

RECENT ADVANCES AND APPLICATION OF JACKFRUIT SEED STARCH AND ITS DERIVATIVES IN DRUG DELIVERY: A REVIEW

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ABSTRACT

Starch found in many green plants and they are naturally occurring polymers. It found in plant roots, stems, leaves, nuts, seeds, bulbs staple crops such as corn, rice, wheat, and potato. it widely used textile, adhesive, cosmetics, foods, and pharmaceutical industries. Artocarpus heterophyllus Lam is known as jackfruit which belongs to the family “Moraceae”. It is one of the largest tree – borne fruit in the world. Studies shown that the starch extracted from the seeds of jackfruit has lots of properties such as it used as a super disintegrate, drug carrier, used in the modified release dosage forms, it also used as a thickening agent in food industry.

KEYWORDS: jackfruit seed starch, modification, delivery.

INTRODUCTION

Starch found in many green plants and they are naturally occurring polymers.^[1] it found in plant roots, stems, leaves, nuts, seeds, bulbs staple crops such as corn, rice, wheat, and potato. it widely used textile, adhesive, cosmetics, foods, and pharmaceutical industries.^[2] it has non-irritant and nontoxic properties and also easy to modification Low production cost and versatility in use which makes starch a good polymers used as pharmaceutical excipient, in many conventional capsule and tablet starch used as a binder, lubricant, and diluents.^[3] The starch consists of two structural components, the amylose, which is basically a linear polymer in which glucose residues are -D-(1-4) joined typically constituting 15% to 20% of starch, and amylopectin, which is a more divided molecule with [↓]-D-(1-4) and -D-(1-6) linkages and is a main component of starch.^[4] Artocarpus heterophyllus Lam is known as jackfruit which belongs to the family “Moraceae”. It is one of the largest tree – borne fruit in the world the

weight of jackfruit ranges from 3kg. to 36kg.^[5] There are three main regions of the fruit, The true fruit, the fruit axis and the persistent perianth. presence of lactiferous cells it produces latex which help the fruit to hold together the core of the fruit and axis of the fruit which are inedible.^[6]

Jackfruit contains carbohydrates, vitamins, calcium, and starch protein^[7] Jackfruit cultivated in temperature region, subtropical, topical regions in the world.^[4] It need the moist soil which is well drained and ph. range of 4.3 to 8.0 and the optimum temperature 19 to 29 degree centigrade and the annual rain fall is between 1000 to 2400mm.^[8] It is cultured in Srilanka, Burma, Palau, pacific island, Bangladesh and Samoa. In India it is easily found in south eastern part such as Karnataka, Goa, Kerala, Maharashtra and Tamil Nadu.^[5] Jackfruit tree easy to grow as compare to other common Atrocious species. Jackfruit is also used in the preparation of jams, jellies, juice chips, deserts, baking.^[8] It had a big contribution into the food supply of people and their farms when there is shortage of food grains, therefore it is known as poor man's food. Jackfruit is a non-seasonal fruit.^[6]

TAXONOMICAL CLASSIFICATION OF JACKFRUIT^[9]

Family – Moraceae – mulberries Genus—Artocarpus—breadfruit

Species— Artocarpus heterophyllus lam. Order—Urticales

Kingdom- Plantae – planta, plants Subkingdom - Tracheobiophyta—vascular plant

Class – Magnoliopsida.

Ayurveda description^[9]

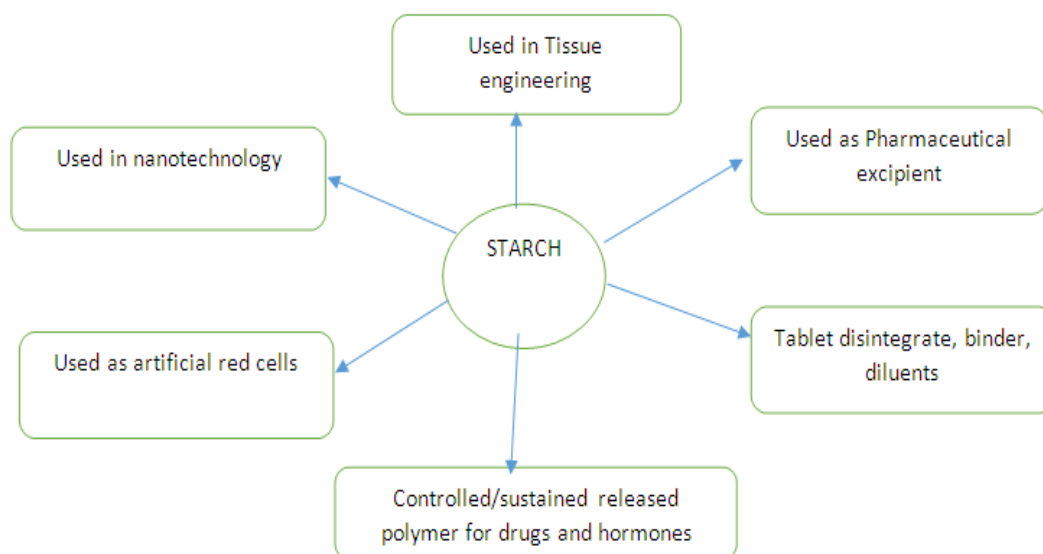
Sanskrit name – panasa synonyms; Atibrhataphala

Properties -- Rasa; Madura, Kaseya (Unripe fruit) vipaka: Madura

Virya: sita Guna: snigdha, guru, picchila,

Actions --- durjara, balaya, sukraprada, tarpana

Therapeutic uses – klibata, varna, durbalya, raktapitta.

Importance of starch^[10-16]**Uses of jackfruit seed starch**^[22-26]

- Used as a natural superdisintegrants.
- Used as raw material for bioplastics manufacturing.
- Used as colon drug delivery carrier.
- Used as thickener and stabilizer in chilli sauce.
- Used as coagulant aid for treatment of turbid water.

Modification technique of starch

There are lots of chemical modification techniques of starch are there to produce different functional characteristics. modifications are generally achieved by canonization, oxidation, esterification, crosslinking and grafting of starch. There are lots of new techniques are there these are achieved by different chemical treatment to produce new chemical modification techniques. the functional and chemical properties achieved following chemical modification are depend on the biological or botanical source of starch reaction conditions (P^H , reaction time, presence of catalyst), extent of substituent, type of substituent (degree of substituent or molar of substituent) and distribution of the substituent starch molecule.^[27]

1. CHEMICAL MODIFICATION

Chemical modification used for the introduction of function group in the starch molecule, marked in altered in physico-chemical properties. Such modification changes gelatinization, pasting and retro gradation behaviour of native granular starches.^[28]

The efficiency rate of modified starch depends upon the size and structure of granules, botanical origin of starch and reagent type.^[29] This is also involves the starch granules structure which encompasses outer and inner surfaces depending on the channel and pores.^[30]

Different types of chemical modification are.^[31]

Etherification & Esterification Cross linking

Acid treatment Oxidation

Dual modification

2. PHYSICAL MODIFICATION

Physical alteration generally used for the convert the native starch into cold water scratch or small crystallite starch and modify the granule structure of starch. The main techniques used in the preparation of cold water-soluble starches include rapid cooking–drying of starch suspensions on heated rolls (drum-drying), puffing, constant cooking–puffing–extruding, and spray-drying.^[32] Among the physical methods useful to starch alteration, high pressure treatment of starch is considered an example of ‘minimal processing.’^[33] A method of repeated syneresis applied to the alteration of potato, tapioca, corn and wheat starches caused in a new type of physically reviewed starches.^[34]

This type of modification is given more preference as these do not involve in chemical treatment that can be harmful for human health.^[35]

Different types of physical modification are:

Heat moisture treatment Annealing

Freezing Ultra-high pressure treatment

Osmotic pressure treatment Gelatinization

3. GENETIC MODIFICATION

These are a set of technique involve in transgenic technology which target the enzymes involved in starch bio synthesis thus having advantage over environmentally hazardous post-harvest enzymatic or chemical modifications.^[36] Genetic modifications can be done by through biotechnology or plant breeding techniques.^[37]

MODIFICATION OF JACKFRUIT SEED STARCH

1. CHEMICAL MODIFICATION

The extracted jackfruit seed starch was chemically modified by thiolation process. At first homogenous solution of starch was prepared by dissolving it in sufficient amount of distilled water under stirring. A mixture of sulphuric acid and thioglycolic acid with varying reaction parameter. After that sufficient amount of methanol was added to form white precipitate, the white precipitate was collected and washed thoroughly by methanol then dried in oven at room temperature. A white powder of thiolate starch was obtained.^[38]

2. OXIDATION

At first 40%(w/w) starch was taken and made slurry with distilled water in a reaction vessel equipped in a heating mental, the starch slurry was mechanically stirred and at room temperature and the pH is adjusted at 9.5 with 2 M NaOH. Sodium hypochlorite (NaOCl) with 1% active chlorine was slowly added into the starch slurry within 30 min while maintaining the pH at 9.5 with 1 M H₂SO₄ and a temperature of 35°C. After the addition of the NaOCl, the starch slurry was maintained at the same pH and temperature for an additional 50 min with stirring. The slurry was then neutralized to pH 7.0 with 1 M H₂SO₄, filtered through suction (What man filter #4), washed with deionized water, and dried in an oven at 40°C for 48 h.^[39]

Application of jackfruit seed starch in novel drug delivery

Recent studies has shown that jackfruit seed starch used as super disintegrates in novel drug delivery^[38], jackfruit seed starch is also used as a drug carries in colon targeted drug delivery.^[39] Jackfruit seed starch used in the preparation of alginate mucoadhesive beads.^[40] Jackfruit seed starch also used in the modified release dosage form preparations, i.e. Jackfruit seed starch used in control release preparation^[39] the jack fruit seed starch also have stabilizing properties. In food industry jackfruit seed starch use as a thickening agent.^[41]

Newer opportunity

Starch is an important pharmaceutical excipient due to its many properties. Recent studies has shown that jackfruit seed starch has also have good excipient properties as compare to other starches. Jackfruit seed starch has a good advantage over other starches due to its low production cost, and raw material need for the production of jackfruit seed starch is easily available. This makes jackfruit seed starch preferable for researchers and create newer opportunity to develop new properties of jackfruit seed starch.

CONCLUSION

This study investigated the recent advances of jackfruit seed starch in novel drug delivery and use of jackfruit seed starch as a drug carrier, beside this properties jackfruit seed starch can also be used as thickener and stabilizer in chilli sauce, Used as coagulant aid for treatment of turbid water, jackfruit seed starch also used as a raw material for bioplastic manufacturing. Most importantly the extraction of jackfruit seed starch is easy as compare to other starch extraction process.

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