SECTION IV

CHALKONES DERIVED FROM 2-HYDROXY-4-CHLORO ACETOPHENONE :

Chalkones and related compounds derived from 2-hydroxy-4-chloro acetophenone and benzaldehyde :

2-Hydroxy-4-chloro-acetophenone on condensation with benzaldehyde in alcoholic solution using potassium hydroxide (40.0%) as condensing agent, gave the chalkone in good yield.

\[
\begin{align*}
\text{Cl} & \quad \text{OH} \\
\text{COCCH}_3 & \quad \text{R} \quad \text{CHO} \\
\text{Cl} & \quad \text{OH} \\
\text{COCCH} & \text{CH} \text{Ph}
\end{align*}
\]

\[ R = \text{C}_6\text{H}_5 \]

The constitution, 2'-hydroxy-4'-chloro chalkone has been assigned on the following grounds :

(i) The product is highly coloured (yellow). It gives deep red colour with concentrated sulphuric acid.

(ii) It dissolves in alkali with yellowish green colour.

(iii) It gives brown colour with alcoholic ferric chloride solution indicating the presence of hydroxy group in ortho position to ketonic group.

(iv) It gives an acetyl derivative indicating a free hydroxy group.
(v) On treatment with bromine in acetic acid the compound gave a dibromide, which on debromination by potassium iodide in acetone gave the original chalkone.

\[
\begin{align*}
\text{Cl} & \quad \text{OH} & \text{Br}_2 & \rightarrow & \text{Cl} & \quad \text{OH} \\
\text{COCH:CH:Ph} & \quad \text{Aceton + KI} & & & \text{CO.C.H.CH:Ph} & \quad \text{Br Br}
\end{align*}
\]

The following other reactions of the chalkone were also carried out:

1. The chalkone dibromide on treatment with alcoholic alkali gave 6-chloro benzylidene coumaranone.

2. On oxidation by selenium dioxide in dry isoamyl alcohol as solvent, the chalkone was converted into 7-chloro-flavone.

\[
\begin{align*}
\text{Cl} & \quad \text{OH} & \text{SeO}_2 & \rightarrow & \text{Cl} & \quad \text{C:Ph} \\
\text{COCH:CH:Ph} & & & & \text{C:Ph} & \quad \text{CH}
\end{align*}
\]

3. On Algar-Flynn oxidation with alkaline hydrogen peroxide \(\text{H}_2\text{O}_2\) 7-chloro-flavonol was obtained.

\[
\begin{align*}
\text{Cl} & \quad \text{OH} & \text{H}_2\text{O}_2 & \rightarrow & \text{Cl} & \quad \text{C:Ph} \\
\text{COCH:CH:Ph} & & & & \text{C:OH}
\end{align*}
\]
(4) All the attempts to cyclise thechalkone to 7-chloroflavanone were fruitless.

(5) On condensation with ethyl acetoacetate, it gave ethyl-4- (2-hydroxy-4-chloro-phenyl) -6- (phenyl) -\( \Delta^3 \)-cyclohexen-2-one-1-carboxylate which on treatment with alcoholic potassium hydroxide gave 3- (2-hydroxy-4-chloro-phenyl) -5- (phenyl) -\( \Delta^2 \)-cyclohexen-1-one.

\[
\text{ClOCH:CH:Ph} \xrightarrow{\text{Ethyl acetoacetate}} \text{ClOHCH:CH:Ph} \xrightarrow{\text{Alcoholic KOH}} \text{ClOHCH:CH:Ph}
\]

**Chalkones and related compounds derived from 2-hydroxy-4-chloro-acetophenone and other aldehydes**

Similarly, 2-hydroxy-4-chloro-acetophenone was condensed with various aldehydes such as m-hydroxy-benzaldehyde, anisaldehyde, veratraldehyde, piperonal, m-nitro-benzaldehyde, p-nitro-benzaldehyde and cinnamic aldehyde. Potassium hydroxide was used as a condensing agent and the chalkones were obtained in good yield.
The following table describes the chalkones obtained with their melting points:

<table>
<thead>
<tr>
<th>No.</th>
<th>Aldehyde</th>
<th>Name of the chalkone</th>
<th>M. P. °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>m-Hydroxy-benzaldehyde</td>
<td>2'-3-Dihydroxy-4'-chloro chalkone</td>
<td>135</td>
</tr>
<tr>
<td>2.</td>
<td>Anisaldehyde</td>
<td>2'-Hydroxy-4'-chloro-4-methoxy chalkone</td>
<td>136</td>
</tr>
<tr>
<td>3.</td>
<td>Veratraldehyde</td>
<td>2'-Hydroxy-4'-chloro-3,4-dimethoxy chalkone</td>
<td>119</td>
</tr>
<tr>
<td>4.</td>
<td>Piperonal</td>
<td>2'-Hydroxy-4'-chloro-3,4-methylenedioxy chalkone</td>
<td>180</td>
</tr>
<tr>
<td>5.</td>
<td>m-Nitro-benzaldehyde</td>
<td>2'-Hydroxy-4'-chloro-3-nitro-chalkone</td>
<td>199</td>
</tr>
<tr>
<td>6.</td>
<td>p-Nitro-benzaldehyde</td>
<td>2'-Hydroxy-4'-chloro-4-nitro chalkone</td>
<td>222</td>
</tr>
<tr>
<td>7.</td>
<td>Cinnamic aldehyde</td>
<td>2-Hydroxy-4-chloro-cinnamylidene acetophenone</td>
<td>160</td>
</tr>
</tbody>
</table>
On treatment with bromine in acetic acid some of the above chalkones gave dibromides which on debromination with potassium iodide in acetone solution gave the original chalkone.

\[
\begin{align*}
\text{Cl} & \quad \text{OH} & \quad \text{Br}_2 & \quad \text{Br} & \quad \text{Cl} & \quad \text{OH} & \quad \text{COOCH} \cdot \text{CH} \cdot \text{R} \\
\text{COCH} \cdot \text{CH} \cdot \text{R} & \quad \text{acetone + KI} & \quad \text{Br} & \quad \text{Br}
\end{align*}
\]

R = OH, OCH₃, OCH₂, OCH₃.
EXPERIMENTAL

SECTION IV

CHALKONES DERIVED FROM 2-HYDROXY-4-CHLORO ACETOPHENONE:

Fries rearrangement of m-chloro-phenyl acetate without any solvent: Formation of 2-hydroxy-4-chloro-acetophenone and 4-hydroxy-2-chloro-acetophenone:

m-Chloro-phenyl acetate (10.0 g.) was intimately mixed with anhydrous aluminium chloride (12.0 g.; 1.5 mol.) and heated at 150° in an oil bath for 2 hours. The reaction mixture was then treated with ice and concentrated hydrochloric acid (5.0 c.c.) and steam distilled, when a volatile oily liquid was obtained along with the distillate. It was extracted with ether and the ethereal extract was dried over anhydrous sodium sulphate. On removal of ether, the residual liquid was distilled under reduced pressure, b.p. 1520/40 mm. Sen and Tewari (J. Ind. Chem. Soc., 1952, 29, 419) have mentioned its boiling point to be 96°/2 mm. Yield: 6.0 g. It gives violet colour with alcoholic ferric chloride solution.

The non-volatile brown mass that remained in the flask was collected and crystallised from boiling water: white short needles, m.p. 110°. The yield is poor. It does not give any colour with alcoholic ferric chloride solution (Parikh, S. R., M.Sc. Thesis, Guj. Univ., 1955).
CHALKONE AND RELATED COMPOUNDS DERIVED FROM 2-HYDROXY-4-CHLORO-ACETOPHENONE AND BENZALDEHYDE:

Condensation of 2-hydroxy-4-chloro-acetophenone with benzaldehyde:

Formation of 2'-hydroxy-4'-chloro-chalkone:

2-Hydroxy-4-chloro-acetophenone (1.0 g.), benzaldehyde (0.8 g.), alcohol (7.0 c.c.) and potassium hydroxide (7.0 c.c.: 40.0%) were allowed to stand at room temperature for 18 hours. The product was decomposed with ice and concentrated hydrochloric acid. The yellow product obtained was crystallised from alcohol: yellow short needles, m.p. 125°.

Yield: 0.4 g. It gives red colour with concentrated sulphur acid. It dissolves in alkali with yellowish green colour and gives brown colour with alcoholic ferric chloride solution.

Analysis: 0.127 g. substance gave 0.070 g. AgCl

Found: Cl, 13.73 per cent.

C₁₅H₁₁O₂Cl requires: Cl, 13.63 per cent.

Acetyl derivative. — The chalkone (0.3 g.), acetic anhydride (3.0 c.c.) and fused sodium acetate (0.5 g.) were heated on a boiling water bath for 1 hour. The substance on pouring in ice was crystallised from alcohol: rhombic plates, m.p. 90°.

Analysis: 0.139 g. substance gave 0.0658 g. AgCl

Found: Cl, 11.80 per cent.

C₁₇H₁₃Cl requires: Cl, 11.81 per cent.
Action of bromine on 2'-hydroxy-4'-chloro chalkone: Formation of 2'-hydroxy-4'-chloro-chalkone dibromide:

2'-Hydroxy-4'-chloro chalkone (0.6 g.) dissolved in acetic acid (5.0 c.c.) and bromine in acetic acid (3.0 c.c.: 10.0%) were allowed to stand at room temperature for 12 hours. The yellow product separated was crystallised from alcohol: yellow fine needles, m.p. 180°. Yield: 0.3 g.

Analysis: 0.140 g. substance gave 0.172 g. Ag halide

Found: Cl, 8.47; Br, 38.19 per cent
C_{15}H_{11}O_2ClBr_2 requires: Cl, 8.48; Br, 38.23 per cent

Action of acetone and potassium iodide on 2'-hydroxy-4'-chloro chalkone dibromide: Formation of 2'-hydroxy-4'-chloro chalkone

The chalkone dibromide (0.3 g.) was treated with dry acetone (15.0 c.c.) and potassium iodide (0.2 g.) as described in the previous sections. 2'-Hydroxy-4'-chloro chalkone was obtained, m.p. and mixed m.p. with the original chalkone, 124°.

Action of alcoholic potassium hydroxide on 2'-hydroxy-4'-chloro-chalkone dibromide: Formation of 6-chloro-benzylidene coumarane

The chalkone dibromide (0.5 g.) was refluxed with alcohol: potassium hydroxide (1.0 g.: 30.0 c.c.) on a boiling water bath for 2 hours. The resultant product was poured in ice and then acidified with concentrated hydrochloric acid. The product obtained was crystallised from dilute alcohol: reddish yellow
fine needles, m.p. 194°. Yield: 0.1 g.

Analysis: 0.145 g. substance gave 0.0807 g. AgCl

Found: Cl, 13.77 per cent.

C₁₅H₉O₂Cl requires: Cl, 13.84 per cent.

Oxidation of 2'-hydroxy-4'-chloro-chalkone using isomyl alcohol and selenium dioxide: Formation of 7-chloro-flavone:

2'-Hydroxy-4'-chloro chalkone (0.5 g.), selenium dioxide (0.6 g.) and isomyl alcohol (10.0 c.c.) were heated in an oil bath at 140° for 8 hours. The solid obtained on working up as usual was crystallised from alcohol: colourless fine needles, m.p. 151°. It does not give any fluorescence with concentrated sulphuric acid but gives yellowish green colour. It does not dissolve in alkali.

Analysis: 0.120 g. substance gave 0.066 g. AgCl

Found: Cl, 13.60 per cent.

C₁₅H₉O₂Cl requires: Cl, 13.84 per cent.

Algar-Flynn oxidation of 2'-hydroxy-4'-chloro chalkone using alkaline hydrogen peroxide: Formation of 7-chloro-flavonol:

The chalkone (0.5 g.), sodium hydroxide (10.0 c.c.); 10% methyl alcohol (10.0 c.c.) and hydrogen peroxide (4.0 c.c.; 18% %) were kept in ice bath for 2 hours and then overnight at room temperature. The product obtained on pouring in ice was crystallised from alcohol: colourless shining plates, m.p. 181°. Yield: 0.15 g. It gives violet fluorescence
with boric acid-citric acid mixture in dry acetone. It
dissolves in concentrated sulphuric acid giving yellowish green
colour without any fluorescence.

**Analysis**: 0.135 g. substance gave 0.0701 g. AgCl

*Found*: Cl, 12.85 per cent.

\[
C_{15}H_9O_3Cl \text{ requires } Cl, 13.03 \text{ per cent.}
\]

**Condensation of 2'-hydroxy-4'-chloro chalcone with ethyl acetoacetate**: Formulation of ethyl-4- (2-hydroxy-4-chloro-phenyl)-6-phenyl-\(\Delta^3\)-cyclohexen-2-one-1-carboxylate:

The chalcone (0.5 g.), sodium in alcohol (0.2 g. in 10.0 c.c.) and ethyl acetoacetate (2.0 c.c.) were heated on a steam bath for 2 hours. It was then decomposed as usual and the colourless solid obtained was crystallised from acetic acid colourless needles, m.p. 143°.

**Analysis**: 0.185 g. substance gave 0.070 g. AgCl

*Found*: Cl, 9.43 per cent.

\[
C_{21}H_{19}O_4Cl \text{ requires } Cl, 9.58 \text{ per cent.}
\]

**Simultaneous hydrolysis and decarboxylation of the above carboxylate**: Formulation of 3- (2-hydroxy-4-chloro-phenyl)-6-phenyl-\(\Delta^2\)-cyclohexen-1-one:

The above carboxylate (0.3 g.) and potassium hydroxide (10.0 c.c.: 1 N) in alcohol (15.0 c.c.) were refluxed on a boiling water bath for 2 hours. The solid obtained on work up was crystallised from acetic acid: colourless fine needles,
m.p. 106°.

Analysis: 0.148 g. substance gave 0.071 g. AgCl

Found: Cl, 11.78 per cent.

C_{13}H_{15}O_{2}Cl requires: Cl, 11.90 per cent.

Attempted cyclisation of 2'-hydroxy-4'-chloro chalcone using alcoholic hydrochloric acid:

The chalcone was treated as in the previous experiments with dilute hydrochloric acid (10.0%), but the flavanone could not be obtained. The experiment was repeated with dilute sulphuric acid (5.0%) but in this case also the flavanone could not be obtained.

CHALKONE AND RELATED COMPOUNDS DERIVED FROM 2'-HYDROXY-4'-CHLOROACETOPHENONE AND M-HYDROXY BENZALDEHYDE:

Condensation of 2'-hydroxy-4'-chloro-acetophenone with m-hydroxy benzaldehyde: Formation of 3,2'-dihydroxy-4'-chloro chalcone:

2-Hydroxy-4-chloro-acetophenone (1.0 g.), m-hydroxy-benzaldehyde (0.8 g.), alcohol (10.0 c.c.) and potassium hydroxide (7.0 c.c.; 40.0%) were kept at room temperature for 18 hours. The resultant yellow product obtained on working up was crystallised from acetic acid; yellow fine needles, m.p. 135°. Yield: 0.5 g.
Analysis: 0.175 g. substance gave 0.067 g. AgCl

Found: Cl, 12.82 per cent.

C_{15}H_{11}O_3Cl requires: Cl, 12.93 per cent.

Bromination of 3:2'-dihydroxy-4'-chloro chalkone: Formation of 3:2'-dihydroxy-4'-chloro chalkone dibromide:

3:2'-Dihydroxy-4'-chloro chalkone (0.4 g.) in acetic acid (5.0 c.c.) and acetic acid solution of bromine (2.0 c.c.: 10.0%) were allowed to stand at room temperature overnight. The yellow product obtained was crystallised from alcohol:

yellow needles, m.p. 162°. Yield: 0.1 g.

Analysis: 0.143 g. substance gave 0.169 g. Ag halide

Found: halogen, 44.71 per cent.

C_{15}H_{11}O_3ClBr_2 requires: halogen, 44.99 per cent.

Action of acetone and potassium iodide on 3:2'-dihydroxy-4'-chloro chalkone dibromide: Formation of 3:2'-dihydroxy-4'-chloro chalkone:

The chalkone dibromide (0.3 g.) was heated with potassium iodide (0.2 g.) in dry acetone (15.0 c.c.) as described in the previous experiments. 3:2'-Dihydroxy-4'-chloro chalkone was obtained: m.p. and mixed m.p. 132°.
CHALKONE AND RELATED COMPOUNDS DERIVED FROM 2-HYDROXY-4-CHLORO-ACETOPHENONE AND ANISALDEHYDE:

Condensation of 2-hydroxy-4-chloro acetophenone with anisaldehyde

Formation of 2′-hydroxy-4′-chloro-4-methoxy chalkone:

2-Hydroxy-4-chloro-acetophenone (1.0 g.), anisaldehyde (0.8 g.), alcohol (10.0 c.c.) and potassium hydroxide (7.0 c.c. : 40.0 %) were kept at room temperature for 24 hours. The yellow product obtained on working up was crystallised from acetic acid: yellow needles, m.p. 136°. Yield: 0.4 g.

Analysis: 0.210 g. substance gave 0.105 g. AgCl

Found: Cl, 12.45 per cent.

C₁₆H₁₃O₃Cl requires: Cl, 12.66 per cent.

Bromination of 2′-hydroxy-4′-chloro-4-methoxy chalkone:

Formation of 2′-hydroxy-4′-chloro-4-methoxy chalkone dibromide:

The chalkone (0.6 g.) in acetic acid (10.0 c.c.) and bromine (3.0 c.c. : 10.0 %) in the same solvent were left at room temperature overnight. The yellow solid obtained was crystallised from alcohol: yellow fine needles, m.p. 60°.

Analysis: 0.182 g. substance gave 0.214 g. Ag halide

Found: halogen, 44.23 per cent.

C₁₆H₁₃O₃ClBr₂ requires: halogen, 44.37 per cent.
Action of acetone and potassium iodide on 2'-hydroxy-4'-chloro-4-methoxy-chalkone dibromide: Formation of 2'-hydroxy-4'-chloro-4-methoxy-chalkone:

The chalkone dibromide (0.3 g.) was treated with potassium iodide (0.2 g.) and dry acetone (10.0 c.c.) as usual when 2'-hydroxy-4'-chloro-4-methoxy-chalkone was obtained, m.p. and mixed m.p. 134°.

Chalkone and Related Compounds Derived from 2'-Hydroxy-4'-Chloro-Acetophenone and Versatraldehyde:

Condensation of 2'-hydroxy-4'-chloro-acetophenone with versatraldehyde: Formation of 2'-hydroxy-4'-chloro-3:4-dimethoxy-chalkone:

2-Hydroxy-4-chloro-acetophenone (1.0 g.), versatraldehyde (0.8 g.), alcohol (10.0 c.c.) and potassium hydroxide (7.0 c.c.: 40°0 %) were allowed to stand at room temperature for twenty four hours. It was worked up as usual and the yellow product obtained was crystallised from acetic acid: yellow plates, m.p. 112°. Yield: 0.5 g.

Analysis: 0.180 g. substance gave 0.081 g. AgCl

Found: Cl, 11.20 per cent.

C_{17}H_{15}O_{4}Cl requires: Cl, 11.43 per cent.
Bromination of 2'-hydroxy-4'-chloro-3:4-dimethoxy chalkone:
Formation of 2'-hydroxy-4'-chloro-3:4-dimethoxy chalkone dibromide:

The chalkone (0.8 g.) in acetic acid (15.0 c.c.) and acetic acid solution of bromine (4.0 c.c. : 10.0 %) were kept at room temperature overnight. The yellow solid obtained was crystallised from acetic acid: yellow fine needles, m.p. 90°. Yield : 0.4 g.

Analysis : 0.240 g. substance gave 0.263 g. Ag halide

Found : halogen, 41.37 per cent.

C_{17}H_{16}O_{4}ClBr_{2} requires : halogen, 41.55 per cent.

Action of acetone and potassium iodide on 2'-hydroxy-4'-chloro-3:4-dimethoxy chalkone dibromide:
Formation of 2'-hydroxy-4'-chloro-3:4-dimethoxy chalkone:

The chalkone dibromide (0.3 g.) was treated with dry acetone (15.0 c.c.) and potassium iodide (0.2 g.) as described in the previous experiments. 2'-Hydroxy-4'-chloro-3:4-dimethoxy chalkones was obtained, m.p. and mixed m.p. 118°
CHALKONE AND RELATED COMPOUNDS DERIVED FROM 2-HYDROXY-4-CHLORO-ACETOPHENONE AND PIPERONAL:

Condensation of 2-hydroxy-4-chloro-acetophenone with piperonal:

Formation of 2'-hydroxy-4'-chloro-3:4-methylenedioxy chalkone:

2-Hydroxy-4-chloro acetophenone (1.0 g.) in alcohol (10° C c.c.), piperonal (0.8 g.) and potassium hydroxide (7.0 c.c. : 40° 0 %) were allowed to stand at room temperature overnight. The yellow product obtained on working up was crystallised from acetic acid: yellow short needles, m.p. 180°. Yield: 0.4 g.

Analysis: 0.210 g. substance gave 0.099 g. AgCl

Found: Cl, 11.70 per cent.

C₁₆H₁₁O₄Cl requires: Cl, 12.06 per cent.

Bromination of 2'-hydroxy-4'-chloro-3:4-methylenedioxy chalkone

Formation of 2'-hydroxy-4'-chloro-3:4-methylenedioxy chalkone dibromide:

A solution of the chalkone (0.4 g.) in acetic acid (10° 0 c.c.) and a solution of bromine in acetic acid (2° 0 c.c. 10° 0 %) were left at room temperature overnight. The solid obtained on working up was crystallised from acetic acid: pale yellow fine needles, m.p. 80°. Yield: 0.1 g.
Analysis: 0.180 g. substance gave 0.203 g. Ag halide

Found: halogen, 42.57 per cent.

$C_{17}H_{15}OClBr_2$ requires: halogen, 43.00 per cent.

Action of acetone and potassium iodide on 2'-hydroxy-4'-chloro-3:4-methylenedioxy chalkone dibromide: Formation of 2'-hydroxy-4'-chloro-3:4-methylenedioxy chalkone:

The chalkone dibromide (0.3 g.) was treated with dry acetone (15.0 c.c.) and potassium iodide (0.2 g.) as described in the previous experiments. 2'-Hydroxy-4'-chloro-3:4-methylenedioxy chalkone was obtained, m.p. and mixed m.p. 180°.

CHALKONE DERIVED FROM 2-HYDROXY-4-CHLORO ACETOPHENONE AND META-NITRO-BENZALDEHYDE:

Condensation of 2-hydroxy-4-chloro acetophenone with m-nitrobenzaldehyde: Formation of 2'-hydroxy-4'-chloro-3-nitro-chalkone:

2-Hydroxy-4-chloro-acetophenone (1.0 g.), m-nitrobenzaldehyde (0.8 g.), alcohol (10.0 c.c.) and potassium hydroxide (7.0 c.c. : 20.0%) were kept at room temperature for 1 hour. The yellow product obtained on working up was crystallised from acetic acid, yellow short needles, m.p. 199°. Yield: 0.6 g.
Analysis: 0.190 g. substance gave 0.088 g. AgCl

Found: Cl, 11.50 per cent.

\[ \text{C}_{15}\text{H}_{10}\text{O}_4\text{ClN} \] requires: Cl, 11.69 per cent.

**CHALKONES DERIVED FROM 2-HYDROXY-4-CHLORO-ACETOPHENONE AND PARA-NITRO CHALKONE:**

Condensation of 2-hydroxy-4-chloro-acetophenone with p-nitrobenzaldehyde: Formation of 2'-hydroxy-4'-chloro-4-nitro-chalkone:

2-Hydroxy-4-chloro-acetophenone (1.0 g.), p-nitrobenzaldehyde (0.8 g.), alcohol (10.0 c.c.) and potassium hydroxide (7.0 c.c.: 20.0% w.) were kept at room temperature for 1 hour. The yellow product obtained on working up as before was crystallised from acetic acid: yellow needles, m.p. 222°. Yield: 0.5 g.

Analysis: 0.210 g. substance gave 0.097 g. AgCl

Found: Cl, 11.45 per cent.

\[ \text{C}_{15}\text{H}_{10}\text{O}_4\text{ClN} \] requires: Cl, 11.69 per cent.

**CHALKONES DERIVED FROM 2-HYDROXY-4-CHLORO ACETOPHENONE AND CINNAMIC ALDEHYDE:**

Condensation of 2-hydroxy-4-chloro-acetophenone with cinnamic aceto phenone aldehyde: Formation of 2-hydroxy-4-chloro cinnamylidene:

2-Hydroxy-4-chloro-acetophenone (1.0 g.), cinnamic
aldehyde (0.8 g.), alcohol (10.0 c.c.) and potassium hydroxide (7.0 c.c. : 80.0 %) were left at room temperature overnight. It was worked up as usual. The yellow product obtained was crystallised from acetic acid: reddish yellow fine needles, m.p. 160°. Yield: 0.4 g.

Analysis: 0.220 g. substance gave 0.108 g. AgCl

Found: Cl, 12.15 per cent.

C_{17}H_{13}O_{2}Cl requires: Cl, 12.47 per cent.