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Studies on Physicochemical Properties of Various Starch Granules

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1. Developmental changes in starch properties of 9 plant species. Developmental changes in starch properties of 9 plant species (taro, Chinese yam, arrowhead, kiwi fruit, potato, squash, chestnut, Chinese radish and ginkgo nuts) were examined. By Scanning Electron Microscopy, the particle size of starch granules of the nine plant species were found to increase during the early developmental stage. The amylose contents of starch granules of the nine plant species tended to increase during the early developmental stage. X-ray diffractograms of starches could be divided into those showing pattern changes (taro, Chinese yam, chestnuts and ginkgo nuts), A-type pattern (arrowhead) and B-type pattern (kiwi fruit, Chinese radish, potato and squash) throughout development. The initiation temperature for gelatinization of taro, Chinese yam, arrowhead, Chinese radish and chestnut starches tended to be lower in the later stage of development than in the earlier stages. The initiation temperature for gelatinization of kiwi fruit, ginkgo nuts, potato and squash rarely changed throughout development. 2. Some properties of various starch granules. The mean particle size of konjac, taro, takenokoimo and bamboo shoot starch was 1.2-1.3, 1.4, 2 and 3.7 μm, respectively, being very small. The susceptibility of their starch granules to hog pancreatin was very high. The amylose contents of takenokoimo and taro starches as determined by the enzyme-chromatographic method were 10.8 and 13.5%, respectively, being very small. In contrast, the amylose contents of saffron, arrowhead and azuki bean starches were 29.2, 29.2 and 30.4%, respectively, being very large. The initiation temperature for gelatinization of katakuri and takenokoimo starches by photopastegraphy and differential scanning calorimetry were 44, 46.8°C and 73, 76°C, respectively. The former was the lowest, and the latter was highest. 3. Observation of various starch granules by Scanning Electron Microscope (SEM) and field emission scanning electron microscope (FE-SEM). On SEM starch granules in the slices of konjac bulbs (Zairai, Akagi and Haruna) were found to be polygonal in shape. In particular, the small polygonal granules in

slices of Zairai were assembled like a soccer ball. The appearance on the surface of sotetsu trunk starch granules attacked by pancreatin was quite similar to that of normal maize starch granules. By FE-SEM observation, a string with the width of 20 nm was found on the surface of taro starch granules. 4. Gelatinization and swelling of starch as seen on imaging. Under a polarized-light microscope, the appearance of gelatinization and swelling of katakuri and potato starch and starch granules in slices of azuki bean cut by microtome was recorded with a video camera; then the video was edited to a speed 9-12 time faster to demonstrate the progression of changes in the image.

Key words: Scanning Electron Micrograph, average granular size, amylose content