Review Article

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A Vegetarian Capsule: A Review

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ABSTRACT

Many of us knowingly or unknowingly consume non-veg shiny shells derived from cows, pigs and other animals. Religious, cultural and personal issues may affect patients' preference towards the medications presented in capsule dosage forms. Two-piece capsules have been used for almost a century in the pharmaceutical field, and gelatin has been adopted as the main material of these capsules due to its excellent characteristic as a gelatinizer. The gelatin dissolves under high concentration into water of a high temperature and quickly gels in room temperature. The thickness of the film made by the gelatin becomes uniform. The crosslinking of gelatin and drug incompatibilities and the strict regulations regarding the use of animal derived gelatin requiring the absence of transmissible spongiform encephalopathy (TSE) have encouraged the search for gelatin replacement. The aim of this review is to resolve questions regarding the replacement of gelatin in manufacturing of capsules.

Key Words: Capsule**,** Gelatin, TSE, HPMC

INTRODUCTION

Whenever we are taking medicine orally - herbal or pharmacological drug - the choice goes with either coated tablets or capsules. Both media are useful for enhancing patient compliance. Both of them are well proven and well accepted form of dosage.

The capsules appear better as there is no need to add gum or other "inactive" substances as the binding agent. Some of the binding agents could be natural and others artificial that can burden our system further. There is no need for the preservatives and the shelf life of the product is also more comparatively. Some of the chemical coatings of the tablets can cause trouble to some sensitive patients. Capsules are easy-to-swallow, attractive, neutral in taste and free from inactive substances, so they gained popularity.

Most of us remain uninformed about the nature of ingredients that makes up the capsule. Can these attractively colored bright capsules cause some harm in our body? If we all know this before, the need for the vegetarian capsules might have been raised earlier.

The Sovereignty of Gelatin Capsule before Vegetarian Capsules

Previous to the advent of vegetarian capsules, there had been the sovereignty of the gelatin capsules in both the pharmaceutical and health and herbal supplements world. People knowingly or unknowingly had to use them. Even the strict vegetarians that associate vegetarianism with deep religious sentiments didn't raise their voice against using these 'non-veg' capsules as the vegetarian capsules were absent from the scene [1-3] .

What is Gelatin?

Gelatin is derived mostly from collagen by thermal denaturing with the aid of diluted acid or alkali. Gelatin contains a mixture of water-soluble proteins (84-90 percent), mineral salts (1-2 percent), and water (8-15 percent). These proteins contain a significant amount of the amino acids: glycine, proline, hydroxyproline, glutamic acid, alanine, arginine, aspartic acid, and lysine; in addition to other amino acids in smaller amounts.

There are two types of gelatins:

1. Type A: derived from pork skin by hydrolysis with an acid
2. Type B: derived from bones and animal skin by hydrolysis with an alkaline solution.

Gelatin is odorless, tasteless, colorless, and insoluble in most organic solvents, but soluble in glycerin, diluted acids and alkalis. Gelatin swells and absorbs room-temperature water, up to five to 10 times its weight. It dissolves in hot water, and forms a gel upon cooling.

The main source of gelatin is collagen, which is found in the skin and bones of animals such as deep-water fish. Most of the soft gel capsules on the market are made from an animal source, bovine or porcine. Gelatin is readily digested and absorbed so it is considered as good food stuff for children and convalescent persons.

The Use of Gelatin

- Cookery - As a in jellied soups, meats, salad and desserts.
- Home manufactured jams, jellies and preserves.
- The drying and preserving of fruits and meats.
- As a base in bakery and confectionary.
- Its permanent emulsifying property is useful to give final touch to ice-cream.
- The preparation of powdered milk and other powdered foods.
- As a culture media in Microbiological studies.
- As a coating agent in tablets, in preparing capsules, some surgical dressings.
- As a base in ointments, toothpaste etc.

- As an emulsifying agent in liquid preparations and sprays.
- In electrotyping, waterproofing, dyeing and slides coating industries.

So we see clearly seen that gelatin possess so important role in several important industries.

The Gelatin Capsules

The capsule is made from gelatin. The most important significance till date has been their long term safety in capsules as well as in other dietary products. Their shelf life is five years under proper packing. As gelatin is water soluble derivative of collagen, a connective tissue from animals, it gets readily dissolved in stomach. Within a few minutes the contents of the capsule are freed into stomach.

Gel caps of Soft gels

Gel caps are basically tablets that have a coating of gelatin. Some plasticizers are added to the thick gelatin layer to give it more flexibility and stability. Soft gels contain some liquid form of drug or medicine inside them.

Hard Gelatin Capsules

Some capsules that look hard are also made from gelatin. They have 86% bovine or pig skin and 14% purified water. Hard capsules are also made by following GMP or Good Manufacturing Practices guidelines. Pharmaceutical grade gelatin is processed by mixing and melting in precise machineries where all the processes from the beginning to packaging is done under control of quality experts.

Kosher Certification

Kosher stands for "right, fit or proper". It is in use to designate food with Jewish dietary regulations. Any manufacturer of food and health supplement can apply for premarket review by Kosher Council. Even after the approval of the product there are many random inspections to assure the quality. Kosher also ensures for the cross contamination of products. Kosher certification is regarded as equal or better to FDA. There are many manufacturers of gelatin capsules with kosher certification.

So now enough is covered for the important role of gelatin. To move further to vegetable capsules, we need to know how the gel caps have can cause potential trouble to our health. How the need for the vegetable capsules emerged? Then we will deal with the much adored vegetarian capsules. The vegetarian capsules are definitely a better option. At least the persons who relate vegetarianism with religious sentiments will thank God for vegetarian capsules [2-3].

TSE or Transmissible Spongiform Encephalopathies and Gelatin Capsules

CJD or Creutzfeldt-**Jakob Disease** belongs to a family of human and animal diseases known as the transmissible spongiform encephalopathies (TSEs). Spongiform refers to the characteristic appearance of infected brains, which become filled with holes until they resemble sponges under a microscope. CJD is the most common of the known human TSEs.

Creutzfeldt-Jakob disease (CJD) is a rare, degenerative, invariably fatal brain disorder. It affects about one person in every one million people per year worldwide; in the United States there are about 200 cases per year. CJD usually appears in later life and runs a rapid course. Typically, onset of symptoms occurs about age 60, and about 90 percent of patients die within 1 year.

In the early stages of disease, patients may have failing memory, behavioral changes, lack of coordination and visual disturbances. As the illness progresses, mental deterioration becomes pronounced and involuntary movements, blindness, weakness of extremities, and coma may occur.

As gelatin is derived from animals - cow and pigs - there had been great concern over about its susceptibility to pass the infection to men. There had been some research and studies that show some faint possibility of its being transmitted. So we have vegetarian capsules coming to horizon. Finally more in-depth studies are needed about gel caps. And the vegetarian capsules are 100% safe.

How Does The Vegetarian Capsules Come To Scene?

When we use the products derived from cows and other animals who suffer from TSE, we may be at the risk of having CJD or Creutzfeldt - Jakob disease. This danger motivated the people toward bringing the vegetarian capsules to the front scene. This all dither started when we violated the nature's principles. If cows and other animals, that are herbivorous or vegetarian by nature, are not given animal products in their diets, this trouble might haven't been there today. And this is another thread that we don't like to raise here. This trouble opened business opportunity for countries like India where cows are treated sacred and they are never on diet containing any animal product [4].

Vegetarian Capsules and Manufacturing Technology

Vegetarian Capsules Properly marketed would be a capsule that is manufactured from HPMC, or hydroxypropyl methylcellulose. The 1990s saw the first successful attempts to manufacture hard capsules from hypromellose. HPMC is vegetarian board certified, and also Kosher, and Halal acceptable. HPMC is 100% plant fiber and is derived from not only tree cellulose, but also from vegetable and plant fiber.

Figure 1: Image of HPMC Capsule

Vegetarian Capsules are made from Hydroxipropylmethyl-cellulose (HPMC). 92% of methyl cellulose with 8% of purified water is used to vvegetarian capsules. Hydroxipropylmethyl-cellulose is derived from woods and cotton fibers that might have kosher certificate for a year. HPMC comes under GRAS i.e. generally recognized As Safe by FDA. HPMC derived capsules can

meet all requirements of current USP and FCC (Food Chemical Codex).

There are several similarities and differences between HPMC Capsule and hard gelatin capsules. The basic requirements for a hard capsule polymer are: that the film has sufficient mechanical strength to withstand the mechanical handling involved in filling and packaging; that it is relatively inert and stable over the lifetime of the fill material; and that it releases its contents in a timely and reproducible fashion in a biological system. Both polymers have these properties. The differences between them are mainly related to the moisture content of the capsules and how this influences their physical properties.

Previously the attempts to prepare vegetarian capsules were not possible due to technological reasons - jamming of shells in high speed capsule-making machines, the brittle and fragile caps tended to rupture in the bottles etc. By applying the new breakthrough approach in manufacturing technology, it was discovered that cellulose could be used for this purpose. HPMC or Hydroxipropylmethyl-cellulose is the commonly found cellulose in plants and it has the flexibility and the strength to be turned into capsule.

The Cost of Vegetarian Capsules

The cost of vvegetarian capsules is slightly more - it is available at five times the cost of gelatin capsules. But that is still in the affordable range. Many of the Kosher and Non-kosher companies have been using vvegetarian capsules and giving people 100% vegetarian capsules. As people would be using more of the vegetable capsules, their cost would be further down.

Characteristics of HPMC Capsules

- Made from non-animal materials than Gelatin capsule.
- Lower water vapor permeability
- Low static electricity and light protected.
- No Millard reaction with fillings.
- Not substrate for protease.
- Chemical inactivity and solubility at room temperature.
- In these type of capsules powder, tablet, granules, pellets, liquids and semisolids are filled [5-7] .

The characteristics of vvegetarian capsules over gelatin capsules and tablets given in Table 1

Table 1 Characteristic of Vegetarian Capsules over Gelatin Capsules and Tablets

Vegetarian Capsules	**Gelatin Capsules**
100% vegetarian	Animal derived - cows, bovine product
HPMC or Hydroxipropylmethyl cellulose is used.	Gelatin is used
GRAS listed in FDA	GRAS listed in FDA
Kosher certified	Kosher certified
Suitable for cultural, religious and vegetarian dietary requirements	Not suitable for vegetarian requirements
Stability over wide range of temperature and humidity.	Not that much stable.
Perfect for hygroscopic preparations.	Not suitable.
Compatible with capsule filling machines, all sizes available.	Same compatibility
Doesn't support bacterial growth.	Under good storing conditions, it doesn't support bacterial growth.
Vegetarian Capsules	**Tablets**
Without Preservatives	Preservatives are to be added.
Ideal for hygroscopic preparations.	Not ideal.
Fast dissolving ensuring better bioavailability.	Delay in dissolving.
Free from irritants, inactive binders, colors.	They are to be added.

CONCLUSION

Religious, cultural and personal issues may affect patients' preference towards the medications presented in capsule dosage forms. The gelatin has been adopted as the main material of these capsules due to its excellent characteristic as a gelatinizer. As gelatin is derived from animals - cow and pigs, when we use such products which are derived from cows and other animals who suffer from TSE, we may be at the risk of having CJD or Creutzfeldt - Jakob disease. For such instances vegetarian capsules are definitely a better option.

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