

Chemical Research Laboratories,
Research and Development Division,
Takeda Chemical Industries, Ltd.
Juso, Higashiyodogawa-ku, Osaka

MASAHIKO FUJINO
OSAMU NISHIMURA
CHITOSHI HATANAKA

Received March 19, 1970

[Chem. Pharm. Bull.]
18(6)1293-1294(1970)

UDC 547.552.1.04.09 : 547.457.1.04.09 : 547.457.2.04.09

Formation of New Crystallizable Pigments from D-Glucose or D-Fructose and *p*-Toluidine

It was reported by Kato¹⁾ that melanoidins was formed through D-glucosone and 3-deoxy-D-glucosone derived from D-glucose in the presence of amine or amino acid. But the structure of colored materials, melanoidins, remained unknown as it was. The present paper describes the formation of some new crystallizable pigments in amino-carbonyl reaction of D-glucose or D-fructose and *p*-toluidine.

In our model system of amino-carbonyl reaction in ethanol used D-glucose or D-fructose and *p*-toluidine, a cleavage of C₂—C₃ bond in sugars was occurred and by the reaction of C₁—C₂ fragment formed by this cleavage with *p*-toluidine, some pigments colored reddish brown or violet were isolated as pure crystals.

When N-*p*-tolyl-D-glucosylamine (GPT) prepared from D-glucose and *p*-toluidine was allowed to stand in ethanol solution containing *p*-toluidine at room temperature, a free radical assumed to be F₁ formed and then autoxidative cleavage of glucose C-bond was occurred.

From the reddish brown solution, three pigments were isolated in addition to the next decomposed products, N,N'-di-*p*-tolylformamidide, N,N'-di-*p*-tolylloxalamide, N,N'-di-*p*-tolylurea, N-*p*-tolyl-D-arabonamide, D-erythronic acid, D-glyceric acid, glycolic acid and non-crystallizable melanodins.²⁾

They were 5-methyl-2,3-di-*p*-tolylimino-indoline (I), reddish brown needles, mp 206—207°, 5,5'-dimethylindirubin (II), light violet needles, mp >300° and 5,5'-dimethyl-3-deoxy-3-*p*-tolylimino-indirubin (III), dark violet needles, mp 256—258°.

Under the similar condition, N-*p*-tolyl-D-fructosylamine (FPT) prepared from D-fructose and *p*-toluidine was cleaved to the same decomposition products as GPT and moreover, an another pigment IV was obtained, which was 5,5'-dimethyl-2-deoxy-2-*p*-tolylimino-isoidigo, reddish orange prisms, mp 276—278°.

The structure of these pigments were identified by comparison with authentic specimens derived from 5-methylisatin (V).³⁾

II was obtained by reduction⁴⁾ of V with LiAlH₄ and condensation of II with *p*-toluidine gave III. The reaction of V with diphenyldiazomethane produced 5-methyl-3',3'-diphenylspiro[indoline-3,2'-oxiran]-2-one and hydrolysis⁵⁾ of it with hydrochloric acid gave 5,5'-dimethylisoidigo (VI). This sample was identical with the hydrolysate of IV.

1) H. Kato, *Agr. Biol. Chem.*, **26**, 187 (1962); **27**, 461 (1963).

2) T. Ozawa and N. Kinai, *Yakugaku Zasshi*, **89**, 1581 (1969).

3) *Org. Syn.*, Coll. Vol. I, 327 (1941).

4) E. Giovannini, *Helv. Chem. Acta*, **40**, 1553 (1957).

5) A. Schönberg and K. Junghans, *Chem. Ber.*, **96**, 3328 (1963).

On the other hand, GPT-1-¹⁴C and GPT-2-¹⁴C were cleaved in contact with *p*-toluidine respectively under the same condition in case of GPT and *p*-toluidine. The results of ¹⁴C incorporation into I indicated that C₁ and C₂ in glucose C-bond were contained in I.

Therefore, these our findings have given a possibility to the formation of melanoidine that there would be a route passing through C₂—C₃ cleavage of glucose C-bond first and next through reaction of C₁—C₂ fragment with amine or amino acid.

At enlarged sense, it may be possible that the pigments obtained by us are classified to a group of melanoidins.

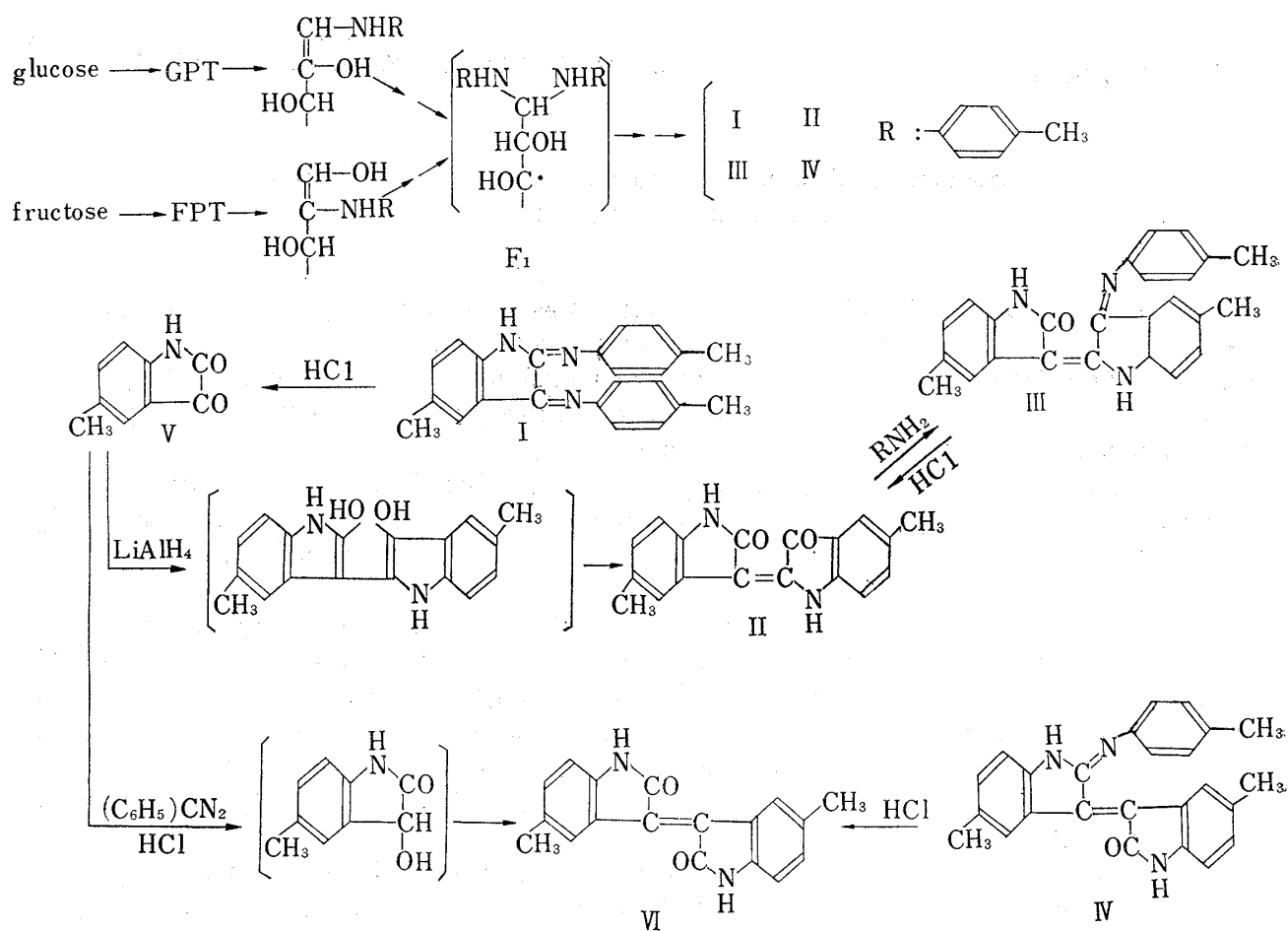


Chart 1

Shizuoka College of Pharmacy
Oshika, Shizuoka

TATSUO OZAWA
NAOHIDE KINAE

Received April 11, 1970