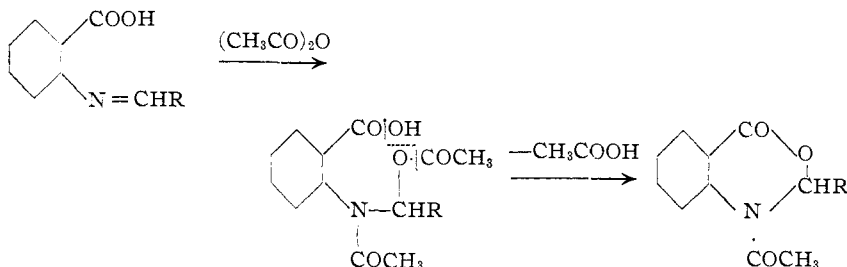


[CONTRIBUTION FROM THE CHEMICAL LABORATORY OF THE UNIVERSITY OF COLORADO]  
**THE ACTION OF ACETIC ANHYDRIDE ON SOME BENZYLIDENE-  
 ANTHRANILIC ACIDS. V**

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It has been shown in former papers<sup>1</sup> that when acetic anhydride reacts with benzylidene-anthranilic acids, oxazine derivatives are formed according to the following equation.



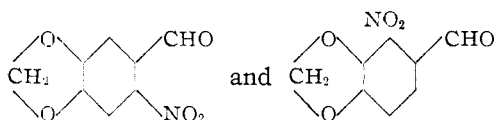
The reaction is apparently a very general one, since in all cases in which a benzylidene-anthranilic acid has been prepared, acetic anhydride yields with it the corresponding oxazine derivative. Including those described in former papers, oxazine derivatives have been obtained from 40 different benzylidene-anthranilic acids. The acids are usually very easily prepared, and the method has failed in only 2 cases out of the 42 aldehydes with which it has been tried, namely, with cuminal and with the methyl ether of  $\beta$ -naphthol aldehyde. These two aldehydes were tried with anthranilic acid both with and without dehydrating agents in various solvents, also by heating the reagents together at various temperatures, but in no case could a benzylidene-anthranilic acid be isolated.

It is not clear why these two aldehydes show this abnormality, when such a large number of other aromatic aldehydes react so easily. Why should the entrance of the *isopropyl* group into benzaldehyde inhibit the reaction, when the methyl group in any of the three positions has no effect? Why should the methyl group in the ether of  $\beta$ -naphthol aldehyde inhibit the reaction, when it has no effect upon the reactivity if the corresponding ether of an hydroxy-benzaldehyde is employed?

A curious anomaly was met in the preparation of the benzylidene compound with *o*-nitropiperonal and anthranilic acid, when two different benzylidene-anthranilic acids were obtained, one insoluble in benzene and xylene and melting at 185° with decomposition, and the other soluble in benzene and xylene and melting at 128°. These compounds, in turn, when treated with acetic anhydride, yielded two different oxazine derivatives, melting at 206° and 165°, respectively. Apparently these facts cannot be explained except on the assumption that what is known

<sup>1</sup> THIS JOURNAL, 34, 161 (1912); 35, 282 (1913); 36, 603 (1914); 37, 582 (1915).

as *o*-nitropiperonal is in reality a mixture of two very similar nitration products, possible with the following structures,



It is our intention to study

this matter further.

The benzylidene-anthranilic acids from which the oxazine derivatives were prepared are readily obtained by bringing molecular proportions of the aldehyde and anthranilic acid together in conc. alcohol or benzene solution at 0°. These acids yield the oxazine derivatives either by refluxing molecular proportions with acetic anhydride in xylene solution for several hours, or by heating the acid for some time with an excess of acetic anhydride and removing the excess by distillation. With terephthalylidene-anthranilic acid the reaction was carried out by refluxing in nitrobenzene solution.

The following benzylidene-anthranilic acids and their oxazine derivatives were prepared. In naming the latter the original position of the aldehyde group is taken as 1. The two nitropiperonylidene-anthranilic acids and their oxazines are called  $\alpha$  and  $\beta$  compounds.

#### SUBSTITUTED BENZYLIDENE-ANTHRANILIC ACIDS

Compound	Properties	M. p.	Formula	Analysis	
				Calc. N %	Found N %
3-Nitrosalicylidene	Orange-red needles	227	C <sub>14</sub> H <sub>11</sub> N <sub>2</sub> O <sub>5</sub>	9.8	9.63
5-Nitrosalicylidene	Orange-red needles	270	C <sub>14</sub> H <sub>11</sub> N <sub>2</sub> O <sub>5</sub>	9.8	9.7
2,4-Dinitrobenzylidene	Mustard-colored prisms	153	C <sub>14</sub> H <sub>9</sub> N <sub>3</sub> O <sub>6</sub>	13.3	13.0
<i>m</i> -Cresylidene	Orange-red crystals	202.5	C <sub>15</sub> H <sub>14</sub> NO <sub>3</sub>	5.5	5.6
<i>p</i> -Diethylamidobenzylidene	Red needles	154	C <sub>18</sub> H <sub>20</sub> N <sub>2</sub> O <sub>2</sub>	9.44	9.24
Terephthalylidene	Yellow crystals insol. in all solvents except nitrobenzene	300	C <sub>22</sub> H <sub>16</sub> N <sub>2</sub> O <sub>4</sub>	7.55	7.5
<i>p</i> -Ethoxy-benzylidene	Yellow needles	117	C <sub>16</sub> H <sub>13</sub> NO <sub>3</sub>	5.2	5.32
<i>o</i> -Methoxy-benzylidene	Yellow needles	130	C <sub>15</sub> H <sub>13</sub> NO <sub>3</sub>	5.49	5.5
$\beta$ -Naphtholidene	Orange crystals	252	C <sub>15</sub> H <sub>13</sub> NO <sub>3</sub>	4.81	4.5
3-Methyl-4-methoxy-benzylidene	Straw-colored needles	161	C <sub>16</sub> H <sub>13</sub> NO <sub>3</sub>	5.18	5.11
3,4-Dimethoxy-benzylidene	Light-yellow needles	169	C <sub>16</sub> H <sub>13</sub> NO <sub>4</sub>	4.89	4.62
<i>o</i> -Carboxy-benzylidene	Colorless crystals	225	C <sub>13</sub> H <sub>11</sub> NO <sub>4</sub>	5.2	5.1
$\alpha$ -Nitro-piperonylidene	Yellow-brown crystals	185	C <sub>18</sub> H <sub>15</sub> N <sub>2</sub> O <sub>6</sub>	8.91	8.42
$\beta$ -Nitro-piperonylidene	Yellow crystals	128	C <sub>15</sub> H <sub>10</sub> N <sub>2</sub> O <sub>6</sub>	8.91	8.24
2,4,5-Trimethoxy-benzylidene	Orange-yellow crystals	151	C <sub>17</sub> H <sub>17</sub> NO <sub>6</sub>	4.44	4.53
<i>p</i> -Homosalicylidene	Red needles	209	C <sub>16</sub> H <sub>13</sub> NO <sub>3</sub>	5.49	5.36

(w. decomp.)

## SUBSTITUTED ACETO-KETO-DIHYDRO-BENZO-METOXAZINES

Compound	Properties	M. p. ° C.	Formula	Analysis	
				Calc. N %	Found N %
2 - Acetoxy - 3 - nitro-phenyl-	Colorless crystals	190	C <sub>18</sub> H <sub>14</sub> N <sub>2</sub> O <sub>7</sub>	7.59	7.6
2 - Acetoxy - 5 - nitro-phenyl-					
2,4-Dinitrophenyl-	Straw-colored crystals	178	C <sub>18</sub> H <sub>14</sub> N <sub>2</sub> O <sub>7</sub>	7.59	7.6
2-Acetoxy - 4 - methyl-phenyl-					
<i>p</i> -Diethyl-amidophenyl-	Colorless crystals	156	C <sub>19</sub> H <sub>17</sub> NO <sub>4</sub>	4.64	4.6
<i>p</i> -Phenylene-bis-		170	C <sub>20</sub> H <sub>22</sub> N <sub>2</sub> O <sub>3</sub>	8.28	8.13
<i>p</i> -Ethoxyphenyl-		267	C <sub>26</sub> H <sub>20</sub> N <sub>2</sub> O <sub>6</sub>	6.1	6.3
<i>o</i> -Methoxyphenyl-		182	C <sub>18</sub> H <sub>17</sub> NO <sub>4</sub>	4.51	4.6
$\beta$ -Acetoxynaphthyl-		178	C <sub>17</sub> H <sub>16</sub> NO <sub>4</sub>	4.71	4.6
3 - Methyl-4 - methoxy-phenyl-		198	C <sub>22</sub> H <sub>17</sub> NO <sub>4</sub>	3.9	3.64
3,4-Dimethoxyphenyl-		128	C <sub>18</sub> H <sub>17</sub> NO <sub>4</sub>	4.5	4.26
<i>o</i> -Carboxyphenyl-		183	C <sub>18</sub> H <sub>17</sub> NO <sub>5</sub>	4.28	4.65
$\alpha$ - Nitro - 3,4 - methyl-enedioxyphenyl-		134	C <sub>17</sub> H <sub>13</sub> NO <sub>5</sub>	4.50	4.38
$\beta$ - Nitro - 3,4 - methyl-enedioxyphenyl-		Brownish-yellow crystals	206	C <sub>17</sub> H <sub>12</sub> N <sub>2</sub> O <sub>7</sub>	7.83
2, 4, 5 - Trimethoxy-phenyl-	Colorless crystals	165	C <sub>17</sub> H <sub>12</sub> N <sub>2</sub> O <sub>7</sub>	7.83	8.12
2-Acetoxy - 4 - methyl-phenyl-		135	C <sub>19</sub> H <sub>19</sub> NO <sub>6</sub>	3.92	3.64
		166	C <sub>19</sub> H <sub>17</sub> NO <sub>4</sub>	4.33	4.22

## Summary

1. Sixteen substituted aceto-keto-dihydro-benzo-metoxazines have been prepared from substituted benzylidene-anthranilic acids by means of acetic anhydride.

2. The only cases observed thus far in which the reaction of an aromatic aldehyde fails with anthranilic acid are those of cuminol and  $\beta$ -naphthol-aldehyde methyl ether. No explanation is offered for the anomalous behavior of these aldehydes.

3. Two different benzylidene-anthranilic acids were obtained from *o*-nitropiperonal with anthranilic acid. These in turn reacted with acetic anhydride to form two different oxazine derivatives. This is difficult to understand except on the assumption that the substance known as 6-nitropiperonal is a mixture of 2 different *ortho*-nitro compounds.

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