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Significance of Papain Enzyme Extracted From Papaya

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Abstract

The immature papaya fruit is used to extract Papain (dried latex). Papain is an internal binding polysaccharide plant thiol enzyme which has great demand in international markets, particularly in UK and USA. In recent years present days papain have raised as a standard bio catalyser in the industry process,it is an essential ingredient in pharmaceutical, medicine(wound healing, digestive debriding, breaks down protein toxin in the form of venom),detergent manufacturing, food science, textile, tanning industries widely used around the world, it also has lot of benefits in human health and agricultural industry and wide use in food processing applications.This review addresses not only the new trend or latest advances in classic industry applications, such as protein hydro lysates and meat tenderization but also most innovative applications in different industries such as food (bread making,cheese production),animal feed (deworming cattle), sewage disposal, bioactive poly peptides production,baking industry and brewing industry (clarifying beer) among others. It is very muchimportant for future industrial investment, it can be utilized to address the issues in agricultural farms to accelerate production and reduce environmental hazards .Papain enzymeshows a decisive role in biological practice in pathological situations and in physiological practice, drug designs and also capable to break down ofproteins or peptides which are made of a chain amino acids.In addition to this papain enzyme is good thing characteristic of its kind for desired aim in industry application or processing that extend over entire series of biocatalysts chain which is required for industry execution.This bio catalyticcycle related to enzyme includes action of making or manufacturing and especially using effort in extracting papain involved in action (biological source), functional, immobilization, structural characterization and at last in industry processing. This paper enumerates entirenew trend classification orbio catalytic cycle of papain. Papain enzyme is clearly a case of industry and commercial success over last 40 years. The key to success has been continual biotechnologically and increasing processing innovative techniques or applications, which has been opened to a new trend changes in development use of papainandrange of its possibilities for the exciting bio catalyser.

Keywords: Papain, Biocatalyst, Medicinal, Pharmaceutical, Industrial Processing, Extraction.

Introduction

Carica papaya belongs to caricaceafamily it is commonly known as papaya in English, papita in Hindi and erandakarkati, in Sanskrit and it is native to tropical America and it was introduced in 16^{th} century. The major applications of papain are used in the food industry,meat tenderization, beer clarification, and others like human health, Agriculture industry, biotechnologically, pharmaceuticals and drug design(Thomas, 1995). Latex containing papain obtained from*Carica papaya* has been extensively studied (Brocklehurst et al., 1981 and Mellor et al.,1993) and it is used in industries and is having research ability.

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Enzymes acts as biological catalyst that increase and decrease the rate of reactions activation energy. It is not consumed itself as an enzyme activity, it is first named in the nineteenth century, as a partially purified product obtained from sap of papaya. When named it simply recognized as proteolytic active constituent in latex of tropical papaya fruit.The precursors and inhibitors of papain were studied in 1990s. In this finding it has been concluded that papaya leaves containpapain enzyme (Bekhit et al 2014). This plant leads iswell known by its weak and usually unbranched soft stem yielding copious white latex and crowded by terminal cluster of large and long stalked leaves, it is rapidly growing up to 20m tall. Papain is proteolytic enzyme from cysteine protease family. The biological and economic product of enzyme is usually perform on cysteine ,thiolprotease enzyme being active on a wide ranging of bioactive compounds and processing applications .This arousing characters of papain give necessary time to it, to lead the peptides,greater quantities of specified source, thiol enzyme, as well as fungal source cysteine enzymes (MarketResearch future, 2017&GlobalMeat Tenderizing AgentMarket Research Report-Forest2023). Major producers of enzyme papain includeSrilanka, India, Democratic Republic of Zaire, Uganda, Brazil.

This enzyme core branches are enzyme technology that makes different industrial procedures convenient,economical and simple. This enzyme the product of technology has wide applications in chemical and food industries. Unripe papayas are the principal source of papain enzyme.Recently it has been reported (Kinoshita, 2003) that Papain is a major bio chemical compound extracted from latex of papaya used in several industries for various industrial and pharmaceutical products. Papaya is a rich in vitamins C,E and antioxidants like phytonutrients, flavonoids and foliate.Moreover, it consists of a hydrolytic enzyme that is successful in treating of physical injury, allergy and athletic injury. Consists of many vitamins, proteins,phyto-nutrients in *Carica papaya* it protects against from heart stroke. Papaya is source of hydrolytes and Vitamin A thus the free radicals cause no damage. This review helps in the curing diabetes, cancer, and heart stroke.Carica reducescholesterol level in the body. It also represents papain is industry success a pattern or model (paradigm) in a Biochemical catalyst, where entire steps which are important and required for the industryplan or process implementing of any of the proteinswhich are successful in producing a desired one (Anuar,et al 2008). This surveymakes available for use ofa complete clear description of each step, including different purification and isolation features from natural,genetic recombinant resources, genetic modifications, operational conditions to improve enzyme immobilization, and its functional characteristics in industry properties (Evans et al 1997). It enumerates the present developmental changes or development of uses of enzyme in dairy industry, synthesis of amino acids, (application in sports medicine), meat tenderization, biological compounds, peptides, food allergies removal, breadbaking – brewing industry, deworming of cattle and among many other fields. At last, some industrial properties on usesor applications of latex enzyme have not focused seriously in applications of the brewing and food industrial, but they enormouslyshow the existence of proteins as antimicrobial food packaging,medical approaches which used in tooth- whitening additive in tooth pastes or acts as removal agent.

World Trade in Papain

The principal producers or country that makes, or supplies goods of crude papain enzyme are Democratic Republic(government operating on principles adopted from a republic and democracy) of Congo (formerly Zaire), Uganda, Tanzania and Sri Lanka. Most spray- dried papain comes from DRC.Main importers are USA, Japan, United Kingdom, Belgium and France. USA has the best quality papain in terms of quality. Britain has the papain in crude

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form used in the brewery industry (Mahajan and Chaudhari, 2014). An increase in free bears which are additive is increasing-has been started European countries- is affecting in Britain, whose market for papain is therefore declining. Papain is, however, used in the tenderizing of meat and in production of meat tenderising powders(Dietrich, 1965).

Papain Trade in India

India manufactures concentrated ultra-refined spray dried papain enzyme powder in various strengths 400 TU/mg, 1000 TU/mg and 200 TU/mg. Our ultra-refined powder of papain enzyme is produced by tapping the latex from theimmature fruit of *Caricapapaya.*The latex under goes various steps of filtration, microfiltration, ultrafiltration and polishing filtration. It is finally spray dried into a free-flowing white colour powder. And also manufacture liquid papain enzyme of 200,400 and 600 TU/MG strengths. Papain enzyme is mainly used for the following applications like baking, brewery, protein hydrolysis, pharmaceuticals(Available in IP and USP grade).

Extraction process of papain from papaya

Papaya fruits, which are about 90-100 days old (fully mature but not ripe) are selected for tapping. In the morning, hours before 10:00 a.m. four longitudinal incisions are given on the four sides of the selected part containing stalk to the tip portion.Depth of the incision should be about 0.3 cm deep, more than four cuts it should not be done per fruit at equal distance they are done about three to four interval period five tapping have done. Vitreous instruments mostly used in making incisions and also for collection of latex, milky latex acts upon metals and gets discoloured (Milind and Gurditta,2011). An ivory blade with a sharp edge along with piece of bamboo stick may be used. The latex is scraped out from the tray and dried in the sun(Irulappan and Rao, 1980). Extraction of latex is done in 8am- before 12 noon time to avoid precooling and sun drying done before mid-day this shows proper drying of latex after drying it looks solid form, then it is grinded in the form of powder and it should be placed in air- tight bottles or poly bags. Papain can be also dried artificially at temperature of 50 to 55^0 c which will attain better colour and quality (Reddy et al 2012). Potassium meta-bisulphate (KMS) about 0.5% may be added to it for better colour and keeping quality. The papain production is influenced by certain factors such as fruit size, fruit maturity, and varietal factor. The biochemical analysis of fruits revealed that latex extraction has no effect on quality of fruits.

Production

Papain is obtainedfrom immature unripe fruit of papaya which is herb and aplant which is succulent found in tropical it retains it self-sustaining stems whichalso grows in many regions of subtropical area in world (Jaime and Cotty, 2007).There is no any limitation because of availability of pawpaw fruitsall around the year. Papain manufacturefrom papaya has yielded about papain production of 686.29 g per plant and 8.17 g per fruit in six months duration (Kamalet al 2007).

This usually produced as a crude, dried material by collecting the latex from the fruit of the papaya tree. Thelatex is collected after scoring the neck of the fruit, where it may either dry on the fruit or drip into a container. This latex is then further dried. It is now classified as a crude material or dried papain. A purification step is necessary to avoidloss of enzyme activity and to remove contaminating substances.This purification consists of the solubilisation and extraction of the papain enzyme system through a government-registered

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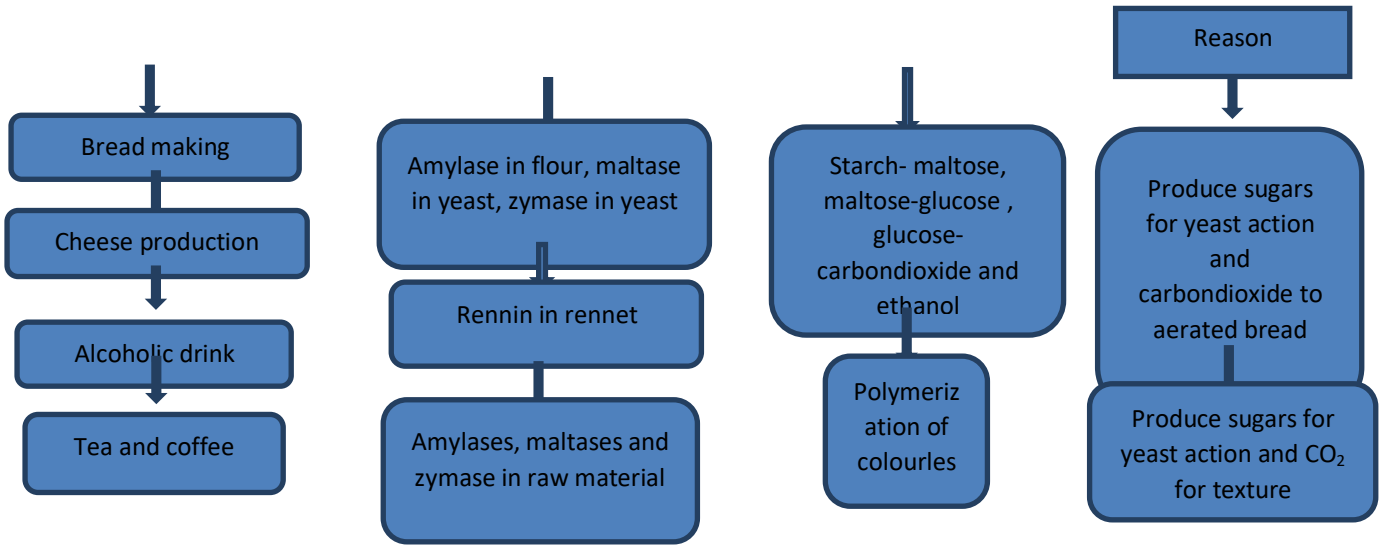
process.This purified papain may be supplied as powder or as liquid (Chaudhari, 1996). Papain could be used inindustries processing and applications such as in brewery making, tanning, detergents, and fishery, other a variety of processes. Papain isin demand for export and major prospect for papain markets, the papain extraction can be considered for income of small farmers.



Importance of enzyme in Medicinal uses

This enzyme works as a broken or torn pieces (debris)-remover agent and it has no any harmful effect of soundon tissues and due to enzyme active and specificity working on the tissues (Flindt, 1979). Process ofelimination of biochemicaltakes the split orcleavage of amino acids.Papain based gel was reported as useful potential in chemical processes and substances which are excavated for dentin process(Piva et al2008). Enzyme (crudePapain) have been found good in chemo-mechanical dentine carries evacuation because papainwill not react or act in the materials strengthin dentin relatively(Lopes et al 2007).

This crude papainis helpful in treating other causes of cancer, trauma,injuries and allergies occurred in sports play(Dietrich, 1965). It has been proven to track the record in all these conditions which is managing with significant advantages in clinical evidence and also the protease thiol enzyme use in sportinjury issues.It has reported previously injuries which are minor can be cured faster or healed with papain proteases. Athletes who use papain protease supplements are also capable of reducing time recovery from 3.9 to 8.4 days (Trickett, 1964 and Dietrich, 1965).It is successfully very much used in inadequate stomach acid to tackle sport injuries and allergies which are occurred due to leaky gut. Papain has previously reported as to reduce inflammation activity against the symptoms of (cold causing viral infection) called acute rhino sinusitis allergies such as headache without any side effects It is found to be beneficial for use in curing many ailments. (Mansfield, 1985).

Papain uses in Drug Design

In large amount it shares of many genetically related aspects of great significancemammalianthiol enzymes breakdown of peptides and protein(proteases) and shows almost similar identical folding motion/patterns especially

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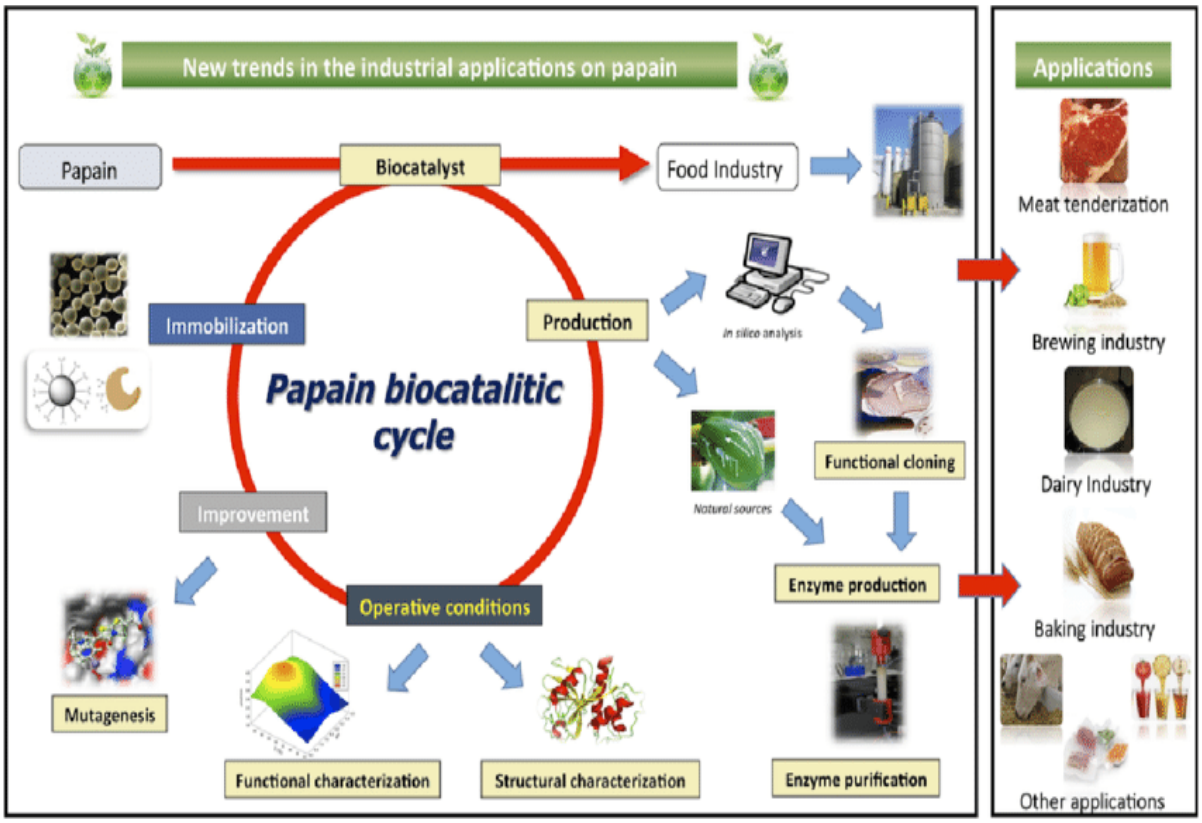
used in rational design (Meara and Rich, 1996). Itis also formally reported as very muchuseful as a xenograft modelstructure to understand mechanisms of newly developed specific substance which slows down the activity of particular enzyme or catalyst. Superfamily of papain has oxidation inhibiting properties that can be very much useful in preventing certain type of health illness(Tsuge et al 1999 Gayosso-Garcia et al 2010). It is also have been formallyreported to be used indrug design as surrogate enzyme to obtain influence/ effect and relating to oxidation inhibition of cathepsin K, a member superfamilyof papain thiol proteases that is selectively and high expressesin a large multinucleate bone cell called osteoclasts and is implicated in bone resorption. Papain (Thomas, 1956) proposed that parental administration of a plant enzyme, papain, causes a reversible softening of cartilage of rabbits without any other apparent adverse effect. Dreyer and Cleaton- Jones (1969) reported similar findings in their work on rabbits and rats. Further, they studied on local effects of papain indicated that softening of cartilage after local injection, starts within a few hours and it reach its maximum effect within 24 hours; and there after the affected cartilage becomes to normal condition. They suggested that inactivated crystalline papain can be used in the early treatment of bilateral cleft palates if the resistance of the vomer can be overcome. The injection of a proteolytic enzyme, papain, into the nasal septum. This softens its cartilage which combined with pressure and surgery, allows easier repositioning and a better premaxillary relationship with adjacent structures. The nature of the movement obtained result in a good profile with minimal downward rotation. The satisfactory appearance of the patient fifteen months after the initial papain and pressure therapy and subsequent surgical repair of the lip.



Industrial Uses and its Applications and Pharmaceutical Preparations: Papain is used as meat tenderizer, with proteins and connective tissue proteins being the main

proteins responsible for tenderness. It has been widely used in the processing of meat (Khann and Panda, 2007). Papain functions as pharmaceutical products in the proteolytic cysteine enz yme dependent and act as a drug that reduces inflammation properties (anti-inflammatory) (ChukwuemekeAnthoni,2010).It also plays a major role in tendering processing in the food industry.Papain is used as a protein digester in digestive disorders,stomach and intestinal disorders(Huet et al., 2006).Papain has been long time to be used in food production applications and in pharmaceutical preparation and also used inhigh-quality production and other local sweets, pastries, pizza (Abu-Alruz et al 2009).

Conclusion

The papaya fruit is a potential alternative for papain extraction. The latex for unripe fruits contains a high activity enzyme. It is found to be useful in many pharmaceutical properties. Papain has revealed that it is economically important enzymatic protein for its medicinal use, widely used protease worldwide in the industry.Papain enzyme remains a very important and plays a crucial role as a applicant in animal, clarifying beer and milk sector, whereto be made better the challenges andprocessing properties of crude latex enzyme. Also, its supplying size is to be reduced. In respect certain style or trends in market or industry, to the greatest extent of vigorous challenges who are focused on bioactive peptides process of being so developed and designed to be so practically infoods that may haveallergenic, antioxidants property.

As advanced, further great achievementsare required in designed to create a fictional character of relating enzyme, in addition of a production of newlydeveloped gene altered varieties of enzyme papain consists of highly better possessions. In general way, from the protein engineering, bioinformatics modelling, it is a simulation method for analysing physical movements of atoms and molecules and heredity modification which ismore crucial in comprising to become better and has a sustained level of activity in economy stability of the crude latex.

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