RADIOCHEMISTRY

Physical and Chromatographical Observations of γ-Irradiated Potato Starch Granules

THE changes produced in potato starch by the action of ionizing radiation is of considerable importance and have been the subject of many investigations in recent years[1-4]. Physical changes induced in air-dried starch granules by γ-irradiation indicated that hydrolytic degradation had been occurring. Therefore, small molecular fission products of an irradiated specimen of potato starch were analysed by several chromatographical methods.

Air-dried potato starch granules containing 18·5 per cent moisture were irradiated from a source of 1,400 c. cobalt-60 giving total doses of 10^5–10^8r. at a rate of $2{\cdot}5 \times 10^5$r./hr.

As a result, intrinsic viscosity, viscoelasticity measured by a V.I. viscometer, and blue value of the starch specimens decreased, while reducing power, alkali lability number, carboxyl value, carbonyl number and susceptibility by β-amylase of the specimens increased corresponding to radiation doses. X-ray diffraction diagram showed that the crystalline part of the potato starch is damaged by doses up to $1{\cdot}5 \times 10^7$r.

From an 80 per cent ethanol extract of the irradiated starch specimen, D-glucose, maltose a pentose D-glucuronic acid, D-gluconic acid, and a series of small dextrins were detected by paper chromatographic analysis.

A quantitative separation of sugars from an alcoholic extract of 6×10^7r. γ-irradiated potato starch grunules, was carried out by the elution of their borate complexes from strong-base anion

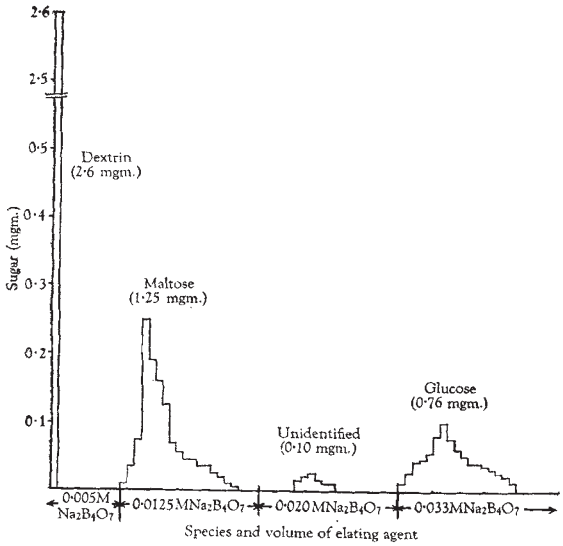

Fig. 1. Separation of glucose and maltose from γ-irradiated starch granules (1·8 gm.). Total dose, 6×10^7r., exchanger 0·6 cm.$^2 \times 6$ cm. Strong-base anion resin ('Dorvox-1-8X'). c.300 mesh, borate form. Eluting agent borate solutions. Flow-rate, 1 ml./min.

exchangers with boric-borate solution[5-7]. D-glucose and maltose were separated readily from other sugars and measured by the anthron method[8]. The results were shown in Fig. 1. Gases formed during γ-irradiation were analysed using gas chromatography by nitrogen elution from an absorption column packed with silica gel, and hydrogen, carbon monoxide and carbon dioxide were identified.

Thus it is assumed that ether bonds of the starch molecule are split into corresponding radicals, then these are combined with H and OH radicals of crystallization or the starch molecule itself forming mono- and oligo-saccharides. Sugar acids and a pentose might be formed secondary from D-glucose.

AKIRA MISHINA
ZIRO NIKUNI
Institute of Scientific and Industrial Research,
University of Osaka.

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BIOCHEMISTRY

Pantothenic Acid Deficiency and Ubiquinone Levels in Rat Liver Mitochondria

A NEW group of naturally occurring homologous quinones referred to as ubiquinone or coenzyme *Q* (Q_{275}) has been recognized in recent years[1]. Structural studies have led to the characterization of these compounds as derivatives of 2, 3,-dimethoxy, 5-methyl benzoquinone, substituted at position 6 with a polyisoprenoid side-chain[1,2]. Homologues with 6–10 side-chain isoprenoid units have been identified in animal and plant tissues and in micro-organisms[3]. While much interest has centred around its biological functions, little work has been done on the biosynthesis of ubiquinone. The incorporation of mevalonic acid into the isoprenoid chain has been recently reported[4]. The known participation of coenzyme *A* and acetate in the biosynthesis of mevalonic acid prompted a study of the possible relationship of dietary pantothenic acid to tissue-levels of ubiquinone.

Weanling rats (40–50 gm.), Wistar strain, were divided into two groups of six each, one receiving the basal diet consisting of an 18 per cent purified casein ration deficient in pantothenic acid and replete in all other vitamins and the other receiving the same diet supplemented with calcium pantothenate at a level of 20 mgm./kgm. diet[5]. The animals were killed at end of 10 weeks, by which period those on the basal diet showed typical symptoms of pantothenic acid deficiency. Livers were excised, chilled in cracked ice and a 20 per cent homogenate prepared in ice-cold isotonic (0·25 *M*) sucrose; an aliquot was used for centrifugal fractionation of mitochondria[6].

The unsaponifiable lipids from mitochondria were extracted with ether, chromatographed on Brockmann grade alumina and ubiquinone determined in the appropriate fraction spectrophotometrically by measurement of the characteristic absorption at 272 mμ in the oxidized and reduced states[4]. Coenzyme *A* was assayed by acetylating ability using pigeon liver enzyme (cf. ref. 5). Pantothenic acid was determined microbiologically using *Lactobacillus arabinosus*[8]. Vitamin B_{12} was assayed with *Euglena gracilis*[9] after liberation by overnight incubation with papain under toluene. Succinoxidase activity was followed manometrically in the Warburg apparatus.

It will be seen from Table 1 that rats on the basal diet have decreased hepatic stores of total pantothenic acid and of coenzyme *A* (cf. ref. 5). Pantothenic acid deficiency results in a marked fall in the concentration