

Journal of Pharmaceutical Advanced Research

(An International Multidisciplinary Peer Review Open Access monthly Journal)

Available online at: www.jparonline.com

A Review on Vegetarian Capsules

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Received: 22.02.2018

Revised: 24.02.2018

Accepted: 26.02.2018

Published: 28.02.2018

ABSTRACT: The vegetarian supplement market continues to grow now a day's worldwide. Today's supplement consumers are more discerning and informed than ever before. They are young, diverse and global. They are growing in number. Maintaining a healthy balanced lifestyle has grown from 62 % in 2007 to 79 % in 2015. In the U.S., 44 % of supplement users say that vegetarian is important when choosing a supplement, up from 26 % in 2006. They want non-animal products with no pesticides or preservatives. The hydroxyl propyl methyl cellulose (HPMC), this component is frequently used in the elaboration of Pharmaceuticals, groceries, and cosmetics. These capsules containing HPMC have some properties; the most distinguished are the following: They fulfil all the Pharmaceutical dissolution requirements (USP & EP). "Non-animal" product – suitable for vegetarians. Stable in a wide range of temperatures and humidity. This review attempted for thorough study on vegetarian capsule, its importance and future prospective.

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Key words: Soft gel capsules, Gelatin, Hydroxy Propyl Methyl Cellulose, Vegetarian capsule films, Vegetarian polymers.

INTRODUCTIONS:

Pills are a common part of many people's lives. There are pills that are prescribed, pills that can be bought over the counter for ailments such as headaches or stomachaches, and there are supplements which are taken by people who want to live a little healthier. Pills for the most part come in two different forms, tablets and capsules. Tablets were the most popular way to take medicine for quite some time, but then people started to discover the downfalls. Tablets were more often than not the medicine they thought they were taking, plus some added ingredients^[1]. The added ingredients are used to bind everything together and make the tablet in a solid form. Most folks did not like the idea of putting more chemicals in their body than they had too, hence most

people tried to switch to capsules whenever it was possible. At this point there are two different kinds of capsules, gelatin based capsules and vegetarian based capsules. Essentially a capsule is better than a tablet because there is no binding agent involved in keeping the pill together. Capsules can either be soft gels or hard, either way the benefits of taking capsules over tablets are evident. Here are some of the great benefits that capsules carry: Quick dissolving, meaning your medicine gets into your system faster, often tasteless, easy to swallow when compared to tablets, no extra added ingredients to hold the pill together and choice of gelatin or vegetarian capsules^[1,2].

GELATIN CAPSULES:

Despite the fact that both types of capsules look the same there are some drastic differences between them. The most notable difference is what they are each made of when created. Gelatin capsules are made through a process that involves boiling down certain parts of animals such as bovine and pigs. The hoofs, bones, and connective tissue is boiled down until it is a gel like substance, and then allowed to cool and expand in cool water. When the process is finished all that is left is a tasteless, odorless, and colorless substance that can be formed into the gel capsules that are taken every day by consumers. The main advantage of gel caps is that they are generally less expensive than their vegetarian counterparts^[2,3]. Many folks do not like taking this kind of capsule for various reasons. It could have something to do with their religious affiliation that does not permit them to consume these kinds or parts of animals. It could also simply be because the person is a vegetarian and does not want to consume animals in any form - particularly when it comes to taking their medication. Another disadvantage to gelatin capsules is that they do not remain stable when exposed to heat or humidity. If you live somewhere that is particularly hot you might have trouble storing gelatin based capsules^[4].

VEGETARIAN CAPSULES:

The alternate to these kinds of capsules are vegetarian capsules. These types of capsules are used by forming cellulose, as opposed to animal parts. It is a great alternative for people who simply do not want to take pills that they would deem religiously wrong, or morally wrong. They provide a safe way for people who want to still enjoy the benefits of speedy release and tasteless medication without the guilt of consuming boiled animal

parts as the shell of the pill. As time goes on more companies are switching to vegetarian capsules to package their pills. It is easy to see why when you look at the figures. While it would appear that a majority of people who take medication in capsule form don't care what the source of the capsule is, there are still a number of people who do care. The best way to mediate the situation is to make a full switch over so that the pills are safe and natural for every one^[1,5].

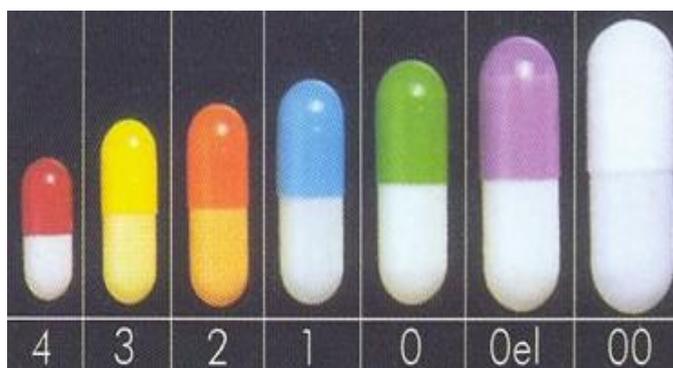


Fig 1. Hard capsules for Pharmaceutical and dietary supplement industries in different sizes.

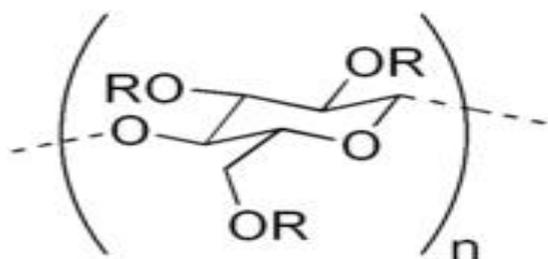
Similarities between Capsules:

Despite their overwhelming differences they do have some things that are the same. First of all they can be stored for many years without the risk of bacterial growth when compared to traditional tablets. The ability to store medication without the fear of sickness is a great advantage for both gelatin, and vegetarian capsule users, regardless of preference. The second important similarity is both can be made in a variety of shapes, sizes, and colored to match different medications. This kind of flexibility means that consumers are never going to have to be worried about what they are taking, because the pills are noticeably different. At the end of the day your choice on capsules is just that, your choice. You should keep in mind that vegetarian capsules are a great way for everyone to have the ability to take capsules, regardless of religious, moral, or health related preferences. Two piece capsules have long been a reliable drug delivery system. Capsules continue to offer worldwide consumer appeal because they are easy to swallow, mask odours, tasteless, aesthetically pleasing and versatile. In addition, two-piece capsules are a top choice of many Pharmaceutical and contract manufacturers because they can be filled in-house under a company's direct supervision and control standards, require fewer excipients than other drug formulations, require less initial investment in processing equipment,

are manufactured to universal standards, which allows for multi-sourcing and runnability on all types of filling equipment and offer endless varieties of color and print options for unique identification of your product in the market place [5-7].

POLYMERS USED IN VEGETARIAN CAPSULE:

Vegetable capsule shell is mostly prepared from the hydroxyl propyl methyl cellulose (HPMC), most commonly known as hypromellose. It is produced by synthetic modification of the naturally occurring polymer cellulose and is considered safe for normal consumption, in human. HPMC is used as a coating polymer, bioadhesive, thickening agent in controlled release systems, in solid dispersion to enhance drug solubility, bioadhesive, and binder. The material is described as a white to slightly off white powder or granules, practically insoluble in hot water, in acetone, in dehydrated ethanol and in chloroform, but dissolves in cold water giving a colloidal solution owing to the reversible thermal gelation property. HPMC is available in different type of groups with limits on methoxy and hydroxyl propoxy groups.



$R = H \text{ or } CH_2CH(OH)CH_3$

Fig 2. Chemical structure of HPMC.

These groups affect many of the HPMC properties such as gelation temperature, viscosity, flexibility and hydration [3]. Vegicaps soft capsules are alternative animal free capsules. The shell is made from seaweed extract and gluten free starch and contains no modified sugars and artificial colours. Advantages of it is that it is free of all animal derivatives-no pork or beef content, easy to swallow, soft, natural, perception of a healthier product and low shell odour [4,8].

Properties of HPMC:

Hydroxy propyl cellulose (HPC) is a derivative of cellulose with both water solubility and organic solubility. It is used as an excipient, and topical ophthalmic protectant and lubricant. Other names are

Cellulose, 2-hydroxypropyl ether; oxypropylated cellulose; E463; hyprolose [9].

Manufacturing process of vegetarian capsule:

The manufacturing of HPMC based capsules requires some modification to the moulding machine or to the formulation of the shell materials. HPMC gelling from solution occurs when the temperature is increased while it is converted to its original solution as the temperature is decreased, unlike gelatine solution.

It means that the pins immersed in the dip pan containing the HPMC solution must be of higher temperature (70°C) in order for the film to be formed. The pins, the temperature of the pins must be further maintained post-dip to facilitate gelation until the films dry out in the kilns [9-12]. Because HPMC shell walls are much weaker than gelatin made shells, removal of the capsule from the pins and subsequent handling and filling are difficult. To overcome these problems, three approaches were adapted. These approaches were to use a stripper jaw with depressions on the inner surface, increase the formed HPMC film thickness and the use of gelling agents [13,14].

ALTERNATE POLYMERS FOR SOFT CAPSULES:

The materials mostly used for films/ edible coatings belong to the following categories that are Hydrocolloids, Polysaccharides – Gums (carageenan, gellan gum), Starch, Proteins – Collagen, Lipids, Fatty acids and Waxes [14]. Polysaccharides exhibit great diversity of structural features in terms of the monosaccharide composition, linkage types and patterns, chain shapes, and degree of polymerization, thus influencing their physical properties [10].

Starch:

Starch is the polysaccharide energy storage material of the plant kingdom. It consists of amylose which is linear – (1 4) glucan and amylopectin which is a highly branched, high molecular weight glucan. Amylopectin has – (1 4) glycosidic linkages containing – (1 6) branch points [11-13]. Gelatin is the original and most common material used to produce capsules. It is the less expensive option, and is available in many options. These capsules can be purchased in various colors, flavors, as well as sizes to suit your needs. However, gelatin is an animal by product formed from collagen. This protein is obtained from connective tissues as well

as organs of animals, which can be a major downfall for some consumers. Individuals with religious or dietary restrictions which forbid them from consuming such animal products will not be suited for the usage of the traditional gelatin capsules. Another factor to consider when choosing between gelatin and vegetarian capsules is what they are going to be filled with. Gelatin capsules are only suitable for use with powdered medications or supplements. Liquids and various other materials such as gels are not compatible with capsules made of gelatin. One of the most obvious advantages of using cellulose based or vegetarian capsules is that they are not made with animal by products.



Fig 3. Empty vegetable capsule shell.

This distinct characteristic allows them to be suitable for individuals who choose not to consume products sourced from animals. Vegetarian capsules in addition to being both the obvious choice for both vegetarian and vegan consumers are also more acceptable for religious reasons as well. In fact, vegetarian capsules are often deemed suitable to be classified as both Kosher and Halal products.

The non-animal origin of HPMC capsules ensures full compatibility with Halal and Kosher certifications and compared to gelatin the raw material offers many technological benefits. Due to its low moisture content which ranges from 4 to 6%, the HPMC is a perfect choice for moisture-sensitive drugs. Even after storage under harsh condition the capsules won't retain elevated moisture levels. Unlike gelatin, HPMC doesn't tend to form cross-linked bonds which results in high stability and well-defined dissolution profiles ^[15,16].

CONCLUSION:

The well known capsule manufacturer are thinking that now a day vegetable capsules give tough competition to gelatin capsules in market but it required some modification or improvement. These published literatures are from scientists affiliated for their own premises and companies and so there may have overemphasized the potential of HPMC capsules over gelatin one. Two important areas where improvements have to be achieved in order to qualify the HPMC capsules ahead of gelatin capsules are in their machineability and in the *in vitro* and *in vivo* disintegration/dissolution performances. The main area where HPMC capsules can have better prospect compared to gelatin capsules.

This review article has provided the details of various polymers from vegetarian sources that can act as a possible replacement for gelatin in the preparation of soft gel capsule films. These polymers can overcome the demerits associated with the gelatin like the spread of bovine spongiform encephalopathy (BSE, Mad Cow disease) and not being preferred by the people belonging to certain religious groups or those who have dietary restrictions.

ACKNOWLEDGEMENT:

The author wish to thanks Jeypore College of Pharmacy for providing library facility to carry out this review study.

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Conflict of Interest: None

Source of Funding: Nil

Paper Citation: Simanchal, *et al.* A review on Vegetarian Capsules. J Pharm Adv Res, 2018; 1(1): 1-5.