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A REVIEW ON UTILIZATION OF NATURAL SUPERDISINTEGRANT IN THE ADVANCEMENT OF ORALLY DISPERSIBLE TABLET

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ABSTRACT

In recent years, orodispersible tablets as a novel drug delivery system are emerging as an alternative to conventional oral drug delivery systems. Despite being the most accepted route of drug administration conventional oral tablets have a drawback of difficulty in swallowing (dysphagia). This problem can be solved by developing orally dispersible tablets which disintegrate rapidly within a few seconds in saliva in the mouth without the use of water. Thisquick disintegration is due to the action of superdisintegrant in the formulation which leads to rapid absorption, improved bioavailability and better patient compliance. Various synthetic disintegrants such ascrospovidone, croscarmellose sodium, sodium starch glycolate have been used to formulate orally dispersible tablets. But recently researchers are investigating use of natural superdisintegrantsuch as hibiscus rosasinesis, Plantago ovata, Lepidium sativum, Fenugreek and Guar gum over the synthetic superdisintegrants. This is because naturally obtained polymers are more beneficial as they are non-toxic, economical, chemically inert and easily available. Further, they are potentially degradable and compatible with other excipients in the orally dispersible tablet due to their natural origin. Most of the natural disintegrant are capable of chemical modification to design tablets of specific properties such as drug release and desired therapeutic effect. In this review, the main importance is given on different types of natural superdisintegrants used in formulation of oro-dispersible tablet.

KEYWORDS: Natural superdisintegrant, Synthetic superdisintegrant, bioavailability, dysphagia,orally dispersible tablets.

INTRODUCTION

Conventional Tablets are the most widely used among all dosage forms available today because of its convenience of self-administration, stability and patient acceptance. But elderly and pediatrics patients are unable to swallow(dysphagia). This condition affect about 35% of the general population.[1] conventional tablets which may lead to patient non-compliance. So for the patients who prefer the convenience of easily swallable dosage forms oro-dispersible tablets are designed. Also for conventional tablets fast onset of action is the major concern. The problem of slow onset of action of drugs can be overcome by development of appropriate dosage forms. oro-dispersible or fast dissolving tablets are defined as a solid dosage form which instantaneously dissolve or disintegrate within seconds into the saliva when kept on the tongue. The notion of use of orodispersible tablet drug delivery system appeared from the need to provide patients with conventional means of taking self medication.[2]

There are several synonyms which are used for oro-dispersible tablet like mouth disintegrating tablet, fast dissolving tablet, quick dissolving tablet, fast melt tablets, rapid disintegratingtablets. Orally dispersible tablets are formulated to disperse quickly in mouth without water within few seconds in the mouth due to the action of superdisintegrant.

Superdisintegrant aids the breakdown of the tablets within few seconds in the mouth as they come in contact with saliva without the need of water. Theincorporation of appropriate superdisintegrant play the key role in the development of oro-dispertsible tablet. Oro-dispersible tablets are prepared using both natural and synthetic superdisintegrant. This review explains various naturalsuperdisintegrantsused in orally dispersible tablets and need of utilization of natural disintegrant over synthetic superdisintegrant.

Advantages of Fast Dissolving Drug Delivery System

i. Good mouth feel propertyproduced by the use of flavors and sweeteners especially in the pediatric patient

ii. Easy to administer for patientswho cannot swallow, as elders and, bed ridden patient

iii. Increased bioavailability for the dosage unit which require fast onset of action

iv. Easy to prepare with minimum amount of apparatus and time.[2]

V. Accurate dosing as compared to liquids dosage form.[1,2]

SUPERDISINTEGRANT

Disintegrants are the substances that are added to the tablet to help in the breakup of compacted mass into smaller particles. Nowadays, superdisintegrants are employed in the development of orally dispersible tablets. These are more effective at low level in the dosage form, typically 1-10% by weight to total weight of unit dosage form.[3]

The suitable choice Superdisintegrantare of importance to the development of oro-dispersible tablet. The incorporation of superdisintegrantin oro-dispersible tablet is a promising method for enhancing absorption rate and eventually bioavailability for poorly soluble drugs. Due to the action of superdisintegrantoro-dispersible tablet turn into soft paste or solution form as they come in contact with saliva When. Saliva passes down through the mouth, pharynx and esophagus tablet get absorbed through respective organs. Because of pregastric drug absorption bioavailability of oro-dispersible tablet is considerably improves than conventional dosage form.

MECHANISM OF SUPERDISINTEGRANT

Superdisintegrant form soft paste as they come in contact with liquid environment There are various mechanism by which tablets speeds up disintegration process of tablet. They are as follows.

1. Swelling:Water penetration is a necessary first step in this most acceptable mechanism of superdisintegrant. Particles of superdisintegrant swell on coming in contact with water which causes break up of matrix from within due to pressure developed from swelling of particles.

2. Porosity and capillary action:Thedisintegrant that do have swelling capacity conduct their disintegrating action by porosity and capillary action. The aqueous medium penetrates through the porous pathways of the tablet and replaces the air adsorbed on particles which leads to weakening of intermolecular bond. This eventually leads to breaking of tablet into smaller pieces.

3. Particle repulsive force:This is another mechanism for the non swellabledisintegrant. In this mechanism of disintegration water penetrates through the pill through hydrophilic pores offering a full-size hydrostatic pressure. Thereby breaking the hydrogen bonds and other forces that are accountable for protecting the ingredients, a repulsive force is produced within particles which leads to breaking of tablet.

4. Deformation recovery:somedisintegrants such as starch grains are believed to be elastic by nature which means they are deformed under pressure and return to their original shape after

pressure is Removed. Shape of particles is distorted because of compression forces involved in tabletting and particles return to their preompressionshape when they come in contact with liquid medium which causes tablet to break down into pieces.

5. By enzymatic reaction: Enzymes that are already present in the body acts as disintegrant. They decrease the binding capacity of the binder present in the tablet. Swelling causes pressure in the outer direction and makes tablet to rupture. Our body enzymes which promtes disintegration of tablets are as follows: Table: Body Enzymes With binders.

Sr.no.	enzyme	binder
1	amylase	starch
2	protease	gelatin
3	celluase	cellulose
4	invertase	sucrose

TYPES OF SUPERDISINTEGRANT

The superdisintegrants can be classified intofollowing two main classes.

1. Natural superdisintegrant
2. Synthetic superdisintegrant[4]

NATURAL SUPERDISINTEGRANT

Recently various researchers have explored that the natural superdisintegrant exhibited faster drug dissolution as compared to some of the synthetic superdisintegrant. These natural gums and mucilages are favoured over synthetic ones because they are abundantly accessible, economical, non toxic in nature. Furthermore, they can be transformed into customized, materials for drug delivery system.[5] Most of the synthetic superdisintegrants are not capable of chemical modification which is the disadvantage of synthetic superdisintegrant. These plant based products are replacing synthetic one as they are environmentally safe due to biodegradable nature. It is also compatible with other excipients and active pharmaceutical ingredient dur to natural origin. So interest in natural gums and mucilages has been increased as an effective superdisintegrant for the development of orally dispersible tablets.

Gums are are released by the plants as response to injury or due to unfavourable conditions, such as drought, by breakdown of cell walls. This phenomenon is called as gummosis. Gums are either soluble or they have water absorbing capacity. Mucilages are water soluble in nature so they have water holding capacity.

Plantago ovata seed mucilage

Fig.1: plantago ovata seed

Fig.2 plantago ovata seed powder.

PlantagoOvata seeds are traditionally known as Psyllium or ispaghula. Psullium mucilage is extracted from psyllium husk(seed coat). Psullium husk is acquired by seeds of plantago plant by milling of outer layer of seed. Psyllium seed mucilages is hydrophilic white fibrous material. It has different characteristics such as binding, disintegrating, and swelling properties. In an investigation containing lorazepam fast dissolving tablets, Fenugreek Mucilage powder and Plantago Ovata Mucilage powder were used as natural super disintegrants, it was found that Fenugreek Mucilage powder was poor natural superdisintegrant as compared to Plantago Ovata Mucilage powder. This is because of high swelling index of plantago ovata mucilage as compared to other natural supetdisintegrants. In recent study Plantago Ovata mucilage powder was proved tobe a superior disintegrating agent than sodium starch glycolate and cross carmellose sodium in fast dissolving tablet containing Trimetazidine hydrochloride as a model drug.[8]

Fenugreek seed mucilage

Fig.3 Fenugreek seed.

Mucilage from the seeds of Trigonella foenum graceumis an herbaceous plant of the leguminous family. It is commonly known as fenugreek seeds which contain a high

percentage of mucilage (30%). This high mucilage content of fenugreek seedsis responsible for multiple uses from disintegrating agent to gelling agent. Fenugreek seeds becomes bulgy and forms viscous mass when they come in contact with liquid medium. Since fenugreek seeds produce high viscosity mucilage at low concentration it can produce high yield when taken in small portion.

Guar Gum

Fig.4 Guar gum seeds.

Guar gum is obtained from seeds of the plant Cyamopsistetragonolobus. Gum is obtained by drying the pods in daylight so it's extracted from the seeds. Chemically, gum could be a saccharide composed of the carbohydrate sucrose and mannose. It isused as food preservative mainl; y in processed foods because of its ability to form gel in contact with liquid attributing to binding and thickening properties. These properties are also suitable for ideal superdisintegrant.

Mangifera indica gum

Fig.5 Mangifera Indica.

Fig.6 Mangifera Indica Bark.

Mangifera indica commonly known as mango belongs to the family Anacardiaceae. Mangifera indica gum is extracted from bark of the plant as a gummy exudate and mango peel as a mango peel pectin which is believed to have a good superdisintegrant quality. Mangifera indica gum is used in pharmaceutical preparation for its various properties such as binding, sustained release and disintegrating properties .According a research article, orally dispersible tablets containing furosemide as a model drug prepared by using pectin powder of mango peel deliver better disintegration time as compared to tablets prepared from other disintegrants.

Lepidium Sativum

Fig.7 Lepidium sativum seeds.

Lepidium sativumisoften referred to as garden cress seed. It iswidely utilized as herbal medicinal plant in indiadue toantihypertensive, antioxidant, hypoglycemic properties. In addition to various pharmacologic propertiesmucilage of Lepidium sativum has various characteristic such asbinding, disintegrating and swelling properties. Mucilage is commonly extracted from outer layer of seed known as seed coat. But the isolation of mucilage has a common problem that mucilage does not separate from the seeds. So alternate methods for isolation of mucilage have been employed rather than conventional method.

Hibiscus rosa sinesis mucilage

Fig.8 Hibiscus rosa sinesis.

Hibiscus rosa sinesis is also known as china rose, shoe flower plant and chinese hibiscus .It belongs to the family malvaceae. Leaves of hibiscus rosa sinesis contains high proportion of mucilage which can be used in pharmaceutical preparation for binding, gelling, moisturizing, disintegrant properties. Mucilage of the leaf has antiinflammatory activity and reported to have various medicinal properties such as hypoglycemic, antioxidant, antihypertensive activity.

Opuntia ficus-indica

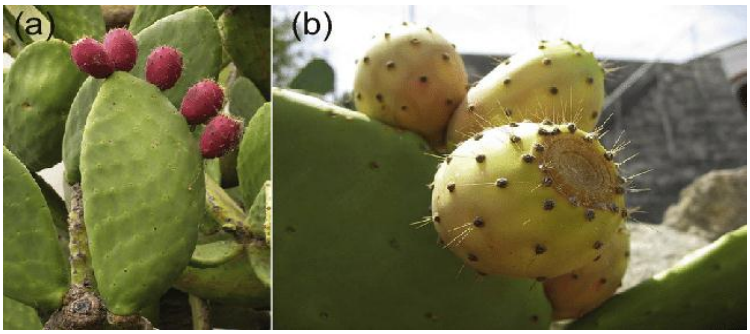

Fig.9 a)Red opuntia ficus-indica b)Yellow opuntia ficus-indica.

Opuntiaficus-indica Mill.is usually referred to as prickly pear, cactus pear, Barbary fig, cactus fruit, Indian fig, or Nopal cactus and belongs to the Cactaceae family. It originates from from some arid parts of Mexico although it grows in Latin America, Africa, and Mediterranean countries. The mucilage of fruit is obtained from pulp of fruit Ficus indica containing various constituents such as arabinose, rhamnose, galactose and xylose. The colour of fruits of opuntia ficus-indica have various ranges due to varying proportion of pigments betaxanthin and betacyanin. Fruits have an extraordinary range in colour such as green, orange, yellow, red and yellow. The mucilage of ficus indica fruit is employed as superdisintegrant because of its binding and gelling properties.

Locust bean gum

Fig.10 Locust bean gum.

Locust bean gum also known as carob bean gum is a vegetable gum obtained from the seeds of the Carob tree mostly found in the Mediterranean regions. used in food industry as a. Locust bean gum has also been reported to hve gelling amd thickening properties so it is used vas superdisintegrant. In recent study containing locust bean gum as a natural superdisintegrant in nimesulide orodispersible tablets, the gum of locust bean gum was found to have appreciable swelling index. In the pharmaceutical preparation, locust bean gum is used as tablet excipient, dentifrice thickener, gelling agent.

CONCLUSION

The use of natural superdisintegrant such as gums and mucilages are morefeasible and preffered over synthetic superdisintegrants in orally dispersible tablets. It is due to ease of access, economical cost, chemically inactive and non-toxic nature of natural superdisintegrants over the synthetic superdisintegrants. The use of natural superdisintegrats has played crucial role in development of orally dispersible tablets. Even Some of the natural superdisintegrants such as Plantago Ovata Mucilage and Fenugreek Mucilage were found to be better super disintegrant because of better drug release than poorly released synthetic superdisintegrant. So orally dispersible tablets has made major contributions for health condition which need better bioavailability and fast onset of action.

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