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Glucose-6-phosphate dehydrogenase activity of *Neurospora* grown on media containing malonate and citrate

Abstract

Glucose-6-phosphate dehydrogenase activity om malonate and citrate

Cheng, P. T. and J. E. Willis. Glucose-6-phosphate dehydrogenase activity of *Neurospora* grown on media containing molonote and citrate.

Reports in the literature suggest that *N. crassa* might serve as a convenient source of glucose-6-phosphate dehydrogenase (G6PDH) for purification and production. Rodhagrishnon (1960 Biochim. Biophys. Acta 40: 546) found that crude extracts of *N. crassa* (16117A) contained G6PDH of specific activity 0.31 $\mu\text{moles TPNH produced/minute/mg}$.

protein (25°C). By comparison, Noltmann et al. (1961 J. Biol. Chem. 236: 1225) prepared crystalline G6PDH from yeast extracts of initial specific activity 0.27 $\mu\text{moles TPNH/mg. protein at } 30^\circ\text{C}$. Furthermore, up to 9 times enhancement of G6PDH activity has been reported for extracts of heavily conditioned *N. crassa* grown on nitrate-sucrose-malonate medium as compared to medium lacking molonote (Turian 1962 N N#2: 15). Thus, it appeared that growth of *N. crassa* on molonote medium would provide cells rich in G6PDH. However, in the experiments reported in this communication, no significant enhancement of G6PDH activity was observed in cells grown on malonate as compared to controls.

The microorganism used in this study was wild type *N. crassa* strain 52970 (ATCC 10816). Cells were grown at 28°C for different periods of time in 100 ml of culture medium. The medium was similar to that described by Beadle (1945 Physiol. Rev. 25: 643), except that sodium nitrate was used in place of the ammonium salt and tartrate was replaced by citric or malonic acid. All media were adjusted to pH 6.8 with NaOH before sterilization. After the given period of incubation the culture was filtered with suction. The cell mass was washed with three 100-ml portions of water and a portion was taken for dry weight determination. The remainder of the sample was placed in the deep freeze for one hour, mixed with powdered Dry Ice and ground with a mortar and pestle for 30 minutes. After sublimation of the Dry Ice, the sample was treated with 5 ml of 0.05 M glycylglycine buffer, pH 8.0, per gram wet weight of cells. The buffer was added slowly over a period of 10 minutes with continued grinding. The resulting mixture was stirred for one hour at room temperature and centrifuged at 13,000 x g for 20 minutes to yield the crude extract used in this study. Preliminary experiments showed that growth of the organism for 88 hours on concentrations of molonote from 0.01 M to 0.10 M had no effect on the specific activity of G6PDH. However, levels of malonate greater than 0.05M retard the growth of this strain of *Neurospora*.

A level of malonate that did not interfere with growth (0.05 M) was chosen for an experiment in which the effect of time of incubation on growth and on G6PDH activity of malonate-grown cells was compared to that on cells grown on 0.01 M citrate or on control medium (no organic acid). Growth was more rapid on the media containing organic acids than in the control cultures (Table I). The specific activity of G6PDH was greater in the young control cultures, although the total units of enzyme activity were somewhat higher in the young molonote-grown cells. In the period between 112 and 160 hours, the enzyme activity decreased while the dry weight of the organism increased. In contrast with the results of Turian (loc. cit.), there was essentially no difference in the G6PDH activity in extracts of cells grown on molonote or citrate as compared to the control media. This disagreement in results could be due to the use of different strains of *Neurospora* or to some methodological difference.

Table 1. Effect of incubation time on dry weight and G6PDH activity.

Medium ^a	Dry Weight (g) ^b				Total Activity ^c				Specific Activity ^d				
	Time (hrs.)	66	112	160	232	66	112	160	232	66	112	160	232
Control		.10	.47	.74	.91	8.5	19.3	16.0	15.2	.69	.55	.43	.36
Citrate		.24	.62	1.07	.88	14.3	19.3	14.5	9.7	.48	.52	.44	.27
Malonate		.37	.63	.98	.84	19.8	26.8	16.7	9.7	.49	.63	.38	.36

a Control = sucrose-nitrate medium; Citrate = control + 0.01M citrate; Malonate = control + 0.05M molonote.

b Average weight per 100 ml from two 100-ml incubation mixtures.

c Average units per 100 ml from two 100-ml incubation mixtures.

d $\mu\text{moles TPNH produced/minute/mg protein}$ in the assay system of Noltmann, et al. (loc. cit.). Protein was determined by the Lowry procedure.

In a separate experiment, *Neurospora* was grown on 0.1 M molonote or 0.1 M citrate. The G6PDH activity decreased rapidly in older cultures. In fact, no activity was detected in extracts of 10-day cultures grown on 0.1 M citrate. In all of the above-mentioned experiments, 6-phosphogluconate dehydrogenase activity was assayed, also. The same pattern of activity changes was observed for both enzymes of the hexose monophosphate shunt. It would appear that the shunt may be more important in young cultures than in older cultures. ■ ■ ■ P-L Biochemicals, Inc., Milwaukee, Wisconsin 53205.