TABLE II

RESULTS OF ANALYSES OF FRACTIONS OBTAINED BY DISTILLING METHYL ESTERS OF SATURATED ACIDS OF PAPAYA SEED OIL

Fractions	Temp., °C.	Pressure, mm.	Iodine no.	Sap. value of esters of satd. acids	Esters of unsatd acids, %	Esters of satd. acids, %	Mean mol. wt. of esters of satd. acids	Composition of the esters of saturated acids: Methyl palmitate, %	Methyl stearate, %	Methyl arachidate, %
1	132–160	5–6	18.2	203.9	20.47	79.53	275.1	82.92	17.08	
2	160–165	5	19.4	201.6	22.56	77.44	278.2	71.88	28.12	
3	165–170	6	20.2	200.7	23.51	76.49	279.5	67.26	32.74	
4	170–175	5	26.3	187.3	30.60	69.40	299.5		96.07	3.93
5	175–181	5	28.3	183.7	32.93	67.07	305.4		75.00	25.00
Residue			39.3	182.4	45.73	54.27	307.6		67.14	32.86

TABLE III

SATURATED ACIDS IN PAPAYA SEED OIL

Acids	Yield: Grams	Yield: %	Acids in oil, %	Glycerides in oil, %
Palmitic	15.62	67.18	11.38	11.94
Stearic	7.20	30.96	5.25	5.49
Arachidic	0.43	1.85	0.31	0.32
			16.94	17.76

dium chloride and a few oily droplets were found floating on the surface. The liquid was still milky and was therefore shaken with ether, the ether extract washed with water, dried with sodium sulfate and excess ether removed by distillation. A dark amber oil with a pungent odor was obtained. When highly diluted, it had a cress-like odor similar to that of the seeds. The yield amounted to 1.3 g. or 0.09% based on the weight of the seeds, a quantity too small to make an extended investigation of its chemical and physical properties. It is hoped more may be obtained for further studies. The seeds are said[6] to contain a glucoside, *caricin* which resembles *sinigrin* (potassium myronate, $KC_{10}H_{18}O_{10}NS_2$). By the reaction of caricin with myrosin, an enzyme also present in the seeds, a volatile pungent substance, suggestive of mustard oil, is produced. Possibly this oil is responsible for the cress-like taste of the seeds.

(6) U. S. Dispensatory, 20th Ed., 1918.

Summary

A study has been made of the composition of the glycerides of papaya seed oil, which consist of 11.94% palmitic acid; 5.49% of stearic acid; 0.32% of arachidic acid; 79.94% of oleic acid and 2.22% of linoleic acid.

Besides the fatty oil in the seeds there is also a volatile oil present to which the characteristic cress-like odor of the seeds is due. The unsaponifiable matter amounts to 1.32%.

WINTER HAVEN, FLA. RECEIVED SEPTEMBER 30, 1937

[CONTRIBUTION FROM THE BURROUGHS WELLCOME & CO. U. S. A. EXPERIMENTAL RESEARCH LABORATORIES]

Isomeric Amyl Ureas and Derived Barbitals[1]

BY JOHANNES S. BUCK AND AXEL M. HJORT

With a view to pharmacological study, the complete series of eight amyl ureas and eight 1 - amyl barbitals (1 - amyl - 5,5 - diethylbarbituric acids) have been prepared. Both types are hypnotics, and, by keeping the pharmacologically-active groups constant, the effects of variation in the structure of the amyl groups can be observed. In addition, the two series will give a direct comparison between the hypnotic effects of the ureas and barbituric acids, in pairs. The two 5-alkyl groups were selected as ethyl groups partly to avoid oily products and also to avoid possible complications which might arise from the presence, in some cases, of two asymmetric carbon atoms. In the compounds described below, where an asymmetric carbon atom is present, it is the optically inactive *dl* form which is referred to. Such compounds are indicated by *dl*.

(1) This work is part of a joint research being carried out in collaboration with a pharmacological group at the above Laboratories.

Experimental

The isomeric amyl ureas were prepared as described below. The last four have not been previously recorded.

n-Butylcarbinyl urea (*n*-amyl urea) was prepared from the amine hydrochloride and potassium cyanate,[2] also from the amine and nitrourea;[3] m. p. 100°.

Isobutylcarbinyl urea (isoamyl urea)[4] was prepared as above; m. p. 96°.

Dimethylethylcarbinyl urea (*t*-amyl urea) was made both by the Wurtz method[5] and by the Schneegans method;[6] m. p. 160°.

(2) DeBeer, Buck and Hjort, *J. Pharmacol.*, **52**, 216 (1934).
(3) *Cf.* Davis and Blanchard, THIS JOURNAL, **51**, 1790 (1929).
(4) Dixon, *J. Chem. Soc.*, **67**, 556 (1895).
(5) Wurtz, *Ann.*, **139**, 327 (1866).
(6) Schneegans, *Arch. Pharm.*, **231**, 675 (1893).

TABLE I

1-AMYL BARBITALS

Compound -carbinyl barbital	Formula	Analyses, % Calcd. C	Calcd. H	Found C	Found H	M. p., °C.	Appearance	M. H. D. mM./kg.	M. L. D. mM./kg.
1-*n*-Butyl-	$C_{13}H_{22}O_3N_2$	61.37	8.73	61.48	8.71	36	Small glitt. needles	0.475–0.525	1.25–1.75
dl-1-Methyl-*n*-propyl-	$C_{13}H_{22}O_3N_2$	61.37	8.73	61.25	8.90	35	Clumps of minute prisms	.325–0.375	1.30
1-Diethyl-	$C_{13}H_{22}O_3N_2$	61.37	8.73	61.29	8.84	85	Tiny glitt. needles	.30–0.35	1.20 to >
1-Isobutyl-	$C_{13}H_{22}O_3N_2$	61.37	8.73	61.23	8.74	78	Small glitt. needles	.45–0.525	1.25 to >
dl-1-Methylisopropyl-	$C_{13}H_{22}O_3N_2$	61.37	8.73	61.47	8.71	132	Small needle prisms	convulsant	0.35
1-Dimethylethyl-	$C_{13}H_{22}O_3N_2$	61.37	8.73	61.32	8.83	75	Tiny glitt. leaves	0.90–1.00	1.25
dl-1-*s*-Butyl-	$C_{13}H_{22}O_3N_2$	61.37	8.73	61.32	8.96	76	Bulky mass of tiny prisms	.45–0.50	1.125–1.275
1-*t*-Butyl-	$C_{13}H_{22}O_3N_2$	61.37	8.73	61.43	8.82	112	Bulky mass of tiny needles	1.00–1.10	1.50

***t*-Butylcarbinyl Urea.**—This was prepared by the method of Freund and Lenze,[7] who give the m. p. as 145°. The m. p. is 157°. The urea is better prepared from *t*-butylcarbinylamine and nitrourea. The amine was obtained by a Hofmann reaction (using 10% excess sodium hypochlorite) on *t*-butylacetamide, made by the Aschan method[8] from *t*-butylacetic acid.[9] The latter was prepared by heating *t*-butylmalonic acid, obtained by the action of *t*-butyl bromide on sodiomalonic ester, under the customary conditions (reflux in alcohol, adding the bromide slowly). The *t*-butylmalonic acid was isolated by directly saponifying the crude ester. The yield approaches 20%. Considerable amounts of a volatile compound of strong peppermint odor, b. p. 70°, doubtless ethyl *t*-butyl ether, are produced in the reaction.[10]

***t*-Butylacetamide,**[11] recrystallized from water, forms pearly, felted leaves, m. p. 134°.

Anal. Calcd. for $C_6H_{13}ON$: N, 12.16. Found: N, 12.07.

***t*-Butylmalonic Acid.**—Recrystallized from ether–petroleum ether, the acid forms stout, transparent prisms, m. p. 156°. It is soluble in ether, water and alcohol, and sparingly soluble in benzene and petroleum ether. Different analyses were not concordant. The average of five is given.

Anal. Calcd. for $C_7H_{12}O_4$: C, 52.46; H, 7.55. Found: C, 52.35; H, 7.86.

***t*-Butylcarbinylamine hydrochloride,** recrystallized from alcohol–ethyl acetate, forms felted, thin, silky plates, m. p. above 285°.

Anal. Calcd. for $C_5H_{14}NCl$: N, 11.33. Found: N, 11.22.

***dl*-Methylpropylcarbinyl urea** was prepared from 2-aminopentane (sodium–alcohol reduction of methyl propyl ketoxime[12]) and nitrourea. Recrystallized from water, it forms small, fluffy, flat needles, moderately soluble in hot benzene, very soluble in alcohol, slightly soluble in ether, and readily soluble in hot water. It melts at 144°.

Anal. Calcd. for $C_6H_{14}ON_2$: N, 21.52. Found: N, 21.41.

Diethylcarbinyl Urea.—This was prepared from 3-aminopentane[13] and nitrourea. The urea forms glittering, fine needles, after recrystallization from water, m. p. 193°, It is slightly soluble in hot benzene, soluble in cold alcohol, insoluble in ether, and moderately soluble in hot water.

Anal. Calcd. for $C_6H_{14}ON_2$: N, 21.52. Found: N, 21.50.

***dl*-Methylisopropylcarbinyl urea** was prepared as in the above two cases, starting from methyl isopropyl ketoxime. Recrystallized from water, it forms long, slender, glittering needles, slightly soluble in hot benzene, soluble in cold alcohol, practically insoluble in ether, and moderately soluble in hot water. It melts at 200°.

(7) Freund and Lenze, *Ber.*, **23**, 2865 (1890); **24**, 2150 (1891).
(8) Aschan, *Ber.*, **31**, 2344 (1898).
(9) *Cf.* Delacre, *Bull. acad. roy. Belg.*, 7 (1906); *Chem. Zentr.*, **77**, I, 1233 (1906); *cf.* U. S. patents 2,004,066; 2,034,850; 2,060,154.
(10) *Cf.* Dox and Bywater, THIS JOURNAL, **58**, 731 (1936).
(11) *Cf.* Bougault, *Ann. chim.*, [9] **5**, 317 (1916).
(12) Kursanoff, *J. Russ. Phys.-Chem. Soc.*, **30**, 269 (1898).
(13) Noyes, *Am. Chem. J.*, **15**, 539 (1893).

Anal. Calcd. for $C_6H_{14}ON_2$: N, 21.52. Found: N, 21.79.

***dl*-Methylisopropylcarbinylamine Hydrochloride.**—Recrystallized from alcohol–ether, this forms tiny, felted needles, m. p. 216°.

Anal. Calcd. for $C_5H_{14}NCl$: N, 11.33. Found: N, 11.65.

***dl*-*s*-Butylcarbinyl Urea.**—This urea was prepared from *s*-butylcarbinylamine and nitrourea. The amine was obtained by a Hofmann reaction (using 10% excess sodium hypochlorite) on *s*-butylacetamide,[14] prepared by the Aschan method[8] from *s*-butylacetic acid.[14,15] The urea, recrystallized from water, forms small, pearly leaves, melting at 125°, and soluble in hot benzene, very soluble in alcohol, moderately soluble in ether, and soluble in hot water.

Anal. Calcd. for $C_6H_{14}ON_2$: N, 21.52. Found: N, 21.84.

***dl*-*s*-Butylcarbinylamine hydrochloride,** recrystallized from alcohol–ether, forms tiny, felted crystals, m. p. 180°.

Anal. Calcd. for $C_5H_{14}NCl$: N, 11.33. Found: N, 11.56.

1-Amyl Barbitals.—These compounds were all prepared in the customary manner (condensation of one mole of urea with one mole of ethyl diethylmalonate, in the presence of three moles sodium ethylate, the reaction lasting four and one-half hours). In general, they were worked up by dissolving the reaction product in water, acidifying, extracting with ether, and then extracting the barbituric acid from the ether with dilute sodium hydroxide solution. After saturation of the alkaline solution with carbon dioxide, the product was filtered off if solid or extracted with ether or hexane and the solvent evaporated. With the exception of the *n*-butylcarbinyl barbital and the methylpropylcarbinyl barbital, the products were recrystallized from aqueous alcohol until pure. The methylpropylcarbinyl barbital was first distilled (b. p. *ca.* 147° at 1.5 mm.) and then crystallized from pentane, while the *n*-butylcarbinyl barbital was crystallized from pentane, with or without a preliminary distillation under low pressure. Both these compounds must be manipulated, apart from distillation, at temperatures below 0° on account of their low melting points and extreme solubility.

The amyl barbitals are all white, crystalline compounds. They are practically insoluble in water, are soluble in cold 5% sodium hydroxide solution, and are very soluble in the usual organic solvents. With the exception of the two low-melting compounds, which have a slightly burning taste, followed by a bitter after-taste, the amyl barbitals are practically tasteless. Analytical data, etc., are recorded in Table I. Melting points are corrected. The microanalyses were carried out by Mr. W. S. Ide.

Complete pharmacological data will be published in another place. In the meantime, the minimum hypnotic and lethal doses (by intraperitoneal injection, using white mice) are given in Table I. There were secondary deaths with four of the compounds. In some cases, the effect is not purely hypnotic, in fact, *dl*-1-methylisopropylcarbinyl barbital is a convulsant. For comparison, the M. H. D. of barbital itself, determined in the same way, is 0.70–1.00 and the M. L. D. is 2.5.

(14) Bentley, *J. Chem. Soc.*, **67**, 264 (1895).
(15) Ehrlich, *Ber.*, **41**, 1453 (1908).

Summary

The preparation and properties of the eight isomeric amyl ureas and the corresponding eight 1-amyl barbitals are described, and the minimum hypnotic and the minimum lethal doses of the latter are given.

TUCKAHOE, NEW YORK RECEIVED OCTOBER 14, 1937

[CONTRIBUTION FROM THE FRICK CHEMICAL LABORATORY OF PRINCETON UNIVERSITY]

Glycofuranosides and Thioglycofuranosides. II. Crystalline α-Ethylgalactofuranoside

BY JOHN W. GREEN AND EUGENE PACSU

In a recent publication[1] dealing with the preparation of crystalline β-ethylgalactofuranoside by a new method, it has been stated that "from the mother liquor a sirup is obtained, which may contain the unknown α-form, and which is being investigated." The ether extract of this sirup, on standing in the ice box for several months, deposited a crystalline material in the form of hard glassy buttons. After crystallization from ethyl acetate, the product had the appearance of short needles, with m. p. 139–140° and $[\alpha]^{20}D$ 92° in water solution.

It can now be stated that this substance represents the hitherto unknown α-isomer of the β-ethylgalactofuranoside ($[\alpha]^{20}D$ −102° in water solution). This conclusion has been arrived at from the results of the analysis and the rate of hydrolysis of the compound and from the fact that the rotational difference (194°) of the two isomers agrees closely with that (193.5°) of the two ethylgalactopyranosides ($[\alpha]^{20}D$ 186.8° for the α-, and −6.7° for the β-pyranoside).

By the preparation of this new glycoside in pure state, a second pair of crystalline furanosides has become known in sugar chemistry, the first

(1) Green and Pacsu, THIS JOURNAL, **59**, 1205 (1937).