



# Latest Taste Masking Technologies for Better Patient Compliance: A Review

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## Abstract:

Taste is one of the most important parameter which is responsible for patient compliance. Bitter or obnoxious taste of drugs is a regular problem in the treatment of patients due to their unwillingness to swallow such formulation especially in children and elders. Oral administration of bitter drugs with an acceptable degree of palatability is an important factor for health care providers, especially for pediatric patients. Various oral pharmaceuticals, food and beverage products, and bulking agents have unpleasant, bitter taste components. Thus, masking of unpleasant taste characteristics of drug is an important factor in the formulation. This review describes the recent taste masking technologies by studying various methodologies for masking the bitter and obnoxious taste of drugs that includes taste masking by addition of flavouring and sweetening agents, Microencapsulation, Polymers Used For Coating, Prodrug Approach, Gel Formation, Granulation, Ion Exchange Resins, Solid Dispersion, Addition of Effervescent Agents, Taste Masking By Liposomes And Multiple Emulsion Technique, Bitterness Inhibitors, Taste Masking With Salt Preparation, Addition of Anesthetizing / Desensitizing Agents. These all taste masking technologies are discussed in the given review article.

**Keywords:** Taste, Patient compliance, Bitter or obnoxious drugs, Taste masking technology, Polymers, Prodrug approach.

## Introduction:

Taste is an important factor to enhance the patient compliance. Several oral pharmaceutical drug products, food, beverages and bulking agents, have obnoxious bitter taste due to the components. Masking of the bitter taste of drugs is an important factor for the improvement of patient compliance. [1] Oral administration of

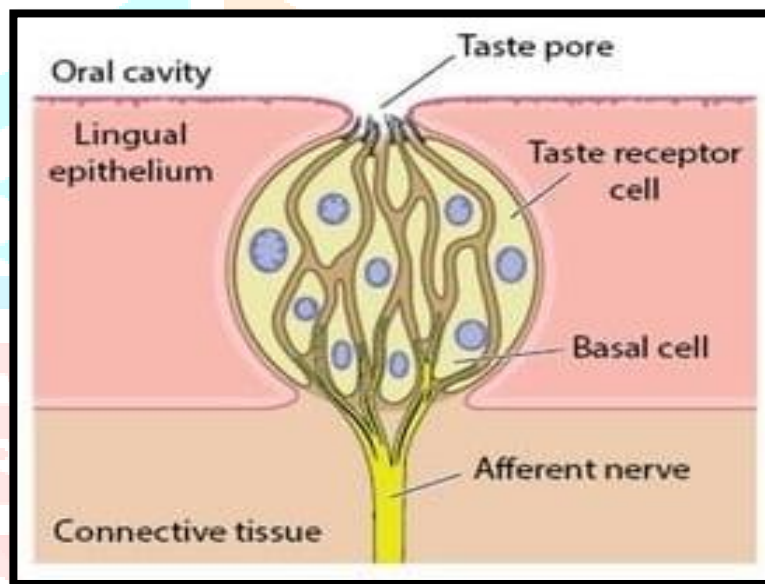
bitter drugs with an acceptable degree of palatability is a key topic for health care providers, especially for pediatric patients. Various methods like polymer coating, microencapsulation, granulation, adsorption, Prodrug approach, addition of flavours and sweeteners, ion exchange resins are used for masking the taste of bitter drugs.

However, there is no general method for taste masking. Each method has specific advantages and applications. Single method is not suitable for masking the taste of all the obnoxious drugs. Some parameters like extent of bitter taste, dose, and dosage form and type of the patient influence the method to be used for masking the taste of the bitter drugs. In addition to oral drug delivery, the taste masked drug delivery in research is gaining importance for improving the quality of the treatment for pediatrics and geriatrics. [2]

## ➤ Physiology Of Taste

### Taste Bud

**Fig.1: Taste Bud**



Taste buds are small sense organ in most vertebrates, helps in the detection of taste. Thus a group of cells, found especially on the tongue. Taste buds have been recognized on the soft palate, pharynx, epiglottis, which allows different types of taste to be identified. The sense of taste is mediated by tongue, which are group of taste receptor cell (50–100Cells), bundled together in clusters like bananas and provides sensation of taste by sensory neurons to Central Nervous System (CNS) within the brainstem.

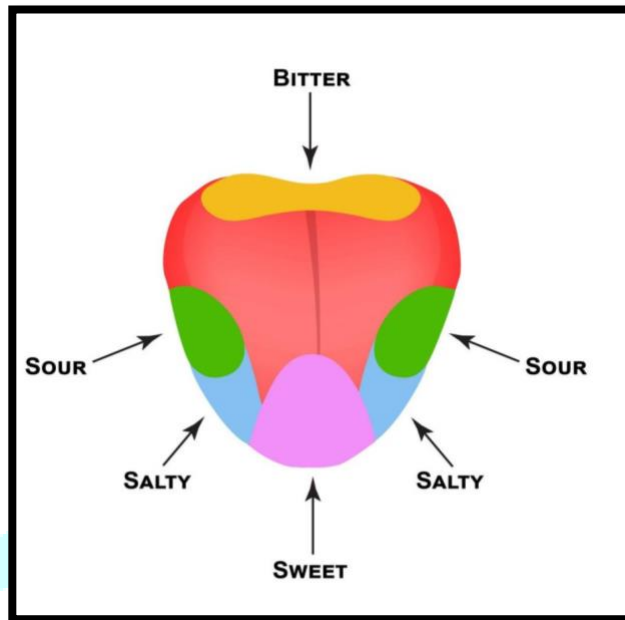
Taste buds are Chemoreceptor stimulated by chemicals dissolved in saliva from oral ingested medicaments and enter by the taste pore followed by contact with surface proteins called taste receptors causing electrical changes within taste cells, which cause the transmission of signals to the Brain. [3]

Different taste buds on the tongue are as given below:

- Sweet Taste
- Salty Taste
- Sour Taste

- Bitter Taste

These are the four different taste buds on tongue are labelled in different colours as shown in figure as given below.



**Fig.2:** Location of Taste Buds on Tongue

**a) Salty taste (edge, upper portion)**

The salty taste is one along with the four taste receptors of tongue. And those receptors are present on the edge and upper front portion of the tongue.

**b) Sweet taste (tip)**

The sweet taste is one along with the four taste receptors in the tongue. They are located on the tip of the tongue.

**c) Sour taste (along sides in back)**

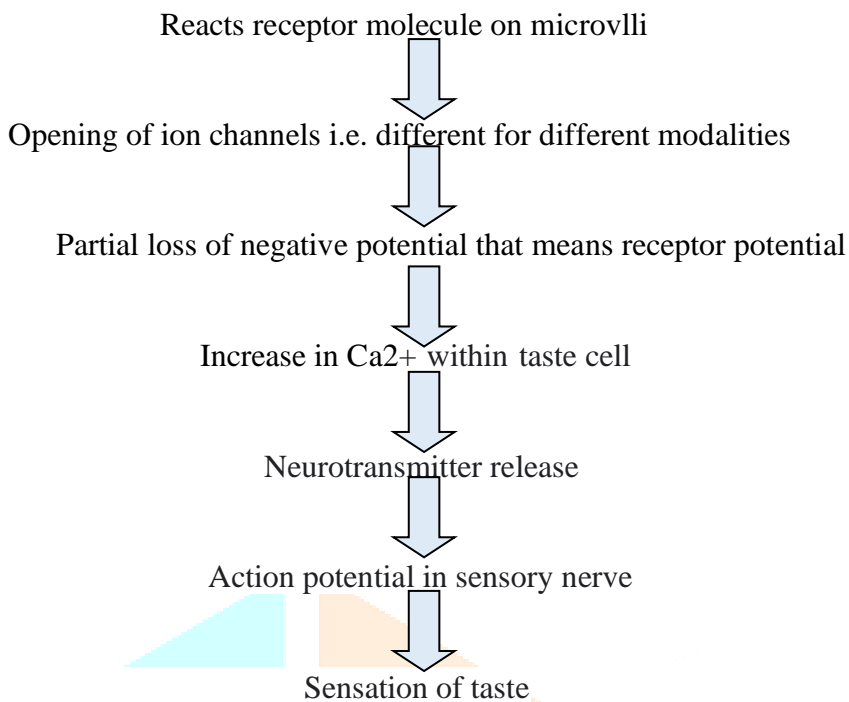
The sour taste is also one among the four taste receptors of the tongue. They arise at sides of the tongue and are stimulated mainly by acids.

**d) Bitter taste (back)**

The bitter taste is the last and one of the four taste receptors in the tongue. That is located near the back of the tongue. It is stimulated by a selection of chemical substances, most of which are organic compounds, while some inorganic compounds such as magnesium and calcium also produce bitter sensations. [4]

- Mechanism Of Sensation Of Taste

Testant (in sol. form) enters pores of taste buds



- **Effect Of Age On Taste Buds**

Cells that make up the taste buds with age wear out, as a result taste buds begins to disappear from roof and the sides of the mouth with the exception of taste buds that are located over tongue. Left over taste buds becomes less sensitive. Researchers have been proved that smoking and eating of hot food may damage to taste buds. This lacking taste may leads to loss of appetite and poor nutrition.

Taste is a type of medium to know how the world of taste for infants and young children. It is seen that children are more sensitive to assured taste than any adults. Because, taste can be subjective, the mechanism that causes taste sensitivity in youngsters can be difficult to evaluate.

- **Causes Of Infected Taste Buds**

Taste buds infection generally occurs due to vitamin B complex deficiency, long term antibiotics drug therapy, smoking, vigorous rubbing by a rough tooth and thickening of tissues in elderly and fungal infection in those by means of decreased immunity. [5]

- **Taste Masking**

Taste masking is defined as supposed reduction of an undesirable taste that may exist. Taste masking technologies suggest an admirable scope for invention and patents. The perfect solution to taste masking of bitter substances is that the invention of a universal inhibitor of all bitter tasting substances that doesn't affect the opposite taste modalities like sweetness. Verified methods for bitterness reduction and inhibition have resulted in improved palatability of oral pharmaceuticals. Taste masking technology is an essential factor for improving patient compliance. [6]

Taste masking technologies are very important for improving patient compliance and better therapeutic value. Many oral drug delivery formulations have obnoxious taste such as bitterness, saltiness or sourness. Taste masking technologies include two aspects:

1. Selection of proper taste masking substances such as polymers, sweeteners, flavors, amino acids etc.
2. Selection of proper taste masking techniques. [7]

- **Ideal Properties Of Taste Masking Process**

An ideal taste masking process, formulation and characterization should have the following properties:

- 1) Involve least number of equipments and processing steps.
- 2) Required minimum number of excipients for a most favorable formulation.
- 3) No adverse effect on drug bioavailability.
- 4).Require excipients those are economical and easily available.
- 5). Least manufacturing cost.
- 6). Can be carried out at room temperature.
- 7). require excipients that have high scope of safety
- 8). Rapid and easy to prepare. [8]

- **Factors Affecting Selection Of Taste Masking Technology**

### **1] Dose of Active Pharmaceuticals**

Dose of a drug may state whether a particular formulation strategy would be appropriate to achieve taste masking. In pediatric formulations, the dose is small so sufficient as to allow the usage of flavoring agents to mask the taste of the medicine.

For example- Low dose pleasant pediatric Aspirin oral formulation was developed by adding sweeteners, but the same approach failed to deal with the problem of drugs like Acetaminophen because of its high dose. In such cases, coating is preferred to get taste masking along with sweeteners to achieve an adequate final dosage form size.

### **2] Extent of Bitter Taste**

With aggressively bad tasting medicaments even a little exposure is sufficient to recognize the bad taste. Coating is more capable technology for aggressively bitter drugs even though coating imperfections, if present, diminish the efficiency of the technique. Viscosity enhancers can balance the taste masking efficiency. Oral suspension containing viscosity enhancers can cover up the unpleasant taste, which arises from the leakage of drug from the coated medicaments or microcapsules.

For example- Sweeteners could not accomplish taste masking of oral formulation of Ibuprofen due to its dominating taste. Similarly, Microencapsulation of potent bitter active agents such as Azithromycin is not enough to provide taste masking of liquid oral suspensions. usual taste masking techniques such as the use of sweeteners, amino acids and flavoring agents alone are often poor in masking the taste of highly bitter drugs

such as Quinine, Celecoxib, Etoricoxib, antibiotics like Levofloxacin, Ofloxacin, Sparfloxacin, Ciprofloxacin, Cefuroxime, Erythromycin and Clarithromycin. [9]

### 3] Drug Solubility

Physicochemical properties of the drug play main role in the selection of taste masking technology.

For example- Ondansetron has a relatively lower water solubility at higher pH, based on which a quickly disintegrating taste masked composition of Ondansetron was formulated by adding an alkalizing agent (sodium bicarbonate) to decrease the water solubility and the subsequent taste sensitivity. The bitter taste associated with a poorly soluble form of Ranitidine may be suitably masked by lipid coating of the drug substance. Though, for water soluble forms of Ranitidine (e.g. Ranitidine hydrochloride), the level of taste masking achieved by simple lipid coating of the drug substance may not be entirely satisfactory, mostly if the product is to be formulated in an aqueous medium. Thus, Ranitidine hydrochloride was first included into the inner core of a polymeric binder, or a lipid or wax having a melting point higher than that of the outer lipid coating to achieve an efficient taste masking.

### 4] Drug Particle Shape & Size Distribution

Particle characteristics of the drug would affect the taste masking process efficiency. Core materials with unequal shapes and small particle size lead to poor taste masking efficiency and varying dissolution of coated particles. Multilayer coating using inner spacing layer to appropriate the drug from taste masking layer helps to reduce or eliminate such coating imperfections.

For Example- Taste masked granules of Gatifloxacin and Dextromethorphan were formulated by multilayer coating consist of inner spacing layer follow by outer taste masking layer. [10]

### 5] Dosage Forms

It is estimated that 50% of the population have problem of swallowing tablets, especially the pediatric and geriatric patients. Chewable tablets and liquid oral dosage forms have been used to deal with these problems. However, it is not easy to formulate some drugs in these dosage forms due to their poor palatability.

For Example- For formulations which are swallowed unchewed: capsules, coated tablets and slowly disintegrating hard tablets have been used as preferred taste masking technologies. Chewable tablets and liquid oral formulations are suitable in case of large dose drugs for an relieve of intake.

### 6] Ionic Characteristics of the Drug

Ionic characteristics of drugs manage the selection of ion exchange resin polymers and the prefer ability of the drug candidate for this technology. Patients now expect and demand formulations that are pleasantly, or at least tolerably, flavored. Flavor enhancers are the simplest and oldest method used but this method fail to mask 90% of moieties. When these methods fail then some new conventional methods were adopted such as microencapsulation which includes coating, spray drying techniques, by chemicals, inclusion complexes with cyclohexatrienes, use of ion exchange resins, prodrugs and other Different techniques like liposomes, multiple emulsions etc.



For example- Anionic polymers (e.g. alginic acid) are good candidates for cationic drugs like Donepezil Hydrochloride, and the cationic polymers are selection of excipients for anionic drugs like Sildenafil. [11]

- **Taste Masking Of Different Dosage Forms**

The drug i.e. the active pharmaceutical ingredient is finally formulated in a proper dosage form such as tablet, powder, liquid, etc.

- i. **Tablets-**

Most of the tablets can be effectively masked for their taste by applying inert polymer coatings that prevent the interaction of the drug substance with the taste buds. Even so attempts have been made time and again by several workers to investigate and explore the use of newer materials in bad taste abatement and good taste enhancement

- ii. **Granules / Powders-**

Granules for reconstituting as liquids (e.g. sachets, sprinkle capsules & powders) hold a high share of pediatric and geriatric market. A large number of patents on the topic highlight the significance of the same. Thus, taste masking of granules becomes an important priority in product development & varied technologies exist for the same as illustrated below. The method comprises of coating the drug cores with separate layers of aqueous dispersions of the copolymers. Granules of the invention could be used in the preparation of chewable tablets, which had good palatability & bioavailability. [12]

- iii. **Liquids-**

They present a major challenge in taste masking because the majority of pediatric preparations are syrups and suspensions although, the above mentioned methodologies have also had been used for improving liquid taste and few patents in this area are worth mentioning. [13]

- **Taste Masking Techniques**

Methods and technologies for taste masking include:

1. Addition of flavouring and sweetening agents.
2. Microencapsulation.
3. Polymers Used For Coating.
4. Prodrug Approach.
5. Gel Formation
6. Granulation.
7. Ion Exchange Resins.
8. Solid Dispersion.
9. Addition of Effervescent Agents.
10. Taste Masking By Liposomes And Multiple Emulsion Technique.
11. Bitterness Inhibitors.
12. Taste Masking With Salt Preparation.
13. Addition of Anesthetizing / Desensitizing Agents. [14]

## **1. Addition of Flavoring & Sweetening Agents**

This technique is simplest approach for taste masking. But this technique is not very successful for highly bitter drugs. Artificial sweeteners and flavors are generally being used individually with other taste-masking techniques to improve the efficiency of these techniques.

### **A.Flavouring Agents:**

#### **Basis of Choosing a Flavor**

- Complementary to existing flavor of the drug
- Known popularity of particular flavors
- Age of patients
- Allergy

#### **a) Natural Flavours**

- \*Juices – Raspberry
- \*Extracts – Liquorices
- \*Spirits – Lemon & Orange
- \*Syrups – Blackcurrant
- \*Tinctures -Ginger
- \*Aromatic waters – Anise & Cinnamon
- \*Aromatic Oils – Peppermint &Lemon.

#### **b) Synthetic Flavours**

- \*Alcoholic solutions
- \*Aqueous solutions
- \* Polymers [15]

<b>Basic Taste</b>	<b>Flavours as a Masking Agents</b>
• Salt	Butterscotch, maple, apricot, wintergreen mint, peach, vanilla.
• Sour	Liquorice, root beer, citrus flavor, raspberry.
• Bitter	Wild cherry, anise, chocolate, walnut, mint.
• Sweet	Vanilla, fruit & berry.[16]

Flavouring  
Taste Masking

**Table No.1 -**  
**Agents for**



## B. Sweetening Agents

Sweeteners are:

- Supplement flavors associated with sweetness.
  - Soothing effect on the membranes of the throat.
- a) **Natural Sweetener:** Sucrose, glucose, fructose, Sorbitol, mannitol, Glycerol, Honey, liquorice.
  - b) **Artificial sweetener:** Saccharin, Saccharin sodium, Aspartame.
  - c) **Nutritive:** Sucrose, Fructose and Glucose.
  - d) **Polyols:** Mannitol, Sorbitol, Xylitol, Erythritol, Maltitol.
  - e) **Non-Nutritive:** Aspartame, Sucralose, Neotame and saccharine.
  - f) **Novel sweeteners:** Trehalose, Tagatose.

Sweetener	Sweetness Factor
Aspartem	180-200
Acesulfame k	200
Saccharin	300
Sucralose	600
Neotame	7000-13000. [17]

**Table No. 2 – Sweetening Agents for Taste Masking**

## 2. Microencapsulation

Microencapsulation may be defined as, “the process of surrounding or enveloping one substance within another substance on a very small scale, yielding capsules ranging from less than one micron to several hundred microns in size”. Microencapsulation is a process by which solids, liquids or even gases may be enclosed in microscopic particles by formation of thin coatings of wall material around the substances. Microspheres are characteristically free flowing powders consisting of proteins or synthetic polymers having a particle size ranges from 1-1000µm. Microspheres received much attention not only for prolonged release, but also for targeting of anti-cancer drugs to the tumor. There are two phases:

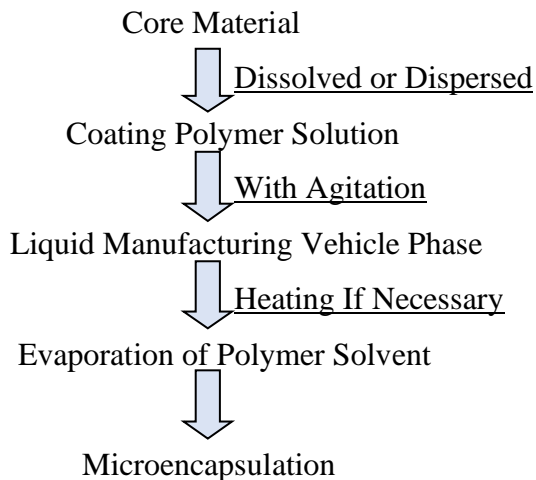
1) Core Material and 2) Coating Solution [18]

### • Method Involved In Microencapsulation

1. Pan coating
2. Spray drying and spray congealing
3. Multiorifice centrifugal process
4. Polymerization
5. Air suspension technique
6. Coacervation phase separation
7. Melt dispersion technique

8. Solvent evaporation. [19]

• **Process of Microencapsulation –**



### **3. Polymers Used For Coating**

One of the most important factors to be considered in taste masking by coating by selection of coating polymers. Ideally, coating polymers should be such that it prevents the release of active agent in the oral cavity, following per oral intake, but allows it in stomach or small intestine where the drug is likely to be absorbed. Polymers, which generally insoluble at salivary pH 6.8 but readily, dissolve at gastric fluid pH 1.2 could be a good candidate for masking of taste. Choosing one of these polymers is difficult selection. Before making a resolution on coating material following factors must be considered. The particle size of drug, flow properties of drug, moisture sensitivity, long term stability, temperature of processing and most important, method delivery of active drug molecule. [20]

Sr.No.	Drugs	Techniques	Polymer Used
1.	Ibuprofen	Air-Suspension Coating	Methacrylic acid Copolymer
2.	Enoxacin	-	HPMC, HPC, EC
3.	Aspirin	Granulation & Coating	Cellulose acetate, latex, triacetin
4.	Amoxicillin	Granulation & Coating	L-HPC
5.	Triprolidine	Dispersion Coating	HPMC [21]

**Table No. 3 - Examples of Polymer Coating.**

## 4. Prodrug Approach

Prodrug design is a powerful method for reducing solubility leading to improve taste. A Prodrug is chemically changed inert drug precursor which upon biotransformation gives the pharmaceutically active compound. Bitterness of a molecule can be because of the efficiency of the flavor receptor substrate adsorption response, that's associated with the molecular geometry of the substrate. If alteration of the separate molecule occurs, it affects adsorption.

The alkyloxyalkyl Carbonates of the Clarithromycin position have remarkably alleviate bitterness & improved bioavailability when administered orally. Tasteless/bitter less prodrugs of opioid analgesics and antagonists were formulated for improved buccal delivery. Tasteless prodrugs of Nalbuphine HCl, Naltrexone, Naloxone, Oxymorphone HCl, Butorphanol, and Levallorphan were synthesized for buccal administration to enhance bioavailability relative to that of oral dosing without the characteristic bitter taste. In rats, the prodrugs established up to 90% bioavailability. It was concluded that when administered as prodrugs, bioavailability improved without observable adverse effects. [22]

Sr.No.	Drugs	Prodrugs
1.	Chloramphenicol	Palmitate
2.	Clindamycin	Palmitate
3.	Erythromycin	Ethyl Succinate, Ethyl Carbonate
4.	Lincomycin	Phosphate Ester, Carbonate Ester
5.	Sulfisoxazole	N'-Acetyl [23]

**Table No. 4 - Examples Of Prodrugs Designed For Masking Taste Problems.**

## 5. Gel Formation

Water insoluble gelation on the surface of tablet containing bitter drug can be used for taste masking. Sodium alginate has the capacity to cause water insoluble gelation in presence of bivalent metal ions.

### **Example-**

Tablet of Amiprolse hydrochloride have been taste masked by applying an undercoat of Sodium alginate and overcoat of calcium gluconate. In presence of saliva, sodium alginate reacts with bivalent calcium and form water insoluble gel and thus taste masking is achieved. [24]

## 6. Granulation

Granulation is a less expensive, rapid procedure and an easy taste making technique. It is the common processing step in the production of tablet dosage form. Some saliva insoluble polymers are used as binding agent. Granules prepared from these polymers show less solubility in saliva and thus taste could be masked. Granulations lower the effective surface area of the bitter substance that come in contact with the tongue upon oral intake. Taste masked Granules, prepared from saliva insoluble polymer, can be formulated in different

type of tablet dosage form e.g. chewable tablet, rapidly disintegrating tablet, liquids and low melting point waxes such as glycerol, Palmitate stearate, and hydrogenated castor oil are commonly used during the granulation to achieve the taste masking.

Drugs	Granulating Agents	Comments
Dextromethorphan	Cyclodextrin	Mixing of drug with Cyclodextrin followed by granulation without complexation.
Erythromycin	Alginic acid	Taste masked granules which can be formulated as a dry syrup suspension or chewable of dispersible tablets.[25]

**Table No. 5 - Examples of drugs taste masked by granulation technology.**

## **7. Ion Exchange Resins**

Ion exchange resins are synthetic inert organic polymers consist of a hydrocarbon network to which ionisable groups are attached and they have the ability to exchange their labile ions for ions present in the solution with which they are in contact. The most frequently employed polymeric network used is a copolymer of styrene and Divinylbenzene (DVB). Apart from this other polymers such as those of acrylic and Methacrylic acid cross linked with DVB and containing proper functional groups, have been used as ion exchange drug carriers.

IERs contain positively or negatively charged functional group and are thus classified as either anionic or cationic exchangers. Within each category, they are classified as strong or weak, depending on their affinity for capable counter ions. These insoluble IERs may be supplied in case of cation exchangers as sodium, potassium or ammonium salt and of anion exchangers generally as the chloride. It is frequently necessary to convert a resin completely from one ionic form to another. [26]

Type Of Resin	Functional Group	Polymeric Network	Commercial Resins
Strong cation	-SO <sub>3</sub> Na	Polystyrene- DVB	Amberlite IRP 69, Indion 254, Tulsion-T-344
Weak cation	-COOH	Methacrylic acid- DVB	Amberlite IRC 50, Indion 204-234, Tulsion 335, 339, PuroliteC102DR, Kyron-T-104, TulsionT 335, Doshion P544.
Strong anion	-N+R <sub>3</sub>	Polystyrene –DVB	Amberlite IR 400, Dowex 1, Indion 454, Duolite AP 143
Weak anion	-N+R <sub>2</sub>	Polystyrene –DVB	Amberlite IR 4B, Dowex 2.[27]

**Table No. 5 – Examples of Resins for Taste Masking**

## **8. Solid Dispersion**

Solid dispersion is defined as dispersion of one or more active ingredients in an inert carrier at solid state prepared by melting (fusion) solvent or melting solvent method. Solid dispersion of drug can be done with the help of polymers, sugar, or other suitable agents, is very helpful for taste masking. Carriers used in solid dispersion systems contain povidone polyethylene glycols, hydroxypropyl methylcellulose, urea, mannitol and ethylcellulose. Various approaches for preparation of solid dispersion are as given below.

### **a) Melting method**

In this method, the drug or drug mixture and a carrier are melted together by heating. The melted mixture is cooled & solidifies rapidly in an ice bath with forceful stirring. The final solid mass is crushed & powdered.

### **b) Solvent method**

In this method, the active drug and carrier are dissolved in a common solvent, followed by solvent evaporation and recovery of the solid dispersion. The bitter taste of Dimenhydrinate can be covered by preparing the solid dispersion of the drug with polyvinyl acetate phthalate. [28]

## **9. Addition of Effervescent Agents**

Effervescent agents have been useful and advantageous for oral administration of drugs and have also been employed for used as taste masking agents for dosage forms that are not dissolved in water prior to administration. A chewing gum composition of bitter medicaments was formulated to provide the medicaments to the oral cavity for local application or for buccal absorption. It comprises a chewing gum base, an orally administrable medicament, a taste masking initiator of carbon dioxide, and other non active materials, such as sweeteners, flavoring components, and fillers.

In recent times, effervescent tablets of Fentanyl and Prochlorpromazine were developed to provide these drugs to the oral cavity for buccal, sublingual absorption. The formulations contain the drugs in combination with effervescent agents to promote their absorption in the oral cavity and to mask their bitter taste. An additional pH adjusting substance was also included in Fentanyl formulation for further promotion of absorption. [29]

## **10. Taste Masking By Liposomes & Multiple Emulsion Technique**

Liposomes are carrier molecules comprising several layers of lipids, in which the bitter drug is present within the lipid molecule. Oils, surfactants, polyalcohol's and lipids efficiently enhance the viscosity in the mouth because of which the time of contact between the bitter drug and taste receptors decreases, thus improving the overall taste masking effectiveness. Inhibition of bitterness of drugs by phospholipids such as phosphatidic acid, phosphatidylinositol, soya Lecithin, etc has been reported.

• Multiple Emulsions are of two types:

a) w/o/w Emulsion

b) o/w/o Emulsion

Multiple emulsions are also a good approach for the taste masking of bitter drugs. This is achieved by dissolving the drug moiety in the inner aqueous phase of w/o/w emulsion with good shelf-life stability. o/w/o emulsion is a type of multiple emulsions in which water globules themselves contain dispersed oil globules, on the other hand w/o/w emulsions are those in which internal and external aqueous phases are divided by the oil.

**Example** - Both types of multiple emulsions are prepared for Chloroquine sulfate and reported to be partially effective in masking the bitterness of the drug. [30]

## **11. Bitterness Inhibitors**

The development of a definite common inhibitor for bitter taste has been usually required in the fields of taste physiology and pharmaceutical sciences, but no such inhibitors has been available. One trouble in discovering of universal inhibitor for bitter taste is that substance that inhibits bitterness of one compound will not affect the bitterness of a second because of many different classes of compound impart bitterness. Sodium salts such as sodium chloride, sodium acetate, sodium gluconate have been exposed to be potent inhibitors of some bitter compounds. The mechanism is unknown; however, research shows that sodium act at peripheral taste level before a cognitive effect. Bitter substances are commonly hydrophobic in nature hence lipoprotein (PA-LG) composed of phosphatidic acid and  $\beta$ -Lacto globulin can cover the target sites for bitter substances on the taste receptor membrane without affect responses to salts, acids, sugars or sweet amino acids.

**Example-**



1) Bitter taste of Brucine, Berberine, Chloride, Caffeine, Denatonium Benzoate, glycyl L-leucine, L-phenylalanine, Naringin, Propranolol Hydrochloride, Quinine Hydrochloride, Strychnine Nitrate and Theophylline have been covered up by lipoprotein.

Selective inhibition of bitter taste of various drugs by phospholipids such as phosphatidic acid, phosphatidylinositol and soya lecithin have been reported.

2) Bitter taste of Polymixin B sulfate and Trimethoprim-sulfamethoxazole has been masked by BMI 60 obtained by fractionating soya lecithin. [31]

## **12. Taste Masking With Salt Preparation**

Salt preparations have been successfully used to mask the taste by decreasing the solubility of drugs into saliva or by altering the chemical group, which is responsible for bitter taste. Most salts of organic compounds are formed by the addition or removal of the proton to form an ionized drug molecule, which is then neutralized with a counter ion.

### **Example –**

- 1) Penicillin prepared as the N-N' dibenzylethylene diamine acetate salt is a tasteless material.
- 2) The magnesium salt of Aspirin is almost tasteless.
- 3) Bitter tasting decongestants, antihistamines, antitussive expectorants effectively taste- masking using magnesium trisilicate/ fumed silica absorbate that is undetectable in the mouth yet provides a high degree of bioavailability drugs into saliva or by altering the chemical group, which is responsible for bitter taste. [32]

## **13. Addition of Anesthetizing/ Desensitizing Agents**

- Anesthetizing agents temporarily desensitized the taste buds. The loss of sensation prevents perception of taste, which helps to mask the bitter taste.
- Desensitizing agents like phenols, sodium phenolates desensitize the taste buds by interfere with taste transduction, the process by which taste signal from the mouth to the brain and thus, mask the taste of drug. Desensitizing compositions containing strontium, potassium or other salts, not surprisingly, can have strong salty tastes. Unfortunately, this salty taste, including a strong salty after taste, can reduce consumer compliance with desensitizing regimens and usage of desensitizing compositions.

### **Example –**

1. Several commercial brands of toothpaste use baking soda, but we are not aware of any commercial dentifrice that has both a desensitizing salt and baking soda.
2. Surprisingly, it has now been discovered that one salt, sodium bicarbonate, can successfully mask the salty flavor of other, desensitizing, salts when the salts are combined in oral care compositions. [33]

## **Future Aspects:**

- 1) In future there may be modified with latest polymers in different grading system. Flavor may be added to the formulation to betterment of tastes.
- 2) For success of company's product & better results taste masking is an important for current & future.
- 3) In future, patients demand for pleasant taste drugs increased. Hence, taste masking is an important factor for the success of any pharmaceutical products.
- 4) The drug release from complex is similar as drug is released from different formulations. In future this technique is very useful in masking of taste of many bitter drugs.
- 5) In future, bitter drugs may be modified with latest polymers in different grading system.
- 6) Patient agreement is important for the pharmacist to administer the drug so drugs are better designed and masked to the market for future development.
- 7) Future scope of bitter drug masking will increase in broad sense in the industry and public in coming years.

### **Conclusion:**

In addition to oral drug delivery, taste masked drug delivery study is gaining importance and commercial success for the quality of treatment provided to suffering patients, especially children. As evidenced by the number of patents and technological developments we made an attempt that an ideal taste masking is widely accepted in the development of more palatable and acceptable dosage forms which not only lead to better patient compliance but with an ultimate clinical output. Taste masking of solid drugs is very difficult as compared to liquid; therefore this masking is considered challenge for the pharmaceutical industries or others. I try my best to explain different methods, which could be suitable for taste masking of bitter drugs. Number of mechanization available in the market which effectively masks the taste of drugs but require skillful application by the use of this method there is no affect on the rate of bioavailability. By this applications or others technologies we can improve product preference.

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