of glycyrrhiza	2.0 ml
Water add upto	30.0 ml

Prepare a draught.

Direction : Take as directed.

Method : Place paraldehyde in a bottle, add the tragacanth mucilage and shake vigorously. Dissolve syrup and liquid extract of glycyrrhiza in water and add it gradually to the contents of the bottle. Transfer the liquid from the bottle to a measure. Add more of water to produce the required volume. Transfer the mixture to the bottle, cork, label and dispense.

Formulation of Mixtures

1. Vehicles : The vehicle commonly used for the preparation of mixtures are:—

(a) Water : Purified water should be used for the preparation of mixtures. The mixtures should never be prepared with potable water because it contains volatile and non-volatile impurities which may produce undesirable changes in the medicines dissolved in it. Sometimes freshly boiled and cooled purified water is used as a vehicle which is free from vegetative bacteria.

(b) Aromatic water : These are saturated solution of volatile oil and volatile substance in purified water. Aromatic water is mainly used for its flavouring properties. Some of the aromatic waters are also having carminative and preservative action. So aromatic water is used as a vehicle to improve palatability, flavour and preservation of mixtures e.g., camphor water, chloroform water, peppermint water and cinnamon water.

(c) Medicated vehicle : Sometimes a vehicle with definite therapeutic activity is prescribed. For example, compound gentian infusion, (a bitter that stimulate appetite) orange peel infusion (bitter and carminative) and infusion of senega (expectorant) are used as vehicle for preparing mixtures. These infusions are

prepared by diluting one volume of concentrated infusion with seven volumes of purified water.

2. Adjuncts : The following adjuncts are generally used to improve the stability, colour and flavour of the mixtures:—

(a) **Chemical stabilisers :** Certain chemicals having antioxidants or reducing properties are used to improve the chemical stability of the mixtures. For example, ascorbic acid (0.1%) is prescribed in ferrous sulphate mixture to prevent oxidation of ferrous to ferric ions. The ferric salts are relatively ineffective in haemoglobin formation. Similarly sodium metabisulphite (0.1%) is included in mixtures containing sodium salicylate to prevent the darkness of mixture due to atmospheric oxidation.

(b) **Colouring agents :** No special colouring agents are added but many mixtures contain coloured medicaments.

(c) **Flavouring agents :** The following flavouring agents are commonly used in mixtures:—

(i) Aromatic water such as anise water.

(ii) Syrup and glycerol for sweetening children's preparation.

(iii) Liquid extract of liquorice to mask the saline taste of certain mixtures.

(iv) Spirit lemon to cover the taste of alkaline citrates.

(v) Orange syrup and compound orange spirit to mask the metallic and astringent tastes of iron salts in paediatric's mixtures.

(d) **Preservatives :** Diluted vegetable extract and flavouring agents are the source of growth of bacteria and fungi in mixture. Hence chloroform (0.25% v/v) and benzoic acid (0.1% w/v) is used to preserve such mixtures.

Storage of Mixtures

Mixtures are dispensed in plain glass bottles with uniform internal diameter. These bottles are available in three different sizes to supply mixtures of 60 ml, 120 ml, and 240 ml. The mixture should be dispensed and supplied to the patient for not more than three days to prevent deterioration. The bottle should be fitted with a suitable cork which will ensure its easy removal and to prevent spilling of mixture.

The mixture should be placed in a cool and dry place.

SYRUPS

A syrup is a concentrated or nearly saturated solution of sucrose in purified water. The concentration of sugar is 66.7% w/w. The syrups are sweet viscous preparations. The syrups containing medicinal substances are called 'medicated syrup' and those containing aromatic or flavoured substances are known as 'flavoured syrups'.

Advantages of Syrups

(1) Syrup retards oxidation because it is partly hydrolysed into reducing sugars such as, laevulose and dextrose.

(2) It prevents decomposition of many vegetable substances. Syrups have high osmotic pressure which prevents growth of bacteria, fungi and moulds which are the chief causes of decomposition in solutions of vegetable matter.

(3) They are palatable. Due to sweetness of sugar it is a valuable vehicle for the administration of nauseous and bitter substances.

Methods of Preparation

(1) **By simple solution method** e.g., syrup, syrup ginger, syrup orange and syrup lemon.

Example 8.6 Prepare and dispense 100 g of simple syrup I.P.

℞

Sucrose	66.7 g
Purified water, sufficient to produce	100 g

Method : Add sucrose to purified water and heat it to dissolve sucrose with occasional stirring. Cool it and add more of purified water to make the required weight.

Example 8.7 Prepare and dispense 100 ml of "Ginger Syrup" I.P.

℞

Strong ginger tincture	5.0 ml
Syrup, sufficient to produce	100 ml

Method : The syrup is prepared by mixing strong ginger tincture in small quantity at a time with syrup.

(2) **By a process of extraction** e.g. Tolu Syrup

Example 8.8 Prepare and dispense 100 ml of Tolu Syrup I.P.

℞

Tolu balsam	1.25 g
Sucrose	66.0 g
Purified water, sufficient to produce	100 g

Method : Add boiling purified water to the tolu balsam contained in a tared vessel. Cover the vessel lightly and boil the contents gently for half an hour, stirring frequently. Add purified water to adjust the specified weight. Cool, filter the solution and add sucrose. Heat on a water bath to dissolve the sucrose. Finally add sufficient purified water to produce the required volume.

(3) **Syrups made by chemical interaction**

Example 8.9 Prepare and dispense 100 ml of compound syrup of ferrous phosphate I.P. '55 (Parrish's food).

℞

Iron wire	4.3 g
Phosphoric acid	48 ml
Calcium carbonate	13.6 g
Potassium bicarbonate	1.0 g
Sodium phosphate	1.0 g
Cochineal	3.5 g
Sucrose	700 g
Orange, flower water	50 ml
Purified water, sufficient to produce	1000 ml

Make a syrup

Direction : Two teaspoonful to be taken after the breakfast.

Method : Mix in a small flask 20 ml of phosphoric acid with 25 ml of purified water, add the iron wire, cut into small pieces and heat very gently on a water bath until dissolved. Triturate the calcium carbonate, potassium bicarbonate and sodium phosphate with the remaining portion of phosphoric acid along with water in a capacious vessel. Add to it the solution of iron phosphate. Boil the cochineal with water for about 15 minutes. Add the sucrose, again boil for 15 minutes, cool , strain and add sufficient purified water to produce required volume. Filter into this syrup, the solution containing phosphates of iron, calcium potassium and sodium. Add the orange flower water and then sufficient purified water to make final volume. Filter, transfer into a bottle, label and dispense.

The following reaction take place during the preparation of syrup.

$$Fe + 2\ H_3PO_4 \longrightarrow Fe\ (H_2PO_4)_2 + H_2$$

$$CaCO_3 + 2\ H_3PO_4 \longrightarrow Ca(H_2PO_4)_2 + CO_2 + H_2O$$

$$KHCO_3 + H_3PO_4 \longrightarrow KH_2PO_4 + H_2O + CO_2$$

$$Na_2HPO_4 + H_3PO_4 \longrightarrow 2Na\ H_2PO_4$$

Formulation of Syrups

1. Vehicles : Syrups are prepared by using the purified water. Potable water should not be used for preparing the syrup because it contains both volatile as well as non-volatile impurities.

2. Adjuncts : The following adjuncts are generally added to improve the formulation of syrup:—

(a) **Chemical stabilizers :** Glycerin, sorbitol and propylene glycol is added in small quantity to the syrup to prevent the crystallisation of sucrose. Certain surfactants like tweens can be combined with syrup to dissolve certain ingredients in the syrup to make a clear syrup.

(b) **Colouring agents :** Many syrups are attractively coloured with coal tar dyes such as amaranth, compound tartrazine and green S and tartrazine.

(c) **Flavouring agents :** The following flavouring agents are added in simple syrups to prepare the flavoured syrups:—

(i) *Tinctures* : such as tincture lemon, and tincture ginger.

(ii) *Fruit juices* : such as raspberry juice, wild cherry.

(iii) *Essence* : such as vanilla, orange.

(d) **Preservatives :** The syrups containing 66.7% w/w of sucrose have high osmotic pressure which prevents growth of bacteria, fungi and moulds. So no preservative is needed. Generally, benzoic acid, sodium benzoate, methyl paraben are commonly used in appropriate concentration. Use of sterilised containers and closures is also effective way of preserving syrups.

Storage of Syrups

The syrup should be stored in well dried, completely filled and well stoppered bottles in a cool dark place. The syrups should be stored at a temperature not exceeding 25°C.

The glass bottles fitted with white polypropylene moulded or black thermosetting plastic screw closures are commonly used for the storage of bottles. These bottles may be colourless or amber coloured (light resistance container).

ELIXIRS

Elixirs are clear, sweetened, aromatic, hydroalcoholic liquids intended for oral use. The main ingredients of elixirs are ethyl alcohol

(5-40%), water, glycerin or propylene glycol, flavouring agent, colouring agent and some suitable preservative. The medicated elixirs usually contain a potent drug such as, antibiotics, antihistamines or sedatives. The flavoured elixirs are non-medicated and are used as flavours and vehicles.

Example 8.10 Prepare and dispense 100 ml of piperazine citrate elixir I.P.

℞

Piperazine citrate	18 g
Chloroform spirit	0.5 ml
Glycerin	10 ml
Orange oil	0.025 ml
Syrup	50 ml
Purified water, sufficient to produce	100 ml

Method : Dissolve the piperazine citrate in part of purified water. Add the orange oil, glycerin, syrup, Chloroform spirit and sufficient purified water to produce the required volume.

Example 8.11 Prepare and dispense 100 ml of phenobarbitone elixir I.P.

℞

Phenobarbitone	400 mg
Alcohol 90%	40 ml
Compound orange spirit	2.5 ml
Glycerol	40.0 ml
Amaranth solution	1.0 ml
Purified water, sufficient to produce	100 ml

Make an elixir.

Direction : Two teaspoonful to be taken at night.

Method : Dissolve the phenobarbitone in alcohol 90%. Add the compound orange spirit before adding the glycerol and amaranth solution. Add sufficient quantity of water to make the required volume. Transfer into amber coloured bottle, label and dispense.

Formulation of Elixirs

1. Vehicles : The elixirs are usually prepared by using water, alcohol, syrup, glycerin, sorbitol, propylene glycol. The water is used to dissolve the majority of ingredients of elixir. The flavouring agents containing essential oils are easily soluble in alcohol. Certain medicinal ingredients of elixirs are easily soluble in alcohol. So alcohol in the

Storage Linctuses are supplied in well filled, well closed airtight glass bottles having screw caps. Linctuses are stored in a cool place, protected from light.

LIQUIDS MEANT FOR EXTERNAL USE

Liquids meant for external use are of three types:—

(i) Liquids to be applied to the skin, for example, liniments and lotions.

(ii) Liquids to be used in the mouth, for example, gargles, mouth-washes, throat sprays and throat paints.

(iii) Liquids to be instilled into body cavities, for example, douches, eye drops, nasal drops, nasal sprays, eye lotions, etc.

LIQUIDS TO BE APPLIED TO THE SKIN

LINIMENTS

The liniments are liquid or semi-liquid preparations meant for application to the skin. The liniments are usually applied to the skin with friction and rubbing of the skin. The liniments may be alcoholic or oily solutions or emulsions. In alcoholic liniments, alcohol helps in the penetration of medicament into the skin and also increases its counter irritant and rubefacient action. In oily liniments, arachis oil is commonly used which spreads more easily on the skin. Soap is also included as one of the ingredient in some of the liniments which help in easy application of liniment on the skin.

Generally, liniments contain medicaments possessing analgesic, rubefacient, soothing and counter irritant or stimulating properties.

A liniment should not be applied to the broken skin because it may cause excessive irritation.

Containers The liniment should be dispensed in coloured fluted bottles in order to distinguish it from preparations meant for internal use.

Labelling The label must state, "for external use only" and "Shake the bottle well before use". The label should carry the warning, "Not to be applied to open wound or broken skin".

Storage Liniment should be stored in tightly closed airtight containers in a cool place.

Example 8.13 Prepare and dispense 100 ml of turpentine liniment I.P.

℞

Soft soap	9 g
Camphor	5 g
Turpentine oil (freshly rectified)	65 ml
Purified water, sufficient to produce	100 ml

Method : Mix the soft soap with small quantity of purified water. Prepare a solution of the camphor in the freshly rectified turpentine oil. Gradually add the camphor solution to the soap mixture with trituration till a thick creamy emulsion is formed. Add sufficient purified water to produce the required volume. Mix it thoroughly. Transfer the preparation to a bottle, label and dispense.

Example 8.14 Prepare and dispense 100 ml of soap liniment I.P.

℞

Soft soap	8.0 g
Camphor	4.0 g
Oil of lemon grass	1.5 ml
Purified water	17.0 ml
Alcohol 90%, , sufficient to make	100 ml

Make a liniment

Direction : To be applied on the affected part three or four times a day.

Method : Dissolve the soft soap, camphor and oil of lemon grass in alcohol 90%. Add the purified water and sufficient alcohol 90% to produce the required volume. Set aside and then filter. Transfer the liniment to a bottle, label and dispense.

LOTIONS

Lotions are liquid preparations meant for external application without friction. They are applied direct to the skin with the help of some absorbent material, such as, cotton wool or gauze soaked in it. Lotions may be used for local action as cooling, soothing or protective purposes. They are generally applied for antiseptic action e.g., calamine lotion. Alcohol is sometimes included in aqueous lotions for its cooling and soothing effect. e.g., salicylic acid lotion.

Containers Lotions should be dispensed in coloured fluted bottles in order to distinguish them from preparations meant for internal use.

Labelling The containers should be labelled "For external use only". Sometimes on long standing lotion have a tendency to separate out. Therefore, the container must be labelled "Shake well before use".

Storage Lotion should be stored in a well filled, well closed, in an air tight container in a cool place.

Example 8.15 Prepare and dispense 100 ml of calamine lotion I.P.

℞

Calamine	15.0 g
Zinc oxide	5.0 g
Bentonite	3.0 g
Sodium citrate	0.5 g
Liquefied phenol	0.5 ml
Glycerin	5.0 ml
Rose water sufficient to produce	100 ml

Method : Dissolve sodium citrate in rose water. Triturate the calamine, zinc oxide and bentonite with a solution of sodium citrate. Add the liquefied phenol. Add the glycerin. Add purified water in sufficient quantity to produce the required volume. Transfer the lotion to a bottle, cork, label and dispense.

Example 8.16 Prepare and dispense 100 ml of salicylic acid lotion B.P. 1988.

℞

Salicylic acid	2.0 g
Castor oil	1.0 ml
Alcohol 95% sufficient to produce	100 ml

Make a lotion

Direction : To be applied on the scalp two or three times a day.

Method : Dissolve salicylic acid in $^3/_4$th of alcohol 95%. Add castor oil. Add more quantity of alcohol 95% to make final volume. Transfer into a bottle and label.

COLLODIONS

Collodions are liquid preparations for external use containing pyroxylin (nitrocellulose) in a mixture of ethyl ether and alcohol. They are applied to the skin by means of a soft brush or suitable applicator. When ether and alcohol get evaporated it leaves a film of pyroxylin on the surface of the skin. Collodions are highly inflammable because volatile solvents are used for its preparation.

Collodions are available as medicated and unmedicated form. Medicated collodions are used for protecting small cuts and scratches, whereas unmedicated collodions provide prolonged contact between the skin and a medicament. Collodions are water repellent.

Containers Collodions should be dipensed in small wide mouth, screw capped, coloured, fluted glass vials with a brush or applicator within the cap or supplied separately.

Labelling The containers should be labelled "For external use only". It should also indicate caution. "Highly inflammable keep away from naked flames".

Storage Collodions are stored in small light resistant, well closed containers in a cool place.

Example 8.17 Preapre and dispense 100 ml of pyroxylin collodion I.P.

℞

Pyroxylin	4 g
Ether	75 ml
Alcohol	25 ml

Method : Add the alcohol and ether to the pyroxylin contained in a suitable container and stopper the container. Well shake the mixture occasionally until the pyroxylin is dissolved.

Pyroxylin is a nitrocellulose. It is prepared from absorbent cotton wool by reacting with sulphuric acid and nitric acid at 15°C. The following reaction take place

$$\underset{\text{cellulose}}{C_{12}H_{14}O_4(OH)_6} + 4HNO_3 \longrightarrow \underset{\text{nitrocellulose}}{C_{12}H_{14}O_4(NO_3)_4(OH)_2} + 4H_2O$$

Sulphuric acid facilitates this reaction and also absorbs the water formed during the reaction, preventing dilution of the nitric acid which would lead to defective nitration of the cotton.

Example 8.18 Prepare and dispense 100 ml of flexible collodion I.P.

℞

Pyroxylin	1.6 g
Colophony	3.0 g
Castor oil	2.0 g
Alcohol 90%	24.0 ml
Solvent ether, sufficient to produce	100 ml

Method : Immerse the pyroxylin in the alcohol. Add the colophony and the castor oil, and finally sufficient solvent ether to produce the

required volume. Shake occasionally, until dissolved set aside for any deposit to settle. Decant the clear liquid.

Example 8.19 Prepare and dispense 100 ml of salicylic acid collodion U.S.P.

℞

Salicylic acid	10 g
Flexible collodion sufficient quantity to	100 ml

Method : Dissolve salicylic acid in flexible Collodion. Add sufficient collodion to make required volume. Mix.

LIQUIDS TO BE USED IN THE MOUTH

GARGLES

Gargles are aqueous solutions used to prevent or treat throat infections. They are usually available in concentrated form with direction for dilution with warm water before use. They are brought into intimate contact with the mucous membrane of the throat and are allowed to remain in contact with it for a few seconds, before they are thrown out of the mouth, They are used to relieve soreness in mild throat infection. Phenol or thymol is generally present in small concentration for its antibacterial activity. Potassium chlorate is also included in gargles for its weak astringent effect to tone up a relaxed throat. It also stimulates secretion of saliva which relieves dryness e.g., phenol gargles, potassium chloride and phenol gargles.

Containers Gargles should be dispensed in clear, fluted glass bottles closed with a plastic screw cap. Coloured bottles are required to be used if the gargles need protection from light.

Labelling The containers should be labelled "For external use only". The direction for proper dilution, should be stated on the label.

Example 8.17 Prepare and dispense 100 ml of potassium chlorate and phenol gargles B.P.C.

℞

Potassium chlorate	3.0 g
Patent blue V	0.0009 g
Liquefied phenol	1.5 ml
Water sufficient to make	100 ml

Method : Dissolve the potassium chlorate in warm water. Cool and add liquefied phenol. Add the dye solution, filter and make up the volume. Transfer to a container, cork, label and dispense.

MOUTHWASHES

These are aqueous solutions with a pleasant taste and odour used to make clean and deodorise the buccal cavity. Generally, they contain antibacterial agents, alcohol, glycerin, sweetening agents, flavouring agents and colouring agents.

Containers Mouthwashes are dispensed in white fluted bottles.

Labelling The label should clearly indicate the proper directions for diluting the mouthwash before use. Also apply the secondary label, "For external use only".

Example 8.18 Prepare and dispense 50.0 ml of compound sodium chloride, mouth wash B.P.C.

℞

Sodium chloride	1.5 g
Sodium bicarbonate	1.0 g
Peppermint water to produce	100 ml

Method : Dissolve the weighed quantity of sodium chloride and sodium bicarbonate in 3/4th of the peppermint water. Add more of peppermint water to produce the required volume. Transfer to a bottle, label and dispense.

Example 8.19 Prepare and dispense 100 ml of zinc sulphate and zinc chloride, mouth wash B.P.C.

℞

Zinc sulphate	20.0 g
Zinc chloride	1.0 g
Dilute hydrochloric acid	1.0 ml
Compound tartrazine solution	1.0 ml
Chloroform water to produce	100 ml

Direction : Two teaspoonful to be diluted in a glass of water before use.

Method : Dissolve the zinc sulphate and zinc chloride in water. Add dilute hydrochloric acid to make a clear solution. Add compound tartrazinc solution. Add chloroform water to make the required volume.

THROAT PAINTS

Throat paints are viscous liquid preparations used for mouth and throat infections. Glycerin is commonly used as a base because being viscous, it adheres to mucous membrane for a long period. It also

provides a sweet taste to the preparation. The commonly used throat paints are boroglycerin, phenol glycerin, tannic acid glycerin, compound iodine paint (Mandl's paint).

Containers Throat paints should be dispensed in airtight, coloured fluted bottle in order to distinguish them from preparations meant for internal use. Glass stoppers are generally used in such bottles.

Labelling The container should be labelled "For external use only".

Storage The throat paints should be stored in airtight container and in cool place.

Example 8.20 Prepare and dispense 100 ml of iodine paint compound (Mandl's paint) B.P.C.

℞

Potassium iodide	2.5 g
Iodine	1.25 g
Alcohol 90%	4.0 ml
Water	2.5 ml
Peppermint oil	0.4 ml
Glycerin to produce	100 ml

Method : Dissolve the potassium iodide in water. Add the iodine and stir until completely dissolved. Dissolve peppermint oil in alcohol 90% in a small container and transfer it into iodine solution. Mix well. Add glycerin and mix thoroughly. Transfer the paint into a measure. Add more of glycerin to make the required volume. Transfer the preparation into a well closed container, label and dispense.

LIQUIDS TO BE INSTILLED INTO BODY CAVITIES

DOUCHES

A douche is a medicated solution meant for rinsing a body cavity. The word douche is often used for vaginal solutions. The vaginal solutions are generally called irrigations. Douches are also used to irrigate the other body cavities, such as eyes, ear or nasal cavities for cleaning or removing the foreign particles or discharges from them.

Douches are generally dispensed in the form of a powder or tablet with a specific directions for dissolving it in a specific quantity of warm water. They are also dispensed as concentrated solutions with direction to dilute it in a specific quantity of warm water before use. Vaginal douches must be sterile.

Douches are generally used for the following purposes:—

(1) Cleansing agents e.g., isotonic sodium chloride solution.

(2) Antiseptics e.g., mercuric chloride (0.001%), potassium permanganate (0.025%), lactic acid (0.5 to 2%), chlorohexidine (0.02%).

(3) Astringent e.g., alum (1%).

Douche is administered by gravitation flow by using douche can. Douche can is a rigid polyvinyl chloride container. A rubber tube of about 2 metre long, along with a nozzle is attached with it. Generally, 1 litre to 2 litre of solution is used as douche.

Containers Douches are supplied in narrow mouthed, coloured, fluted bottle.

Labelling The label should state "For external use only".

Storage Douche should be stored in a cool place.

Example 8.21 Prepare and dispense 100 ml of potassium permanganate douche solution.

℞

Potassium permanganate	0.1 g
Water add upto	100 ml

Make a vaginal douche.

Direction : To be used as a vaginal douche after diluting it with water for preparing 1 litre of 1:4000 solution.

Method : Weigh and transfer potassium permanganate to a glass mortar. Grind the crystal with water and add more water to dissolve potassium permanganate in water. Filter the solution through a clean sintered glass filter and make up the required volume by adding more water through the filter. Transfer the solution into a narrow mouth bottle, label and dispense.

ENEMAS

Enemas are aqueous or oily solutions or suspensions that are introduced into the rectum for cleansing, therapeutic or diagnostic purposes.

Enemas meant for cleansing purpose are used to evacuate faeces in constipation or before an operation. They act by any one of the following method:—

(i) By stimulating peristalsis : Enemas stimulate the peristaltic movement of intestine and thus help to evacuate faeces. This

occurs by any one of the following mechanism:—

(a) Enemas cause osmotic retention of water in the bowel e.g. sodium phosphate enema and magnesium sulphate enema.

(b) Enemas are given in large volume (0.5 to 1 litre) e.g. plain water, soft soap and turpentine enemas.

(ii) By lubricating impacted faeces e.g. olive and arachis oil enemas (100-500 ml)

Enemas meant for therapeutic purpose are used as:

(a) Sedatives e.g. chloral hydrate, paraldehyde.

(b) Anthelmintics e.g. Quassia for expulsion of thread worms.

(c) Anti-inflammatory agent e.g. corticosteroids used for ulcerative colitis.

(d) Nutrient—When absorption by mouth is impaired.

Large volume enemas should be warmed to body temperature before administration. These enemas are administered by using douche can. Douche can is a rigid polyvinyl chloride container. A rubber tube of about 2 meter long, along with a nozzle is attached with it.

Small volume enemas should not exceed 100 ml. Nowadays disposable small volume enemas are commercially available in disposable polythene or polyvinyl chloride bags sealed to a rectal nozzle. These are very convenient for personal administration because the patient has simply to insert the nozzle and then squeeze the bag.

Enemas should be freshly prepared diluted the strong solution with warm water before use.

Containers Enemas are supplied in narrow mouthed, plain screw capped bottle.

Labelling The label should state 'Not to be taken' or 'For rectal use only'.

Storage Enemas should be freshly prepared and used. Hence, storage of enemas are rarely done.

Example 8.22 Prepare and dispense 1000 ml of soft soap enema.

℞

Soft soap	50 g
Water to make	1000 ml

Method : Soap is dissolved in water to make a clear solution.

Example 8.23 Prepare and dispense 100 ml of paraldehyde enema.

℞

Paraldehyde	10 g
Sodium chloride solution to	100 ml

Method : Dissolve paraldehyde in normal saline solution to make clear solution.

Example 8.24 Prepare and dispense 100 ml of prednisolone enema

℞

Prednisolone	20 mg
Buffered solution	100 ml

Method : Prednisolone is dissolved in buffered solution. It is available commercialy in disposable bags.

EAR DROPS

These are solutions of drops that are instilled into the ear with a dropper. The solution is generally prepared in water, glycerin, propylene glycol or dilute alcohol. However, vehicle like glycerin and propylene glycol are preferred. These are generally used for cleaning the ear, softening the wax and for treating the mild infection.

Containers Ear drops are dispensed in coloured, fluted glass bottles with a dropper in the cap. Ear drops are also dispensed in a suitable plastic containers.

Labelling The label should state, "For external use only" and "Store in cool place".

Example 8.25 Prepare and dispense 25.0 ml of soda glycerin.

℞

Sodium bicarbonate	5 g
Glycerin	30 ml
Purified water, to produce	100 ml

Prepare ear drops.

Direction : Place 2-3 drops in each ear as directed.

Method : Dissolve required quantity of sodium bicarbonate in purified water. Add glycerin and more quantity of purified water to produce required volume. Transfer into a bottle, label and dispense.

Uses : It is used to relieve itching in the ear and soften the wax.

Example 8.26 Prepare and dispense 5.0 ml of phenol ear drops B.P.C.

℞

Phenol glycerin	40 ml
Glycerin to produce	100 ml

Method : Mix phenol glycerin with sufficient glycerin to make up the required volume. Transfer in a dropper bottle and label.

Phenol ear drops should always be diluted with glycerin if required. Dilution with water renders phenol ear-drops caustic.

Example 8.27 Prepare and dispense 100 ml of boric acid ear drops.

℞

Boric acid	2.0 ml
Alcohol 95%	20.0 ml
Purified water to	100 ml

Method : Dissolve the boric acid in purified water. Add alcohol and incorporate more of purified water to produce the required volume.

NASAL DROPS

These are aqueous solutions of drops that are instilled into the nose with a dropper. The oily vehicle is not used nowadays because oily drops inhibit the movement of cilia in the nasal mucosa and if used for long periods, may reach the lungs and cause lipoid pneumonia.

Nasal drops should be isotonic with 0.9% sodium chloride having neutral pH and viscosity similar to nasal secretions by using 0.5% methyl cellulose. The buffering capacity of nasal mucosa is quite low and strong alkali solutions can cause considerable damage to cilia. To prevent this, it is advisable to use a phosphate buffer of pH 6.5 as a vehicle. Nasal preparation must not interfere with the cleansing action of epithelial cilia of nasal mucosa.

Containers Nasal drops are dispensed in coloured fluted bottles fitted with a dropper or in a suitable plastic container.

Labelling The container should be labelled "For external use only".

Storage Nasal drops should be stored in a cool place.

Example 8.28 Prepare and dispense 100 ml of ephedrine nasal drops B.P.C.

℞

Ephedrine hydrochloride	0.05 g
Chlorobutol	0.05 g
Sodium chloride	0.05 g
Water to produce	100 ml

Method : Dissolve the ephedrine hydrochloride, chlorobutol, and sodium chloride in warm water. Cool, filter if necessary and make to volume through the filter. Transfer the nasal drops to the container, label and dispense.

NASAL SPRAYS

Nasal sprays are used to reduce nasal congestion and to treat infections. The main aim of nasal spray is to retain the nasal solution in the droplet form in the nasal tract. For this purpose, the nasal solution is sprayed in the form of coarse droplets by using scent spray type of atomiser or a plastic squeeze bottle. The nasal spray should be isotonic and buffered at pH 6.2. They may contain antibiotics and antihistamines.

Containers Nasal sprays are stored in small, coloured, fluted glass bottles. Plastic squeeze bottles, atomisers or pressurised aerosols are most suitable for administration.

Storage Nasal sprays should be stored in well-filled air tight containers. These should be protected from light.

Example 8.29 Prepare and dispense 100 ml of nasal spray.

R_x

Menthol	2.0 g
Camphor	2.0 g
Thymol	2.0 g
Eucalyptus oil	5.0 ml
Liquid paraffin to	100 ml

Method : Triturate menthol, camphor and thymol in a dry mortar. Add the eucalyptus oil. Transfer to a dry measure. Rinse the mortar with liquid paraffin and add more of liquid paraffin to make required volume. Transfer to the container, label and dispense.

INHALATIONS

These are liquid preparations containing volatile substances and are used to relieve congestion and inflammation of the respiratory tract. The inhalations containing the volatile substances which are volatile at room temperature may be placed on an absorbent pad or handkerchief to inhale therefrom. In other cases inhalations are added to hot, but not boiling water (about 65°C) and vapours are inhaled for about 10 minutes.

Nowadays inhalations are available in aerosol packing. Aerosol inhalations are solutions, suspensions or emulsions of drugs in a mixture

of inert propellants held under pressure in an aerosol dispenser. The dose of the medicament in the form of droplets of 50 μm diameter or less is released from the container by using the metering valve. The patient then inhales the released drug through a mouthpiece.

Containers Inhalations are packed in small fluted glass bottles. They are also available in aerosol packing.

Labelling The container should be labelled 'For external use only'.

Storage Inhalations should be stored in an air tight container in a cool place.

Example 8.30 Prepare and dispense 100 ml of benzoin inhalation B.P.C.

℞

Benzoin crushed	10.0 g
Prepared storax	5.0 g
Alcohol 95% to make	100 ml

Method : Macerate the benzoin and prepared storax with alcohol for 24 hours. Filter, and pass sufficient of the alcohol through the filter to produce the required volume. Transfer to a bottle, label and dispense.

Example 8.31 Prepare and dispense 100 ml of menthol and eucalyptus inhalation.

℞

Light magnesium carbonate	7.0 g
Menthol	2.0 g
Eucalyptus oil	10.0 ml
Water to produce	100 ml

Method : Dissolve the menthol in eucalyptus oil and add light magnesium carbonate. Add sufficient water to produce the required volume. Transfer into a bottle, label and dispense.

MARKETED MONOPHASIC LIQUID DOSAGE FORMS

(A) Mixtures

1. ***Carminative mixture*** (Zandu Pharmacentical Works) : contains Sodium bicarbonate, Spirit ammonia aromatic, Tr. Gentian comp., Tr. Card co., Spirit chloroform, Tr. Zingiberis.

2. ***Kaolin mixture*** (Arora Pharmaceuticals) : Each tablespoonful contains Light Kaolin 2 mg, Light Magnesium carbonate. 0.6 g, Sodium bicarbonate 0.6 g and Peppermint water 15 ml.

3. *Gelusil* (Warner-Hindustan) : Each 5 ml contains Magnesium trisilicate 625 mg, dried Aluminium hydroxide gel 312 mg.

(B) Syrups

1. *Crocin syrup* (Duphar-Interfran) : Each 5 ml contains 125 mg of Paracetamol.

2. *Ultragin syrup* (Geoffrey Manners & Co.) : Each 5 ml contains Analgin 15.62 mg, Paracetamol 15.62 mg

3. *Benadryl syrup* [Parke-Davis (India)] : Each 5 ml contains Diphenhydramine hydrochloride 12.5 mg.

4. *Corex cough syrup* (Pfizer) : Each 5 ml contains Chlorpheniramine maleate 4 mg, Codeine phosphate 10 mg, Ephedrine hydrochloride 5 mg, sodium citrate 150 mg and menthol 0.1 mg.

5. *Polybion syrup* [E. Merck (India)] : Multivitamin syrup.

(C) Elixirs

1. *Cadiphylate elixir* (Cadila Pharmaceuticals) : Each 5 ml contains Theophylline ethanoate or Piperazine 80 mg, Ephedrine hydrochloride 12 mg, Glyceryl guiacolate ether 50 mg, Phenobarbitone 4 mg, Alcohol 0.55 ml.

2. *Ephedrine compound elixir* [Parke-Davis (India)] : Each 5 ml contains Ephedrine sulphate 22.80 mg, Caffeine 91.2 mg, Sodium salicylate 114.0 mg, Sodium iodide 60.8 mg, Extract Belladonna 14.52 mg, Alcohol 0.787 ml.

3. *Piperazine elixir* [Burroughs Wellcome (I)] : Each 5 ml contains Piperazine citrate 750 mg.

4. *Phosfomin elixir* (Sarabhai Chemicals) : Vitamin B complex elixir.

5. *Phosfomin iron elixir* (Sarabhai Chemicals) : contains Ferric ammonia citrate 46.5 mg with vitamin B complex.

(D) Linctuses

1. *Coscopin linctus* (Biological Evens) : Each 5 ml contains Noscapine 7 mg, Citric acid 28.75 mg, Sodium citrate 3.25 mg, Ammonium chloride 28 mg, Chlorpheniramine maleate 2 mg.

2. *Phensedyl cough linctus* [Rhone Poulenc (I)] : Each 5 ml contains Codeine phosphate 10 mg, Chlorpheniramine maleate 4 mg.

3. *M.I.T's linctus codeinae* (Astra-IDL) : Each 5 ml contains Codeine phosphate 10 mg, Chlorpheniramine maleate 4 mg.

4. *M.I.T's linctus D* (Astra-IDL) : Each 5 ml contains Dextromethorphan hydrobromide 5 mg, Phenyl propanolamine hydrochloride 25 mg.

5. *Zeet linctus* (Alembic Chemical Works Co.) : Each 5 ml contains Dextromethorphan hydrobromide 10 mg, Guaiphenesin 50 mg, Phenyl propanolamine hydrochloride 25 mg.

6. *Protussa cough linctus* (Boots Pharmaceuticals) : Each 5 ml contains Noscapine 5 mg, Sodium citrate 125 mg, Ephedrine hydrochloride 3 mg, Tr. Belladonna 0.125 ml, Tolu Sol. 0.133 ml.

(E) Expectorants

1. *Asthalin expectorant* (Cipla) : Each 10 ml contains Salbutamol sulphate 2 mg, Guaiphenesin 100 mg.

2. *Dilosyn expectorant* (Glaxo Allenburys) : Each 5 ml contains Methdilazine hydrochloride 2.5 mg, Ammonium chloride 100 mg, Sodium citrate 50 mg.

3. *Avil expectorant* (Hoechest India) : Each 5 ml contains Pheniramine maleate 15 mg, Ammonium chloride 125 mg, Menthol 1.14 mg.

4. *Piriton expectorant* (Glaxo India) : Each 5 ml contains Chlorpheniramine maleate 2.5 mg, Ammonium chloride 125 mg, Sodium citrate 55 mg.

5. *Zeet expectorant* (Alembic Chemical Works Co.) : Each 5 ml contains Diphenhydramine hydrochloride 8 mg, Ammonium chloride 100 mg, Guaiphenesin 50 mg, Bromhexine hydrochloride 4 mg, Menthol 1 mg.

6. *Cadistin expectorant* (Cadila Pharmaceuticals) : Each 5 ml contains Chlorpheniramine maleate 2 mg, Ammonium chloride 100 mg, Sodium citrate 44 mg, Guaiphenesin 80 mg, Laevomenthol 0.8 mg, Terpin hydrate 4 mg, Tolu balsam 6 mg, Vasaka syrup 0.133 ml.

7. *Glycodin expectorant* (Alembic Chemical Works Co.) : Each 5 ml contains Ammonium chloride 62.5 mg, Sodium citrate 50 mg, Terpenehydrate 10 mg, Menthol 2.5 mg, Vasaka liquor Ext. 0.235 ml, Alcohol 95% 0.183 ml.

(F) Linments

1. *Turpentine liniment* (Alpine Industries) : contains Soft soap 90 g, Camphor 50 g, Turpentine oil 650 ml, Purified water to 1000 ml.

2. *Turpentine liniment* (Arora Pharmaceuticals) : contains Soft soap 90 g, Camphor 50 g, Turpentine oil 650 ml, Purified water to 1000 ml.

3. *Methyl salicylate liniment* (Alpine Industries) : contains Methyl salicylate 250 mg, Arachis oil to 100 ml.

(G) Lotions

1. *Caladryl lotion* [Parke-Davis (India)] : contains Calamine 8%, Diphenhydramine hydrochloride 1%, Camphor 0.1%, Denatured spirit 2.37% v/v.

2. *Endruff lotion* (Nulife Pharmaceuticals) : contains Cetrimide 5%, Calcium panthothenate 2% water qs.

3. *Clotrin lotion* (Nulife Pharmaceuticals) : contains Clotrimazole 1% w/w.

4. *Scabine lotion* (Stadmed Pvt.) : contains Gamma benzene hexachloride 2%, Cetrimide 0.5%.

5. *Calderm skin lotion* (Dermocare Lab.) : contains Calamine 15%, Zinc oxide 5%, Glycerine 5%.

6. *Calamine lotion* (Arora Pharmaceuticals) : contains Calamine 15%, Zinc oxide 5%, Bentonite 3%.

(H) Collodions

1. *Salactin paint* (Nulife Pharmaceuticals) : contains Salicylic acid 16.7%, Lactic acid 16.7%, Flexible collodion q.s.

(I) Mouth Washes and Gargles

1. *Listerine mouth wash* (Warner Hindustan Division) : contains Thymol 0.06%, Eucalyptol 0.09%, Methyl alicylate 0.06%, Menthol 0.04%, Benzoic acid 0.15%, Alcohol 25.27% v/v.

2. *Povidine mouth wash* (Stadmed Pvt. Ltd.) : contains Povidone iodine 1%.

3. *Alphadine mouth wash* (Nickolas Piramal India) : contains Povidone-iodine 1% w/v.

4. *Betadine gargle* (Win-Medicare) : contains Povidone-iodine 1% w/v.

5. *Wokadine gargle* (Wackhardt) : contains Povidone-iodine 1% w/v.

6. *Dettolin mouth wash & gargle* (Reckitt & Colman of India) : contains Chloroxylenol 1.02% w/v, Menthol 0.12% w/v, Absolute alcohol 60.80% v/v, Amaranth as colour.

(J) Throat Paints

1. *Paintex paint* (Mendine Pharmceuticals) : Each ml contains Clove oil 3%, Camphor 0.1%, Menthol 1%, Glycerin 5%, Tr. Iodine 7%, Sol. ether 10%, Conc. peppermint water 15%, Alcohol 56%

2. *Candid mouth paint* (Glenmark Pharmaceuticals) : Each contains Clotrimazole 1%

3. *Magenta paint* (Alpine Industries)

4. *Gum paint* (Alpine Industries)

5. *Paint of iodine compound* (Mandle's paint) (Alpine Industries)

6. *Dentex gum paint* (Dermocare Labs.) : Each contains Tannic acid 3%, Potassium iodide 2%, Iodine 0.5%, Thymol 0.2%, menthol 0.2%, Camphor 0.2%.

7. *Dequadin paint* (Glaxo Allenburys, Mumbai) : contains Dequalinium chloride 0.5%.

8. *Sensoform paint* (Warren Pharmaceuticals) : contains Glycerin acid tannic 66.27%, Potassium iodide 0.05%, Iodine 0.03% w/v, Thymol 0.033%, Menthol 0.05%, Glycerin 72% appx.

(K) Douches

1. *Tantum vag douche* (Elder Pharmaceuticals) : Each sachet contains Benzydamine hydrochloride 500 mg.

(L) Enemas

1. *Laxicon enema* (Stadmed) : contains Dioctyl sodium sulphosuccinate 0.25% solution.

2. *Exit enema* (Stadmed) : contains Sodium phosphorous 6% w/v, Sodium acid phosphorous 16% w/v

3. *Neotomic enema* (Neo Pharma) : contains Glycerin 15%, Sodium chloride 15%, Purified water qs.

4. *Mesacol enema* (Sun Pharmaceuticals) : contains Mesalazine 4 g/60 ml.

5. *Procalyss enema* (Mount Mettur Pharma) : contains Sodium dihydrogen phosphate 16%, Sodium phosphate 6%.

(M) Ear Drops

1. *Chloromycetin Ear-Drops* [Parke-Davis, (India)] : contains Chloramphenicol 5% w/v, Benzocaine 1% w/v, Propylene glycol qs.

2. *Bactigen E/E Drops* (FDC) : contains Gentamycin sulphate 0.3% w/v.

3. *Genticyn E/E Drops* (Nickolas Piramal India) : contains Gentamycin sulphate 0.3%, Benzalkonium chloride solution 0.04% w/v.

4. *Conflox E/E Drops* (Concept Pharmaceuticals) : contains Ciprofloxacin 0.3%, Benzalkonium chloride 0.02% v/v.

5. *Sofracort* (Roussel India) : contains Dexamethasone sodium metasulphobenzoate 0.116%, Framycetin sulphate 1%.

(N) Nasal Drops

1. *Decon nasal drops* (Cadila Health Care) : contains Xylometazoline hydrochloride 1%, Benzalkonium chloride 0.02%.

2. *Dristan nasal drops* (Wyeth, Lederle) : contains Phenylephrine hydrochloride 2.5 mg, Pheniramine maleate 2 mg, Thiomersal 0.02 mg, Benzalkonium chloride 0.2 mg, Menthol 0.25 mg, Eucalyptol 0.2 mg, Alcohol 0.004 ml.

3. *Endrine nasal drops* (Wyeth lederle) : contains Ephedrine 0.75%, Menthol 0.55, Camphor 0.5%, Eucalyptol 0.5%, Castor oil 0.5%.

4. *Nasivion nasal drops* [E. Merck (India)] : contains Oxymetazoline hydrochloride 0.05%.

5. *Otrivin nasal drops* (Novartis) : contains Xylometazoline.

(O) Nasal Sprays

1. *Beclate nasal sprays* (Cipla) : contains Beclomethasone dipropionate 50 mcg/dose.

2. *Econase nasal sprays* (Glaxo Allenburys) : contains Beclomethasone 50 mcg/dose.

3. *Betnesol-N-nasal sprays* (Glaxo India) : contains Betamethasone sodium phosphate 0.05%, Naphazolin nitrate 0.05%, Neomycin sulphate 0.5%

4. *Rhinocort nasal sprays* (Astra-IDL) : contains Budesonide 50 mcg/dose.

5. *Efcorlin nasal sprays* (Glaxo Allenburys) : contains Hydrocortisone 0.02%, Naphazoline nitrate 0.025%.

(P) Inhalations

1. *Asthalin inhaler* (Cipla) : contains Salbutamol 100 mcg/metered dose.

2. *Salbutamol inhaler* (Glaxo Allenburys) : contains Salbutamol 100 mcg/metered dose.

3. *Venorlin inhaler* (Glaxo Allenburys) : contains Salbutamol 100 mcg/metered dose.

4. *Autohaler* (Cipla) : contains Isoprenaline sulphate 400 mg/dose.

5. *Aerocart inhaler* (Cipla) : contains Salbutamol 100 mg, Beclomethasone dipropionate 50 mg.

6. *Beclate inhaler* (Cipla) : contains Beclomethasone dipropionate 50 mcg/dose 100 mcg/dose and 200 mcg/dose.