STARCH SYNTHESIS STUDY FOR FURTHER IMPROVEMENT OF CASSAVA VARIETIES

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We have learned from our science class that in the process of photo synthesis of plants, cabondioxide and water are used in producing glucose and oxygen while chloroohyl is functioning to absorb the sunlight puring the process. As a consequence, during the daytime when being in the shade of a tree, we feel fresh from oxygen made from the photo synthesis. In the meantime , the glucose yielded from the synthesis is processed to be combined together to create starch that is bio-substance with large and highly complicated molecules. The process of creating starch from glucose is called Polymer .During the daytime, the starch created from the photo synthesis is temporarily stored at night into glucose which is carried to the tissue specially functioning starch storage of a plant. For examples, cassava stores the starch in a root while wheat, corn and rice store the starch in a grain. Besides, some plants like sago palms store the starch in a trunk.

With the advanced technology, we know that starch consists of two kinds of polymer, namely Amylose, a long and straight characterized polymer, and Amylopectin, a polymer with offshoot character. In general , the naturally-made starch contains 20-30% Amylose and 70-80% Amylopectin. Give the different ratio of element, the starch produced by different species of plants possesses different properties both in physical and chemical aspects. As a result, different kinds of starch are brought into use for different purposes in accordance with its appropriateness. For instance, the starch with highly-contained Amylose is properly used as raw materials for the production of degradable plastic or in paper industry. On the other hand, the starch with high content of Amylopectin is capably used as a substance increasing constancy and stickiness of food.

Having know the chemical structure of the starch, scientists need to know the mechanisms of glucose combination process which creat Amylose and Amylopectin, and the sequencing of these polymers in producing the starch that is stored in different parts of plants. Based on biochemistry, the starch synthesis process of plants consists of the following four main stages, each of which requires enzymes to force the chemical reaction:

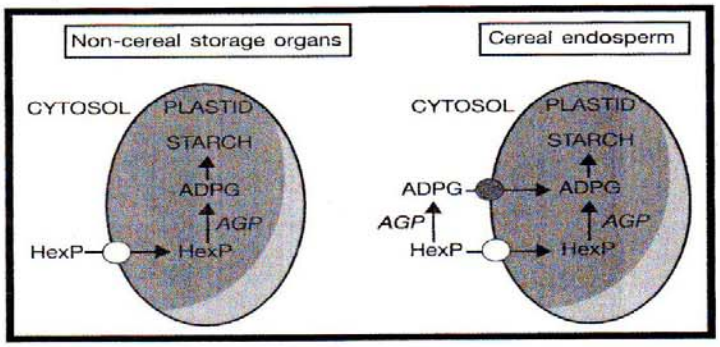
Stage I: the process changing glucose into the proper form to be used as a substance in starch synthesis dependent on ADP-glucosepyrophosphorylase enzyme.

Stage II: Molecule combination of glucose by Starch Synthase enzyme to create the glucose with long characterized molecules.

Stage III: Combination of created glucose to extend offshoot molecules by Starchbranching enzyme.

Final stage: Creation of glucose to be more complicated molecules by Stachdebranching enzme that helps force the reaction of the process.

It can be seen that the starch synthesis is complicated and incomprehensible process of biochemistry. However, over the past decade, the advanced technology contributes to rapidly raise more knowledge and understanding of starch synthesis process. Presently, most studies have focused on the starch synthesis of some plants like rice, corn, wheat and potato. Although the preliminary information on starch synthesis of cassava can be found from the study of other plants, the detailed information on the starch synthesis differences of the randomed plants for the study. For examples, the starch synthesis process of the plants storing the starch in a root like cassava is different from that of the plants storing the starch in a seed or trunk. This is shown in the picture below.



It can be seen that cereal crops contain ADP-glucosepyrophosphorylase enzyme in cytoplasm and plastid while in other plants, this kind of enzyme is found only in the plastid. This enzyme functions as rate-limiting to control the starch synthesis process. Therefore, the enzyme in cytoplasm is quite important for controlling the cereal crops to capably use glucose for producing the starch more efficiently than non-cereal crops. Moreover, the starch yielded from different kinds of plants possesses different properties due to differences in the internal process of starch synthesis of each plants.

Knowing the natural secret of starch synthesis, scientists feel more interested in learning what can be developed from this process. One way to optimize the use of information and knowledge is to develop and improve plant breeding to yield a breed with good properties in producing starch as to the requirement. Up to the present, Thailand has continually promoted the cassava breeding development by conventional breeding, aiming to yield the cassava with great quantity of starch and appropriateness for cultivation in climatic conditions of Thailand. However, due to the rapid expansion of cassava requirement, the cassava breeding has presently been conducted to improve the starch quality that is most required in the starch industry.

According to the preliminary studies by researchers from many universities namely Chulalongkorn, Mahidol, Kasetsart, Ramkamhang, and In starch synthesis of plants, the chemical reaction requires the force by all four types of enzymes earlier mentioned. These enzymes are also classified into various species of Isoform with the functions still clearly unknown. Based on the primary assumption, the four enzymes and Isoform of different species found in cassava could have different function from those found in ther plants and so are the quantity of enzymes in different breed cassava. Consequently, the quantity and quality of tapioca starch made of Thai cassava is different. The molecule biotechnology is a more advantageous option for the study on starch synthesis concerning genetic process as it prevents the complexities of experimental interpreting which results from the action of other uninteresting genes. In addition, the genes originating the enzymes and Isoform is good explanation of Isoform functions. Apart from the molecule biotechnology, Bioinformatics is also used as a tool for the study on the starch synthesis with the references of the study Genome quantity in Arabidopsis.

It can be seen that the use of biotechnology and the cassava breeding development by conventional breeding enables Thailand to produce tapioca starch to meet the requirement of various consumers, which will benefit the increasing value of agricultural products and economic status of Thailand.

Source : Year Book 2005. Thai Tapioca Starch Association.