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THE CYANIDE CONTENT OF LAETRILE PREPARATIONS, APRICOT, PEACH AND APPLE SEEDS.

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ABSTRACT

Laetrile preparations obtained from a cyanide intoxicated patient were analyzed for their cyanide content by a microdiffusion colorimetric procedure. Cyanide was also determined in apricot, peach and apple seeds. The results were compared to those reported in the literature for cyanogenic glycoside containing seeds.

INTRODUCTION

Amygdalin is the diglucoside of mandelonitrile. Although originally described as the monoglucoside of mandelonitrile, most samples of laetrile have been found to be composed primarily of amygdalin (1,2,3,4)

The controversial use of laetrile in the treatment of cancer and the occasional poisoning episodes are well known (1,5). The successful treatment of a laetrile overdose was reported from

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this area (6). This report is on the analyses of cyanide in the parenteral and oral preparations of laetrile in that patient's possession, as well as the cyanide content of several seeds. A review of the cyanide content of laetrile preparations and cyanogenic seeds is also presented.

MATERIALS AND METHODS

Reagents

All chemicals were reagent grade.
β-Glucosidase was Type II (from almonds) from Sigma Chemical Company, St. Louis, Missouri
Ketodase - beef liver β-glucuronidase from General Diagnostics Division of Warner Lambert, Morris Plains, New Jersey.

Samples

D-Amygdalin (from apricot kernels) from Sigma Chemical Company
Yellow tablet - source of laetrile
Kemdalin - parenteral laetrile solution (3g vial)
Air dried apricot seeds, well matured (filled)
Air dried peach seeds, thin and shriveled
Air dried apple seeds, well matured (filled)

Methods

Cyanide was determined in the different samples by a microdiffusion colorimetric procedure (7). Calculations were based upon the use of a standard curve prepared by carrying known amounts of NaCN in 0.1M NaOH through the microdiffusion procedure, using 50% H_2SO_4 as the liberating agent. For hydrolysis of the cyanogenic glycosides, one mL of a solution of the β-glucosidase containing 10 units/mL in 0.1M sodium acetate at pH 5 (8) was added to the outer wall of the Convey microdiffusion dish. Each sample was diluted (suspended in case of seeds) in 0.1M sodium acetate at pH 5 so that one mL was used for analysis. Diffusion time

varied from 1 to 3 hours. The air dried seeds were ground to a fine powder.

RESULTS AND DISCUSSION

We reconfirmed the literature reports (9-11) that β-glucuronidase does not liberate HCN from amygdalin. After 3 hours of diffusion β-glucuronidase at 5000 units/mL did not liberate HCN from amygdalin, Kemdalin or a laetrile tablet. The addition of one mL of a solution containing 5, 10 and 20 units/mL of β-glucosidase to solutions of amygdalin in 0.1M sodium acetate at pH 5 in Convey cells showed that 10 units/mL gave maximum HCN liberation at room temperature. The addition of 100 mg of ascorbic acid to 20 units/mL of β-glucosidase with diffusion for 3 hours did not liberate additional HCN. Further information on the effect of time and temperature on microdiffusion results obtained in HCN determinations will be published later (12).

Polson and Tattersall (13) and Polson, Green and Lee (14) have reviewed most of the early literature on human poisonings from ingestion of cyanogenic fruit kernels. Other literature reports of the cyanide content of cyanogenic fruit kernels and laetrile preparations are given in Table 1.

The results obtained in determining the HCN content of the laetrile preparations and seeds in our study are given in Table 2.

The theoretical concentration of HCN in pure amygdalin based upon its molecular weight of 457 is 59.1 mg/g. Our sample was assayed as received. To prove the presence of amygdalin in the yellow tablet, an alcoholic extract was subjected to an IR scan. An evaporated portion of Kemdalin was examined with similar results. Aqueous solutions of the yellow tablet and Kemdalin showed U.V. absorption maxima in the region of 256, 261, and 267 nm, characteristic for amygdalin (4).

The potency of the laetrile tablet falls within the limits of other reported values. The parenteral preparation had a somewhat lower potency than most of those reported in the literature.

TABLE 1

Cyanide Content of Various Cyanogenic Glycosidic Products

Product	HCN (mg/g)	Reference
Laetrile		
500 mg tablet	39.9	15
3 g vial	39.4	15
500 mg tablets	32.6-51.5	3
10 ml vials	27.2-32.5*	3
250 tablet	2.7	16
500 mg tablets	5.0-53.2	17
500 mg tablets mfr. Mexico	29.0-49.6	18
parenteral, mfr. Mexico	23.2-33.9	18
parenteral	29.5-41.4	19
parenteral, mfr. U.S.	57.9±1.2	4
parenteral, mfr. Canada	51.4±1.2	4
Amygdalin		
10 ml vials, 3 g	8.3-51.3	17
Bitter almond (*Prunes dulcis* var. *amara*)		
seeds	4.7	16
seeds	0.852-1.89	20
Apricot (*Prunus armeniaca*)		
seeds	0.122-1.84	21
seeds	3.14,3.18	22
seeds	4.09	23
seeds, low amygdalin	<0.05	24
seeds, medium amygdalin	1-2	24
seeds, high amygdalin	>2	24
Peach (*Prunus persica*)		
seeds, Dixired	0.471	25
seeds, Elberta	0.435	25

* mg per vial

TABLE 2

Hydrogen Cyanide Liberated from Samples of Cyanogenic Glycosides in This Study

Samples	HCN (mg/g or mL)
Amygdalin - Sigma	55.9
Yellow laetrile tablet	47.8
Kemdalin - parenteral laetrile (3g vial)	14.1
Apricot seeds	2.92
Peach seeds	2.60
Apple seeds	0.61

Apricot seeds vary quite widely in their HCN content and our sample falls within the reported range.

Since a lethal dose of equivalent HCN is upward of 50mg, one can readily see how a person can eat a lethal quantity of apricot or peach seeds but very unlikely enough apple seeds. Although Polson and Tattersall and Polson, Green and Lee consider apple seeds innocuous (13,14), Kingsbury reported a fatal case in an adult male from consumption of a cupfull (26).

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