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Review Article

A Review on Pharmaceutical Emulsion

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A B S T R A C T

The pharmaceutical term "emulsion" is most time used to indicate preparations prepared for internal use. This pharmaceutical dosage form is thermodynamically unstable and must be stabilized by the addition of emulsifying agent. Emulsified systems range from lotions having comparatively low viscosity to creams which are more viscous. There are two basic types of emulsions, that is, oil in water (O/W) and water in oil (W/O). In addition to these two types, a relatively complex emulsion, called multiple emulsions can also be formulated. Emulsions generally have certain advantages over other dosage forms as the drug solubilized may be more bioavailable. Moreover, gastrointestinal problems and first pass metabolic effect are also avoided.

Keywords: Pharmaceutical, emulsions, viscosity, skin, oil in water (O/W), water in oil (W/O)

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INTRODUCTION:

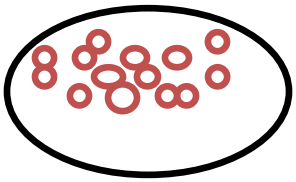
An emulsion is a two phase system consisting of two completely immiscible liquid one of which is dispersed as fine globules into others.

- Emulsion is biphasic system prepared by combining two immiscible liquid.
- DISPERSED PHASE: - Also known as discontinuous phase. The phase which is dispersed into dispersion medium is known as dispersed phase or internal phase.
- DISPERSION MEDIUM: - Also known as continuous phase or external phase in which the dispersion medium is dispersed is known as dispersion medium.
- EMULSION is thermodynamically unstable system which can be stabilized by the presence of an emulsifying agent (emulsifier).
- Emulsifying agent is known as intermediate or interphase between two dispersion phase or dispersion medium system.
- IN PHARMACEUTICAL PRACTICE: - Title emulsion is used for liquid preparation for oral use.
- Emulsion for external use is referred to lotion or liniments.
- The particle size of globules ranging from 0.1 to 100 micrometer

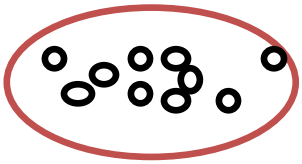
CLASSIFICATION OR TYPES OF EMULSION

A. Based On Dispersed Phase

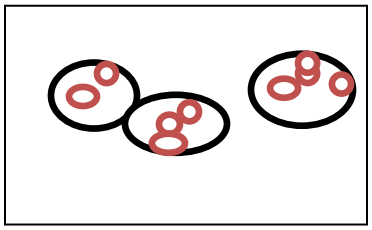
- Oil in water
- Water in oil
- Multiple emulsion (w\o\w) or (o\w\o)



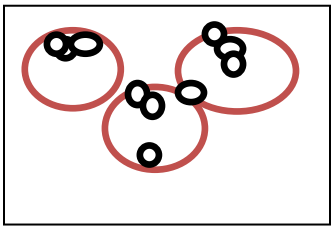
o/w emulsion



w/o emulsion



O/W/O Emulsion



W/O/W Emulsion

B. Based On Size Of Liquid Droplets

- 0.2 to 50 micrometer (macroemulsion)
- to 0.2 micrometer (microemulsion)
- 50 to 1000 nanometer (nanoemulsion)

OIL IN WATER: - In this type of emulsion the oil is dispersed phase whereas water is continuous phase. The oil in water type emulsion is preferred for internal use as bitter taste of oil can be masked. The water soluble drug is more quickly release from this type of emulsion. These are used externally to provide cooling effect. Example: - vanishing cream

WATER IN OIL: - In this type of emulsion the water is in dispersed phase where as oil is continuous phase. The water in oil type emulsion are mainly used for externally as lotions or creams.

PHARMACEUTICAL APPLICATION OF EMULSION

- The unpleasant taste and odor can be masked by emulsification.
- The absorption and penetration of medicament are enhanced by emulsification
- The oral rectal and topical administration of oil soluble drugs.
- Intramuscular injection of water insoluble drug or vaccine to provide slow release.
- Intravenous emulsion containing fats,carbohydrates and vitamin as a nutrition.
- Emulsion is used to improve bioavailability.

ADVANTAGES OF EMULSION

- Unpleasant oil can be administered in pleasant form.
- Unpleasant oil soluble drugs can be administered in pleasant form.
- The aqueous phase is easily flavoured .
- The rate of absorption is increased.
- It is possible to include two incompatible ingredients one in each phase of emulsion.
- Prevent oxidation.

DISADVANTAGES OF EMULSION

- Preparation needs to be shaken well before use.
- A measuring device is needed for administration.
- A degree of technical accuracy is needed to measure a dose.
- Storage condition may affect stability.

Table 1: Ratio of Oil: Water: Gum in Primary Emulsion

Type of Oil	Example	Oil	Water	Gum
Fixed	Almond Oil, Archis Oil ,Castor Oil, Cod Liver Oil	4	2	1
Mineral	Liquid Paraffin	3	2	1
Volatile	Turpentine Oil, Cinnamon Oil, Peppermint Oil.	2	2	1
Oleoresin	Inole Fenn Extract	1	2	1

METHOD OF PREPERATION

1. Dry Gum Method
2. Wet Gum Method
3. Bottle Method

DRY GUM METHOD:

- Measure requires quantity oil.
- Calculated quantity of gum acacia add with rapid triturate.
- Add required quantity of water with rapid triturate until clicking sound occurs.
- Now the product becomes white or nearly white.
- Now the product called primary emulsion.
- Add more water to make required quantity.

WET GUM METHOD:

- Calculate the quantity of oil, water, gum.
- Gum acacia +water form mucilage.

- Add require quantity of oil in small portion with rapid trituration .
- Product becomes white and nearly white.
- Primary emulsion.
- Add more water in small portion with uniform trituration to produce final volume
- Stir thoroughly as to form a uniform emulsion.

BOTTLE METHOD:

- It is only for volatile and and non viscous oil.
- Measure quantity of oil and transfer into flask.
- Add gum acacia.
- Now shake the flask until the gum and oil mix properly.
- Add water.
- Shake the mix vigorously to form a primary emulsion.
- Add more water to make up the volume of emulsion.

FORMULATION OF EMULSION

1. Emulsifying agent
2. Preservatives
3. Antioxidants
4. Flavouring agent

EMULSIFYING AGENT: Emulsifying agent reduces interfacial tension b\w aqueous and oil phases so make them miscible to form a stable emulsion.Emulsifying agent are also known as emulsifiers'.
There are large number of emulsifying agent no single agent have all properties required so two or more emulsifying agent used to make stable emulsion.

IDEAL PROPERTIES OF EMULSIFYING AGENT

1. It should be capable of reducing interfacial tension it should be compatable with other ingredients.
2. It should be non toxic
3. It should be chemically stable
4. It should be capable to reduce required consistency

EMULSIFYING AGENTS

1. Natural

- Vegitable Source: Tragacanth ,Agar,Gumacacia,Pectic,Starch,Irishmoss.
- Animal Source: Wolf Fat,Eggyolk,Gelatin.

2. Semisynthetic Polysaccharides

- Methyl Cellulose
- Sodium Carboxy

3. Synthetic

- Anionic
- Cationic
- Non Anionic

4. Inorganic

- Milk Of Magnesia
- Magnesium Oxide
- Magnesium Trisilicate
- Magnesium Bentonite

5. Organic

- Alcohol
- Carbo Waxes
- Cholestrol
- Lecithins

ANTIOXIDANT: During storage fats and emulsifying agents undergo oxidation by atmospheric oxygen so to prevent this anti oxidants are used.

E.g. tocopherol ,gallic acid ,propyl gallate and ascorbic acid.

Flavouring agents: These are selected by trial and error method.

e.g. vaniline used for –liquid paraffin emulsion.

Preservatives: EXAMPLES benzoic acid, methyl and propyl paraben ,chloroform[0.25%] , chloroaerosol [0.1%].

IDENTIFICATION OF EMULSIFYING AGENTS

1. Dye test
2. Dilution test
3. Electricity conductance test
4. Flouroscence test
5. Cobalt chloride

Dye Test

Water soluble dye (amaranth dye) dissolve in water and gives blue colour.
Amaranth dye is dissolve in a unknown emulsion .then take a drop of emulsion and place on a microscopic slide and examine it under microscope. If the dispersed globules appear blue color and ground is colourless mean (w/o type) emulsion the reversed condition occurs in (o/w)type.

Dilution Test

When we can add the water in w/o type emulsion at equilibrium state the amount of water in emulsion is equal to the amount of oil in emulsion then two layers are formed one layer is oil phase and other is equal to the amount of oil in emulsion then two layer are formed one layer is oil and other is water and the nature of emulsion is change. It means the emulsion is w/o type .In case of o/w type there is no change in addition of water.

Electricity Conduction Test

Water is conduction of electric charge water is good conductor of electricity where as oil is non conductor of electricity the conductivity test can be performed by dipping a pair of electrodes connected through a low voltage bulb glows on passing the electric current the emulsion is o/w type because water is continuous phase in case the bulb is not glow the emulsion is w/o type because oil is the continuous phase .

Fluorescence Test

When a beam of light is passed through unknown emulsion then the emulsion show fluorescence properties if the emulsion show small droplet fluorescence it means the emulsion is o/w type .if the emulsion show large and continuous fluorescence it means the dispersion medium is oil and emulsion is w/o type

Cobalt Chloride Test

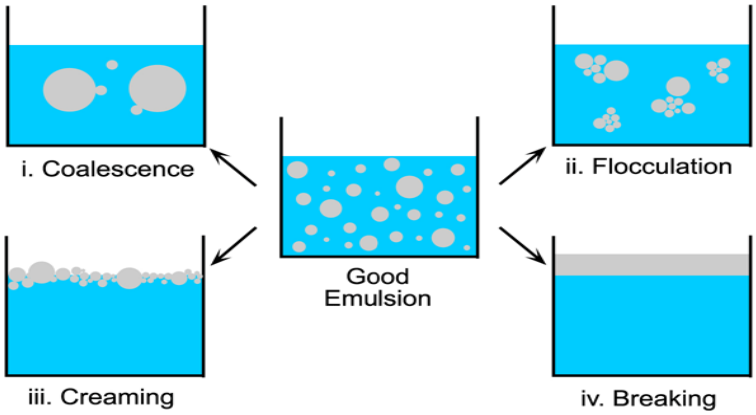
Cobalt chloride is water soluble substance.
Small amount of cobalt chloride is add in unknown emulsion when the cobalt chloride is dissolve in the emulsion it means emulsion is o/w type because water is continous .

When cobalt chloride is does not dissolved in emulsion it means the emulsion is w/o type because oil is in continuous phase.

STABILITY OF EMULSION

There are two principle requirements to ensure the stability of emulsion.

1. No change in mean particle size or size distribution of droplet of dispersed phase throughout self life.
2. There should be homogenous distribution of emulsified droplet throughout the system.



FLOCCULATION:

Flocculation is joining of globules into loose aggregates often redispersed by shaking it is usual for flocculation to produce coalescence.

cause	Remedy
Decreased in repulsive force result in aggregation in globule due to inadequate quantity of emulsifying agent.	A high energy barrier exists in the presence of high charge of density on dispersed phase.

CREAMING:

Creaming occurs in o/w emulsion dispersed oil globules move upward and accumulate at the top.In w/o emulsion – sedimentation occurs accumulation of water droplets at the bottom. A creamed emulsion usually redispersed by agitation undesirable. Rate of creaming can be reducing by:

- Reducing particle size of globules.
- Equalizing the density of oil and water phases.
- Increasing the viscosity of system.

CAUSE	REMEDY
Rate of creaming and radius of globule	Use viscosity enhancer
Difference between dispersed phase and dispersion medium increased then creaming also increased	Difference between dispersion phase and dispersion medium decreased
Rate of creaming directly proportional to 1 and inversely proportional to viscosity of medium.	Storing cool place
Storage condition : store in cool place	Reduce globule size

CRACKING:

Rupture of interfacial film can lead to coalescence of globule in dispersed phase coalescence may lead complete and irreversible separation of two phases such phase separation is called cracking.Film breakdown arise from:

- Chemical incompatibility of emulsifying agents and content
- May also include by exposures to increased and reduced temperature or by microbial contamination

CAUSE	REMEDY
By addition of opposite type of emulsifying agent. By decomposition perception of emulsifying agent.	Maintain temperature avoid microbial growth. Addition of suitable emulsifying agent.

PHASE INVERSION

Phase inversion is the process by which dispersed phase becomes continuous phase and becomes dispersed phase O/w emulsion to w/o emulsion

Phase inversion may occur:

- If the amount of dispersed phase increased
- Temperature change
- Addition of material that change solubility of emulsifying agent

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