



## Starch chemistry and research & development

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My first experience with starch chemistry was at the age of 19, after my father died: I applied the enzymatic saccharification method, which my father had invented in his later life, to produce glucose for the first time in the industry. In those days, I became increasingly interested in starch while consulting my mentors such as Dr. Nikuni, Dr. Fukumoto and Dr. Ueda for their insights into starch. I realized the necessity of earnestly studying and learning for the first time in my life. So I read a lot of books uncharacteristically and seized opportunities to gain knowledge directly from corporate engineers as well as the above-mentioned mentors. At that time, starch chemistry was not receiving much attention and there were not many researchers in the field. Since then, the number of starch researchers has further declined, and there are now very few researchers working in this field. The number of companies conducting basic research in this field has also decreased to the extent that ours is the only company remaining. This is because most researchers prefer to get involved in the field of protein, with few daring to enter the field of starch. There have been only a handful of starch researchers in the world. Dr. Nikuni was one of the top three back then.

Roy L. Whistler was another one among the top three researchers. As laboratory director at Corn Products Company in the U.S., he got involved in both basic research and applied research. The American company employed hundreds of researchers and was the world's largest and second to none in the industry at that time. This company seems to have spent a lot of time and money on developing coating films in partnership with the United States Department of Agriculture (USDA), having anticipated that such films would be able to prevent frozen foods from transubstantiating, and thereby would become indispensable, especially to a country as vast as the U.S.

I turned to this field at the age of 19 without any background knowledge and learned a lot of things from Dr. Nikuni. For example, I have got to know that as much as 70% of starch has either linearly-linked glucose or branch-shaped glucose. I was told "if we could cut only each base of these branches, the starch would be transformed into linear starch called '100% amylose' at once." As a fearless amateur, I thought that we could produce not only amylose but also numerous new materials only if we succeeded in finding any microbe which would secrete the dedicated branch cutter enzyme. In the following month, I asked Dr. Nikuni to start searching for such a microbe or bacteria. We were lucky enough to find one kind suddenly from the soil under a persimmon tree in the garden of our laboratory. Furthermore, our finding was suitable for industrial use even at this stage. So we were excep-

tionally lucky.

As a result, our company succeeded in the mass production of amylose. In contrast, the American company failed to produce such a product beyond a purity of 85%, as they had tried to achieve their goal through improvements in corn varieties. Thus, our company won the day in this area. Several months later, they stopped their research completely for unknown reasons and eventually closed their laboratory as well.

Since then, our company has been exclusively focusing on starch-related research to this day. For this purpose, we have changed our R&D approach as follows:

- (1) The president is responsible for results, while researchers are responsible only for technologies. (This division of responsibility is effective especially in Japan where researchers typically have no experience in marketing and/or manufacturing.)
- (2) Themes are not emphasized in basic research. Instead, we make sure not to miss any by-products which could be yielded in the course of our research. (Even now, most of our main products come from by-products.)
- (3) The following policy of Dr. Yasuichi Nagano, who discovered interferon, has been inherited: "Don't give up easily once you have started."

When researchers are required to specify their themes especially in the area of basic research, such requirement becomes a big burden and is most likely to result in failure. Therefore, the above change in approach enables both researchers and employers to reduce their burden.

In addition, if you have various by-products on hand, you can always select and present one that suits any particular purpose when necessary. This ensures a continuous flow of new products.

When considering basic research from the above point of view, small- and middle-sized businesses such as our company, under the same president, seem to be able to work on even 10- to 20-year projects which large companies can't afford to take on. In sharp contrast, it is difficult for large companies to conduct research with a long-term vision due to the importance of shareholders, in spite of their abundant financial resources and talents. This is where the possibility of coexistence between small/middle companies and large companies emerges. At the expense of such coexistence, we small/middle companies would be wise not to step into manufacturing and sales in a big way, if possible.