
An Update On Taste Masking Technologies For Oral Pharmaceuticals

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Taste is an important parameter governing compliance. Several of the oral pharmaceuticals, numerous food and beverage products and bulking agents, have unpleasant bitter-tasting components. In numerous cases, the bitter taste modality is an undesirable trait of the product or formulations and can considerably affect its acceptability by consumers. Bitter characteristics found in such systems have been eliminated or minimized by various known processes, but no universally applicable technology for bitterness inhibition has ever been recognized. The desire for improved palatability of these products has prompted the development of numerous formulations with improved performance and acceptability. This article discusses the recent approaches and methodologies for bitterness reduction for oral pharmaceuticals.

Organoleptic characteristics of pharmaceutical products, i.e., mainly appearance, odor and taste are essential factors in assessing the consumer acceptability, thereby the commercial success in the market. More than 50% of pharmaceutical products are orally administered for several reasons, of which better patient compliance and existence of highly developed production technologies are most important. Undesirable taste is one of the important formulation problems that are encountered with certain drugs. Administration of bitter drugs orally with acceptable level of palatability is a key issue for healthcare providers, especially for pediatric patients. Thus, elimination or reduction of bitterness is an important mainstay of product evaluation in oral pharmaceutical formulation. Proven methods for bitterness reduction and inhibition have resulted in improved palatability of the oral pharmaceuticals. Thus, taste masking of oral pharmaceuticals has become a potential tool to improve patient compliance and commercial success of the product¹. Considerable amount of progress has been achieved in the development of taste-masked formulations in recent years. Various techniques have been identified for bitter oral pharmaceuticals that can be processed

or formulated to improve taste by using polymeric coating strategies, complexation with cyclodextrins and ion exchange resins, effervescent systems, salt formation and use of excipients like flavors, sweeteners, gelatin, gelatinized starch, acidic amino acids, lecithin, or lecithin like substances, and surfactants. The present article is an attempt to review strategies and technologies for taste masking and tools available to pharmaceutical scientists.

Flavoring as a means of taste masking:

It is important to understand that only soluble portion of the drug can generate the sensation of taste. Addition of flavors and sweeteners is the foremost and simplest approach for taste masking especially in the case of pediatric formulations. This approach is however not very successful for highly bitter and highly water soluble drugs. Besides taste masking, this approach is also used to improve the aesthetic appeal of the product especially to make it more attractive for the pediatric patients as well as used for the liquid formulations and the chewable tablets.

Numerous pharmaceuticals like denitrifices and mouthwashes applied to oral cavity elicit unpleasant taste perceptions². Formulations like mouthwashes or cough drops containing bitter substances like eucalyptus oil can be

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masked by adding fenchone, isoborneol or borneol. Various taste-masking agents significantly suppress the perception of unpleasant organoleptic sensations such as bitterness or medicinal off-taste of the volatile oils³. Cooling effect of certain taste masking agents also aids in reducing the bitterness. Sweetening compositions containing D-fructofuranose are useful for denitrifices, mouthwashes, and foods. Menthol reduces the bitter taste and gives a low calorie formulation with beneficial anticaries effect⁴. Menthofuran and anethol not only mask the bitter taste but also improve the stability of the formulation considerably⁵. Zinc acetate dihydrate present in the lozenges imparts a bitter or astringent taste to it, which can be taste masked by saccharine anethol- β -cyclodextrin complex and magnesium stearate followed by tableting with compressible polyethylene glycol and fructose. In aqueous suspensions, the taste can be controlled by liposome-associated flavourants⁶. Clove oil has been found to be a good taste masking component for a number of medicinals, because of its spicy and anaesthetic effect. To support the taste masking capabilities of clove, vanilla flavoring such as honey or artificial vanilla, are preferred⁷. Anaesthetizing agents like sodium phenolate can be added to numb the taste buds sufficiently within 4-5 seconds that is helpful in inhibiting the perception of bitter taste of the formulation. This approach has been used to produce taste masked medicated floss of aspirin⁸.

Aspartame is a prominent sweetener for bitterness reduction. A concentration of as small as 0.8 % was effective in reducing the bitterness of a 25% formulation of acetaminophen. Starch, lactose and mannitol are diluents known for their taste masking characteristics. Artificial sweetener like neohesperidine dihydrochalcone, which is a bitterness suppressor and flavor modifier, elicits a very intense sweet taste. It is obtained by hydrogenation of a bitter flavone neohesperidine. Hesperidine dihydrochalcone 4'- β -D-glucoside belonging to the same class of sweetener has the ability to reduce the perception of bitterness by virtue of its lingering sweetness⁹. Vitamins containing oral solutions are rendered bitterness-free by adding sugars, amino acids, and apple flavors. Oral compositions consisting of vitamin B complex, sodium 5c-ribonucleoside (inosinate), citrus (orange) flavor or fruit flavor also have remarkably improved taste¹⁰. Oral liquid compositions containing theophylline salts are formulated with sorbitol to produce a solution, which is less bitter than aqueous theophylline solutions.

Adrenergics or stimulants usually impart a strong bitter taste. The "chewing not brewing" trend has become quite popular and has led to increased demand for caffeine

chewing gums and lozenges. These gums or lozenges are made palatable by addition of vitamins, essence of garlic, spices, carrot concentrate and four types of sugar for taste masking¹¹.

Taste masking by coating:

Coating is an extremely useful technique for a number of applications in the pharmaceutical field. Although it is used primarily for production of sustained release, gastro-resistant dosage forms, it also has major application in masking the unpleasant taste¹². Merely applying thicker layer of coating material can be ineffective in taste masking of certain drugs with objectionable taste. Thick coating can cause problems both in terms of size and cost apart from being problematic in getting the desired release profile of the drug. However, by coordinating the right type of coating material it is possible to completely mask the taste of a bitter drug while at the same time, not adversely affecting the intended drug release profile¹³. Any non-toxic polymer that is insoluble at pH 7.4 and soluble at stomach pH, would be an acceptable alternative for taste masking.

Taste masking of ibuprofen has been successfully achieved by using the air suspension coating technique to form microcapsules, which comprises of a pharmaceutical core of crystalline ibuprofen and a methacrylic acid copolymer coating that provides chewable taste-masked characteristics. The methacrylic acid copolymer has a rapid rate of dissolution at a pH of about 5.5. Aqueous-based coating systems are safe, in accordance with regulatory requirements, economical, and relatively easy when compared to non-aqueous based coating systems. The elasticity provided to the microcapsule by the polymer inhibits the release of ibuprofen in the mouth when chewed¹⁴.

Polymers used for taste masking by coating:

The selection of the coating polymers for taste masking is based on the fact that the polymer should prevent the rapid release of the drug in the saliva, but allow it in the gastric cavity or in the duodenal region where the drug is expected to be absorbed. A number of coating materials such as hydrophilic polymers, lipophilic polymers, celluloses, carbohydrates, etc are employed for taste masking.

Lipids:

Oils, surfactants, and polyalcohols are effective in increasing the viscosity in the mouth and coat taste buds. Aliphatic or fatty acid esters such as stearyl stearate have been employed to prepare a taste-masking carrier for ac-

etaminophen compositions using fluidized bed coating for acetaminophen granules. The resultant granules were mixed with suitable excipients and incorporated into a chewable tablet and bitterness-free syrup formulation¹⁵. Similarly, the experimental drug for seizures, gabapentin, has improved taste when coated with gelatin and then with a mixture of partially hydrogenated soyabean oil and glycerol monostearate¹⁶. A mixture of hydrogenated rape oil, polyoxyethylene or polyoxypropylene glycol and sucrose fatty acid ester in methylene chloride is used to coat the antidepressant drug indeloxazine-HCl to produce the taste masked granules. Another approach of coating for taste masking oral medications includes a unique combination of triglycerides and a polymer. The triglyceride mixture melts at body temperature and the copolymer causes the coating to dissolve upon reaching the acidic environment of the stomach. The ingredients necessary for this approach are triglycerides, which when mixed together, melt at body temperature leaving the polymer, which is insoluble at pH 7.4 but soluble in the stomach¹³.

Practically when the patient places the medication in his mouth, for that brief moment, the triglyceride portion of the coating begins to melt as it is now at body temperature. The coating remains intact, because the polymer portion will dissolve only when it reaches a pH of 5.5, which is much more acidic than the pH of the mouth. The medication then travels down the esophagus and enters the stomach. Once in the acidic environment of the stomach, the dissolution of such dosage form occurs and the medication is then available for absorption.

Eudragit E, a FDA approved cationic copolymer based on dimethylaminoethyl methacrylates and neutral methacrylic acid esters, dissolves in gastric juice. Fattibase is the trade name for an FDA approved composition of triglycerides derived from palm, palm kernel, and coconut oils. It also contains glyceryl monostearate and polyoxyl stearate as emulsifying and suspending agents respectively, but neither is necessary for the coating to function properly. It is the triglycerides which cause the composition to melt at body temperature. Alternative triglycerides which may be used include non-toxic acids derived from vegetable oils such as coconut and palm kernel oil that have been modified by esterification or hydrogenation¹³.

Metronidazole and various other solid drugs with disagreeable or bitter taste have been effectively taste masked by using this approach¹³. The coating materials may be easily applied using a variety of methods, including spray coating

and pan coating. In case of suspensions, the coating material will maintain its integrity to mask disagreeable taste in a liquid medium with a pH greater than 5.5 and stored at refrigerated temperatures. Clarithromycin was prepared into a wax matrix with glyceryl monostearate and amino alkyl methacrylate copolymer E, resulting in a formulation, which was fully taste masked as well as having optimum release characteristics¹⁷.

Lecithin like substances:

An interesting development in the techniques for taste masking is the development of specific bitter taste inhibitor that is universal to several test substances and may be useful for masking the bitter tastes of the drugs and food stuffs. A homogenated suspension of phosphatidic acid and β -lactoglobulin from soyabean and milk are supposed to completely suppress the bitter stimulants such as quinine, L-leucine, and isoleucine, caffeine, and papavarine hydrochloride. This suspension was effective in selectively inhibiting the bitter taste and did not affect the sweet sour or salty taste. Other lipids such as triglycerides, diglycerides with β -lactoglobulin and phosphatidylcholine did not have marked effect¹⁸.

Carbohydrates:

Coating with carbohydrates is employed as an effective means of taste masking of the bitter drugs. Bitter solid drugs like pinaverium bromide, a spasmolytic agent has no bitter taste when formulated in an organoleptically acceptable formulation by particle coating with a mixture of water insoluble, film forming polymers like shellac and or cellulose and a second film-forming polymer soluble at pH less than 5¹⁹. Adsorption onto the polymeric carbohydrates is an effective means for reducing the bitter taste of an active ingredient. Chlorpheniramine maleate can be adsorbed onto avicel PH 101 porous particles as an aqueous solution containing 50 parts chlorpheniramine maleate onto 3000 parts of the polymeric material. The product obtained after adsorption was spray coated with an aqueous solution containing xylitol to get the final coated product which was taste masked²⁰. The compressible grade formulations of xylitol are available as xylitab. Triprolidine hydrochloride was taste masked with dispersion coating of water soluble polymer hydroxypropyl cellulose, a plasticizing agent, a sweetener and a flavoring agent²¹.

Several drugs can be taste masked with starch or celluloses, containing carboxy methyl groups, examples include carboxymethyl cellulose (CMC), sodium CMC, cross linked sodium CMC, sodium CM starch²². Core element of

drugs when coated with a water insoluble polymer such as ethyl cellulose offer taste masking and reduced dissolution profiles for a variety of drugs including paracetamol, ranitidine hydrochloride, doxycycline hydrochloride, theophylline and aspirin²³. Pharmaceutical agents with bitter taste are coated with water-soluble polymers of hydroxypropyl cellulose and sugars such as lactose and sucrose to decrease the bitter perception at the time of oral administration²⁴. Cefanel daloxate hydrochloride, lactose, cornstarch were mixed and granulated with ethanolic solution of polyvinyl pyrrolidine to produce granules. The granules are first coated with an ethyl cellulose containing methylene chloride/methanol mixed solution. They were further coated with a similar solution of trisodium citrate and ethyl cellulose mixed with lemon oil and granules prepared from sodium saccharine, sucrose and hydroxypropyl cellulose. The resulting product had good bioavailability and no bitterness²⁵.

Sparfloxacin is optimally taste masked by preparing film-coated granules. Higher levels of ethyl cellulose reduce bitterness most effectively. Ibuprofen may also be formulated and coated with a solution containing hydroxyethyl cellulose and hydroxypropylmethyl cellulose in water to obtain coated granules, which can be compressed into chewable tablets²⁶. Aspirin tablets can be taste masked with plasticized thin film of cellulose acetate latex and triacetin along with the coated medicament²⁷. A preparation of the antiulcerative drug propantheline bromide, coated on low substituted spherical hydroxypropyl cellulose was further coated with ethyl cellulose to mask the unpleasant taste²⁸. Croscarmellose sodium has been used to coat bitter tasting active agents to mask their taste and to impart the rapid disintegrating properties to the tablet²⁹. Chewable tablet of acetaminophen was prepared by compressing the coated particles. Particles are coated with a blend of cellulose acetate or cellulose acetate butyrate and polyvinyl pyrrolidine. The coating provides excellent taste masking while still permitting acceptable bioavailability³⁰.

Cross-linked gelatin via glutaraldehyde and Eudragit resin L-100, S-100, and E-100 coated capsules are effective in preventing release of clarithromycin and erythromycin under simulated buccal conditions¹¹. Stearyl alcohol was melted at 100° and Eudragit E dispersed in the melt followed by clarithromycin. The resultant dispersion was spray cooled and granulated. Sorbitol, magnesium oxide and crystalline cellulose were mixed with 100 g of granules for oral administration containing 10% clarithromycin. Melt granulation with water soluble substances successfully reduce

bitterness of cetraxate and ofloxacin. Granules consisting of cetraxate hydrochloride, cornstarch and macrogol 600 were coated with mixture of Eudragit S 100, talc and silica to mask the bitter taste¹¹.

Ibuprofen is encapsulated using chewable methacrylic acid copolymer to reduce bitterness. A fluidized bed of ibuprofen crystals was spray coated with an aqueous dispersion containing Eudragit L-30 D, propylene glycol as plasticizer and talc. The encapsulated ibuprofen was mixed with mannitol and flavor and compressed into tablets. Morphine hydrochloride adsorbed on spherical cellulose was coated with an aqueous solution containing Eudragit NE-30 D and talc. The particles were then over-coated with avicel, sucrose, sorbitol, sodium saccharin, methyl paraben and vanilla essence to produce powder with good sustained released properties and no bitter taste. Table 1 summarizes literature on the various drugs that have been taste masked by using different polymers coating techniques.

Proteins, gelatin and prolamines:

Various forms of proteins have been used extensively for taste masking. Tylenol gel tablets, which are taste masked using the gelatin coating process, also offer ease of swallowing. The notable disadvantage of this preparation is poor stability in hot humid climate³¹. Prolamine forms the main protein components of cereal grains and flour, and can be extracted from the flour with 80% alcohol unlike other proteins. Most important prolamines are zein, gliadin and hordein. Prolamine fractions of grain proteins can be applied as a single coat in weight ratios of 5 to 10 %, relative to the active substance being coated. This gives a suspension, which effectively masks the extremely bitter taste of orally administered drug. The taste masking is effective over prolonged period of storage. Besides effectively masking the taste of the bitter drug, prolamine coating does not affect the immediate bioavailability of the active substance. Various antibiotics, vitamins, dietary fibres, analgesics, enzymes, and hormones have been effectively taste masked using prolamine coatings. Water insoluble vegetable oil or wax in the concentration range of 2.5 to 15 % is capable of plasticizing the prolamine coatings. Zein or gliadin in combination with plasticizers (thickness 1 to 35 µm) were highly effective in controlling the release of the active substance from the encapsulated particle and masking the unpleasant taste of the coated active substance³³.

For mint flavored oral pharmaceutical gums, bitterness of the flavor can be reduced by incorporating a prolamine cellulose ingredient of high pH³². Macrolide antibiotics have

been coated with a mixture of prolamine and plasticizers such as vegetable oil or wax. The coating prevents dissolution of the drug in the mouth and act as a taste masker. Cores of clarithromycin-polyvinyl pyrrolidine mixtures were coated with mixture of zein and medium chain triglycerides to reduce bitterness³¹. Water insoluble gel formed by sodium alginate in the presence of bivalent metals is also exploited for there taste masking properties. Amiprilose hydrochloride was taste masked by first coating the drug with calcium gluconate and followed by coating it with sodium alginate. Upon oral administration, it forms a gel on the surface of the tablet to mask its bitter taste³⁴.

Taste masking by rheological modifications:

Increasing the viscosity with rheological modifiers such

as gums or carbohydrates can lower diffusion of bitter substances from the saliva to the taste buds. This provides a taste masked liquid pharmaceutical composition for administration of a relatively large amount of unpleasant tasting medicines. The composition comprises of a taste masking liquid excipient base with a relatively higher than normal viscosity induced by agents such as polyethylene glycol and sodium carboxymethyl cellulose. Surprisingly, it has been observed that the high viscosity liquid excipient base provides taste masking benefits to the extent that extra strength compositions can be prepared containing increased concentrations of adverse tasting ingredients, e.g. guaifenesin which is normally administered in dosages of not more than 100 mg in 5 ml of liquid, may be administered in dosages of 200 mg/5 ml in the same volume of

TABLE 1: DRUGS AND TASTE MASKING COATING TECHNIQUES.

Drug	Technique	Polymers used	Reference
Pseudoephedrine (antihistaminic)	ESE	Eudragit E	44
d-Indobufin (inhibitor of platelet aggregation)	FBD	Eudragit E-100, RL/RS, Ethyl Cellulose	45
Clarithromycin (antibiotic)	Phase separation-Coacervation	Eudragit E-100	46
Cefuroxime axetil (antibiotic)	ESE	Eudragit E-100 Eudragit L100-55 Eudragit RL-100	47
Beclamide (antiepileptic)	Phase separation-Coacervation	Gelatin	48
Ranitidine (antiulcer)	ENSA	PEG, Ethyl Cellulose	34
Oxybutinin (antihistaminic)	Dispersion coating	Eudragit E-100	49
Indeloxazine (cerebral activator)	FBD	Hydrogenated oils & surfactants	50

ESE = Emulsion – Solvent Evaporation; FBD = Fluidized Bed Drying; ENSA = Emulsion – Non Solvent Evaporation

liquid without the patient experiencing an unduly adverse taste. Other well known and commercially available pharmaceutical compounds delivered using the present approach are pseudoephedrine HCl, dextromethorphan and ibuprofen³⁵.

There are several examples of viscosity modifications as a technique for taste masking. Xanthan gum and microcrystalline cellulose were added to increase the viscosity of the acetaminophen suspensions to reduce bitter taste³⁶. Bitter taste of a syrup composition comprising of phenobarbitone and acetaminophen was taste-masked by using a polyhydric alcohol such as polyethylene glycol or propylene glycol with polyvinyl pyrrolidone, gum arabic, or gelatin¹⁹. Gelatin and flavouring materials mask the bitter taste of tannic acid, presumably by viscosity effects, when made into a jelly by cooling. In addition, a 50-mL aqueous solution of tannic acid (0.1 g) and sodium alginate (0.4 g) had reduced bitterness compared to a control of tannic acid alone. The anti-depressant mirtazapine, is made into an aqueous suspension by formulating with the stabiliser like methionine and thickening agents like maltitol. Maltitol is stable even in the acidic pH range of 2 to 3. Besides masking its unpleasant bitter taste, it also inhibits Mirtazapine's undesirable local anaesthetic effect³⁷.

Taste masking by inclusion complexation:

In inclusion complex formation, the drug molecule fits into the cavity of a complexing agent i.e., the host molecule, forming a stable complex. The complexing agent is capable of masking the bitter taste of drug by either decreasing its oral solubility on ingestion or decreasing the amount of drug particles exposed to taste buds, thereby reducing the perception of bitter taste. Van der Waals forces are mainly involved in inclusion complexes¹². β -Cyclodextrin is most widely used complexing agent for inclusion type complexes. It is sweet, nontoxic, cyclic oligosaccharide obtained from starch.

Strong bitter taste of carbapentane citrate syrup was reduced to approximately 50 % by preparing a 1:1 complex with cyclodextrin³⁸. Palatable ibuprofen solutions are prepared by forming a 1:11 to 1:15 inclusion complex with ibuprofen and hydroxypropyl β -cyclodextrin, respectively. The complex masked the bitter component but creates a sore taste that is masked by sweeteners³⁹. Pharmaceuticals or food additives containing gymnima sylvestre, a bitter and astringent tasting sweetener for diabetes control can have the unpleasant taste masked by mixing with β -cyclodextrin. Besides masking its bitter taste, β -cyclodextrin

further enhances the blood sugar lowering effects of gymnemic acids⁴⁰.

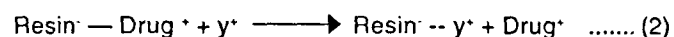
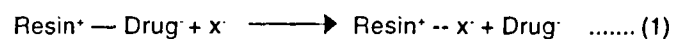
Taste masking by ion-exchange technique:

The scope of ion-exchange resins (IERS) in pharmaceutical use is wide and inexhaustible. With improved processing methods, their use as solid insoluble chemical is growing in the manufacturing industries. IERS are used in drug formulations to stabilize the sensitive components, sustained release of the drug, tablet disintegrants and taste masking which is one of the major applications of IERS. IERS are water insoluble, cross-linked polymers containing salt-forming group in repeating positions on the polymer chain. Drug can be bound to the resin by either repeated exposure of the resin to the drug in a chromatographic column or by prolonged contact of resin with the drug solution. The resin forms insoluble adsorbates or resinates through weak ionic bonding with oppositely charged drugs. The exchange from counter ions from the resin is competitive.

Drug release from the resin depends on the two factors:

- (i) The ionic environment (i.e., pH and electrolyte concentration) within the gastrointestinal tract.
- (ii) The properties of the resin.

Drug molecules attached to the resin are released by exchanging with appropriately charged ions in the gastrointestinal tract, followed by diffusion of free drug molecule out of the resins. The process can be depicted by the following equation 1 and 2 for anion exchange and cation exchange respectively. Where x^- and y^+ are ions in the GI tract⁴¹.



Resins involve ion exchange as the reversible interchange of ions between a solid and a liquid phase in which there is no permanent change in the structure of the solid. The solid is the ion exchange material while the ion could be a drug. When used as a drug carrier, ion exchange materials provide a means for binding drugs onto an insoluble polymeric matrix and can effectively mask the problems of taste and odor¹².

Ion exchange resins can be classified into four major groups:

1. Strong acid cation exchange resin, e.g. Amberlite IRP-69.

TABLE 2: DRUGS AND TASTE-MASKING ION-EXCHANGE RESINS.

Drug	Resin used	Reference
Bufomedil	Amberlite IRP-69	30
Chlorpheniramine maleate	Indion CRP-244, Indion CRP 254.	11
Diphenhydramine HCl	Indion CRP-244, Indion CRP 254	11
Ranitidine	Cation-anion exchange resins.	30
Chloroquine Phosphate	Indion-234	41

- Weak acid cation exchange resin, e.g. Amberlite IRP-65.
- Strong base anion exchange resin, e.g. Amberlite IRP-276.
- Weak base anion exchange resin, e.g. Dimethylamine resins.

Strong acid cation resins (sulfonated styrene-divinylbenzene copolymer product) can be used for masking the taste of basic drugs, as they function throughout the entire pH range. Weak acid cation exchange resins function at pH values above 6. Similarly, strong base anion exchange resins function throughout the entire pH range, while the weak base anion exchange resins function well below pH 7¹¹. Polystyrene matrix cation exchange resins (Indion CRP-244, Indion CRP 254) have been used to mask the bitter taste of chlorpheniramine maleate, ephedrine HCl, diphenhydramine HCl⁴². Adsorption on to carbopol is emerging as an important mechanism of taste masking. To reduce the bitterness of erythromycin and clarithromycin a polymer carrier system was developed by adsorption on to carbopol⁴³. The underlying mechanism is ionic bonding of the amine macrolide to polymeric acid, thereby removing the drug from solution phase in an ion free suspension. Upon ingestion, endogenous cations displace the drug from the polymer into the GIT to achieve bioavailability. Table 2 enlists some of the drugs taste-masked by using ion-exchange resin technique.

Taste masking by salt preparation/functional group modification:

Salt preparation is one of the classical approaches to mask the taste of the bitter drugs by either decreasing solubility or by increasing hydrophobicity and thereby reducing contact of bitter drugs with the taste buds. This approach differs from others in that attempt is made to modify the

chemical composition of the drug substance itself, so as to render it less soluble in saliva and thereby less stimulating to the taste buds, or to obtain a tasteless or less bitter form. Even if one is successful in preparing a new salt or a derivative of a bitter drug, the legal implications of its new drug status from a regulatory point of view must be considered. Moreover, the solubility, stability, compatibility and bioavailability aspects of the new compounds must also be kept in mind. If a less bitter tasting salt form or a tasteless derivative can be obtained, this would represent the best approach to taste masking. Since there is no coating that can be broken during chewing, no problem will be encountered with respect to unpleasant aftertaste¹². Magnesium aspirin tablets are rendered tasteless by making magnesium salt of aspirin. D-chlorpheniramine maleate was also a taste masked salt of chlorpheniramine. The alkyloxyalkyl carbonates of clarithromycin have remarkably alleviated bitterness and improved bioabsorbability when administered orally¹¹.

CONCLUSION

In response to the need for taste masking, better and effective techniques are constantly being developed in the pharmaceutical industry. Taste masking of bitter drugs has certainly improved the quality of treatment provided to the suffering patients, especially the paediatrics. Applicability of all these techniques varies from drug to drug and hence, a universal approach is desirable. A substance which is universal inhibitor of bitter taste is being researched for quit a long time. Lipoproteins composed of phosphatidic acids and b-lactoglobulin selectively and reversibly inhibit the response to bitter taste. This approach would expedite the commercialization of a successful bitterness inhibiting substance. It is also suggested that sensory evaluation of the oral dosage forms of the bitter drug with taste inhibitors should take a more formalized structure for providing better and effective healthcare to the population, especially the pediatric segment.

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