0.1136, 0.0940. Calcd. for $C_{14}H_8O_3Cl_2$: C, 56.96; H, 2.76; Cl, 24.03. Found: C, 56.98; H, 3.01; Cl, 23.95, 24.12.

1,4-Dichloro-anthraquinone.—Thirteen and six-tenths g. of 2′,5′-dichloro-2-benzoylbenzoic acid and 82 g. of sulfuric acid (d., 1.84) were heated together in an oil-bath at 150° for four hours. The reaction product, after being cooled to room temperature, was poured into ice water, filtered, washed with dil. sodium carbonate solution and then with water, and finally dried at 110°; yield, 10.63 g., or 83.0%. It was crystallized from glacial acetic acid as orange-colored needles; m. p., 187.5° (corr.). It was found to be identical with the 1,4-dichloro-anthraquinone of Ullmann and Billig.[3]

Anal. Subs., 0.1142, 0.1438: AgCl, 0.1175, 0.1477. Calcd. for $C_{14}H_6O_2Cl_2$: Cl, 25.60. Found: 25.45, 25.41.

Summary

1. 2′,5′-Dichloro-2-benzoylbenzoic acid has been prepared by condensing phathalic anhydride and *p*-dichlorobenzene, using anhydrous aluminum chloride as the condensing agent.
2. The 2′,5′-dichloro-2-benzoylbenzoic acid, when heated with sulfuric acid at 150°, was converted into 1,4-dichloro-anthraquinone.

WASHINGTON, D. C.

[CONTRIBUTION FROM THE DEPARTMENT OF PHARMACY OF THE UNIVERSITY OF FLORIDA]

THE EFFECT OF AMINO ACIDS AND OTHER COMPOUNDS UPON THE ACTIVITY OF UREASE[1]

BY WILLIAM J. HUSA

RECEIVED SEPTEMBER 27, 1926 PUBLISHED DECEMBER 16, 1926

Rockwood and Husa[2] recorded the effect of 48 different compounds on the enzymic activity of urease and found that all compounds which had a promoter action contained both the amino and carboxyl groups. Furthermore, the promoter effect was dependent on the relative position of these two groups; thus, in the study of mono-amino-monocarboxylic acids it was found that the average promoter effect of 10 α-amino acids was 20%, of 3 β-amino acids 3%, while the only γ-amino acid available had a negative promoter effect, causing a decrease in enzymic activity of 1%. It was also demonstrated that in α-amino acids, replacement of one hydrogen atom of the amino group by benzoyl, or esterification of the carboxyl group, did not diminish the promoter action. These results have been extended in the present investigation by a study of the effect of certain amino acids and other compounds.

Experimental Procedure

The procedure previously described[2] was again employed with two exceptions as follows: (1) the reaction was carried out in a Freas large size

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[1] Presented before the Division of Biological Chemistry at the Seventy-second Meeting of the American Chemical Society, Philadelphia, September 6 to 11, 1926.

[2] Rockwood and Husa, THIS JOURNAL, **45**, 2678 (1923).

water thermostat at 30° instead of at room temperature, (2) the concentration of enzyme preparation was reduced from 0.01% to 0.0025%, the enzyme preparation being about four times as active as those used previously. As before, the experiments were carried out with 0.1 *M* urea, the optimum hydrogen-ion concentration of P_H 7.5 being maintained by use of a phosphate buffer, whose concentration in the final reaction mixture was 0.5 *M*. The concentration of the compound whose effect was being studied was 0.001 *M*.

Experimental Data

In each experiment, the effects of two compounds were compared with the same control; however, the results may be more conveniently presented by taking the average of the several determinations made with each compound. The resulting values cannot be considered as definite constants, but should rather be taken as indicating the approximate magnitude of the effect observed. The results obtained are as follows, the activity of the enzyme in the presence of added substances being expressed on the basis of the control taken as 100.

TABLE I

RESULTS

Substance	Action on basis control = 100
dl-α-Amino-*n*-butyric acid	122
dl-α-Amino-*n*-valeric acid	120
α-Aminocaproic acid	121
dl-α-Aminocaprylic acid[a]	113
δ-Amino-*n*-valeric acid	99
dl-α-Amino-α-methylbutyric acid	128
Ethyl 4-hydroxymethyl-3-aminobenzoate[b]	95
Quinine hydrochloride[c]	93
Mercurochrome 220, soluble	2

[a] Did not dissolve entirely.

[b] For this I am indebted to Dr. F. H. Case.

[c] Dissolved in water but a precipitate formed when buffer solution was added.

Discussion

Effect of Straight-Chain α-Amino Acids.—The marked promoter effect of α-amino acids has been further verified by the results obtained with a series of straight-chain α-amino acids (see Table I).

Effect of Relative Position of Amino and Carboxyl Groups.—It was found that δ-amino-*n*-valeric acid had no promoter action. This result is in harmony with the conclusion that the promoter effect decreases as the distance between the amino and carboxyl groups increases.

Effect of Derivatives of Amino Acids.—The introduction of a methyl group in the α-position in an α-amino acid did not decrease the promoter action, since *dl*-α-amino-α-methylbutyric acid showed a 28% promoter effect. Rockwood and Husa[2] found that *m*-aminobenzoic acid caused a slight decrease in the activity of urease; a similar result was obtained in the present study with a related amino ester, namely, ethyl 4-hydroxymethyl-3-aminobenzoate.

Effect of Quinine Hydrochloride.—Rona and co-workers[3] have shown that quinine hydrochloride retards the action of certain lipases. A similar result was observed with urease (see Table I).

Effect of Mercurochrome 220 Soluble.—Mercurochrome 220 soluble inactivated urease.

Summary

1. The marked promoter effect of α-amino acids on urease has been verified.
2. Introduction of a methyl group in the alpha position in an α-amino acid does not decrease the promoter effect.
3. δ-Amino-*n*-valeric acid does not have a promoter effect on urease. This is in accord with the previous conclusion that the promoter action is a function of the distance between the amino and carboxyl groups.
4. The enzymic activity of urease was slightly decreased in the presence of quinine hydrochloride or ethyl 4-hydroxymethyl-3-aminobenzoate.
5. Mercurochrome 220 soluble inactivated urease.

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[CONTRIBUTION FROM THE CHEMICAL LABORATORY OF BRYN MAWR COLLEGE]

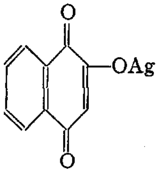
THE ALKYLATION OF HYDROXYNAPHTHOQUINONE

II. CARBON ALKYLATION

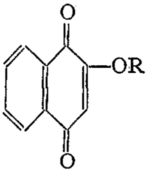
BY LOUIS F. FIESER

RECEIVED OCTOBER 12, 1926 PUBLISHED DECEMBER 16, 1926

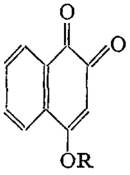
In a previous paper[1] it was shown that isomeric oxygen ethers (II and III) are formed by the action of saturated alkyl halides on the silver salt of hydroxynaphthoquinone (I). Having found that the relative amount of the normal reaction product (II) increases somewhat with increasing reactivity of the alkyl halide, it was to be expected that the very reactive,



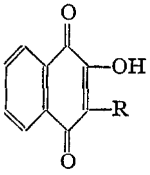
I



II



III



IV

[3] Rona and others, *Biochem. Z.*, **134**, 108, 118 (1922).

[1] Fieser, THIS JOURNAL, **48**, 2922 (1926). The sub-title of this paper should read "I. Oxygen ethers," instead of "I. Ortho-ethers."