# Synthesis and Structure of 6- and 7- (2-Arylvinyl)pteridines



Sayed A. L. Abdel-Hady*, Mohamed A. Badawy, Azza M. Kadry and Mosselhi A. N. Mosselhi

Department of Chemistry, Faculty of Science, University of Cairo
Giza, A. R. Egypt

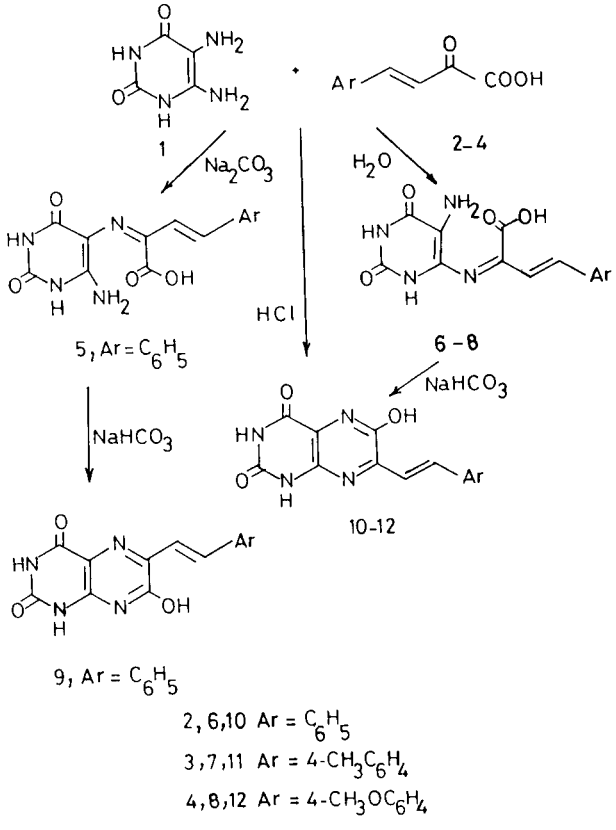
Received February 17, 1987

7-Hydroxy-6-styrylpteridine **9** and 7-(2-arylvinyl)-6-hydroxypteridines **10-12** were synthesized *via* the condensation of 5,6-diaminouracil **1** with benzylidenepyruvic acids **2-4**. The synthesis of the 2-methylthio analogue **15** is also described.

*J. Heterocyclic Chem.*, **24**, 1587 (1987).

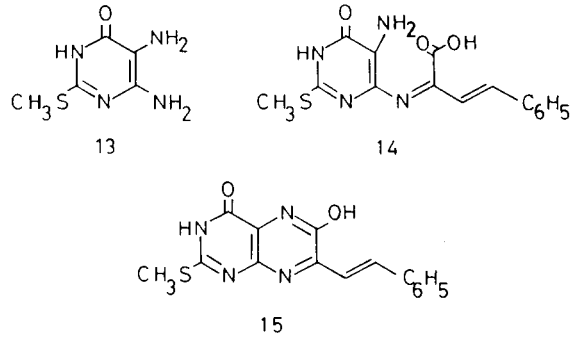
In a previous publication [1] we reported the reaction between some 5,6-diaminouracils and ethyl aroylpyruvates under acidic and basic conditions and we have found that cyclocondensation took place to give a series of isomeric hydroxyphenacylpteridines. This prompted us to extend our study to investigate the condensation between 5,6-diaminouracils and benzylidenepyruvic acids in order to synthesize the hitherto unknown (2-arylvinyl)hydroxypteridines.

Thus, when 5,6-diaminouracil (**1**) was allowed to react with benzylidenepyruvic acid (**2**) in aqueous sodium carbonate, condensation at the 5-amino group occurs first to give **5** rather than the isomeric compound **6**. When **5** was heated under reflux in aqueous sodium bicarbonate it underwent cyclization into 7-hydroxy-6-styryl-2,4(1*H*,3*H*)-pteridinedione (**9**). On the other hand, when the condensation between **1** and **2** was conducted in hydrochloric acid the 6-hydroxy isomer **10** resulted directly in one step.




The structures of the isomeric pteridines **9** and **10** have been confirmed based on their uv absorption spectra and analytical data. Whereas compound **9** gave rise to a shorter wavelength absorption band at 342 nm, the isomeric compound **10** absorbs only at a longer wavelength, *i.e.* 382 nm (this behaviour is in agreement with the reported behaviour of 6- and 7-hydroxypteridine derivaties [2,3]). Furthermore the structure of **10** was established by the fact that compound **1** condenses with the arylidinepyruvic acids **2-4** in water to give the 2-[(5-amino-6-uracilyl)imino]-4-aryl-3-butenoic acids **6-8** which on heating under reflux in sodium hydrogen carbonate underwent cyclization into 7-(2-arylvinyl)-6-hydroxy-2,4(1*H*,3*H*)-pteridinediones **10-12**.

5,6-Diamino-2-(methylthio)-4(3*H*)-pyrimidinone (**13**) condenses with benzylidenepyruvic acid (**2**) in water to give the monocyclic product **14** which when refluxed with aqueous sodium bicarbonate cyclizes into 6-hydroxy-2-methylthio-7-styryl-4(3*H*)-pteridinone (**15**). It should be noted that this behaviour is in contrast to the behaviour of **13** when condensed with ethyl benzoylpyruvate in pyrimidine where 7-hydroxypteridine was obtained directly [1]. The structure of **15** was confirmed by the fact that it was readily hydrolyzed into **10** on heating under reflux with ethanolic hydrochloric acid.



## EXPERIMENTAL

All melting points are uncorrected. The mass spectrum was recorded on Finnigan MAT 312, 70 eV spectrometer. Ultraviolet spectra were obtained on Unicam SP 1750 spectrophotometer. $R_f$ values were determined on Whatman Chromatography paper No. 1 after dissolving the compounds in a mixture of isopropyl alcohol/1% ammonium hydroxide (1:1); fluorescence colour under uv Tungsram 150 W lamp.

Compounds prepared by different procedures were identified by uv spectra (methanol) and $R_f$ values.

7-Hydroxy-6-styryl-2,4(1*H*,3*H*)-pteridinedione (**9**).

A mixture of 1.78 g (10 mmoles) of 5,6-diaminouracil hydrochloride (**1**.HCl), 0.53 g (5 mmoles) of sodium carbonate and 2.14 g (10 mmoles) of the potassium salt of benzylidenepyruvic acid [4] (**2**.K salt) was stirred in 100 ml of water at room temperature for 2 hours. The product was filtered off to give **5**, mp ô 300°, yield 70%. Three g (10 mmoles) of **5** was dissolved in 75 ml of 1*N* sodium bicarbonate and the solution was heated under reflux for 1 hour, cooled and acidified with 1*N* hydrochloric acid. The product obtained was purified by dissolving in 100 ml of 5% sodium carbonate and reprecipitated by the addition of 1*N* hydrochloric acid, filtered, washed with water and dried to give **9**, mp >300° (Table 1 and Table 2).

2-[(5-Amino-6-uracilyl)imino]-4-aryl-3-butenoic Acids **6-8**.

A mixture of **1**.HCl (20 mmoles) and the appropriate arylidenepyruvic acid [4] **2-4** (20 mmoles) in 200 ml of water was stirred at room temperature for 2 hours and left to stand overnight. The product obtained was crystallized from ethanol into **6-8**, respectively, mp >300° (Table 1).

Table 1

Yields and Analytical Characterization of Compounds **6-12**, **14** and **15**

| Products [a] | Yield % | Formula (Molecular Weight) | Analysis % [b] Calcd./Found C | H | N |
|---|---|---|---|---|---|
| **6** | 80 | $C_{14}H_{12}N_4O_4$ (300.27) | 56.00<br>55.80 | 4.03<br>3.90 | 18.66<br>18.80 |
| **7** | 77 | $C_{15}H_{14}N_4O_4$ (314.30) | 57.32<br>57.40 | 4.49<br>4.60 | 17.83<br>17.70 |
| **8** | 75 | $C_{15}H_{14}N_4O_5$ (330.30) | 54.55<br>54.70 | 4.27<br>4.10 | 16.96<br>17.20 |
| **9** | 40 | $C_{14}H_{10}N_4O_3$ (282.26) | 59.57<br>59.70 | 3.57<br>3.40 | 19.85<br>19.80 |
| **10** | 40 | $C_{14}H_{10}N_4O_3$ (282.26) | 59.57<br>59.40 | 3.57<br>3.80 | 19.85<br>20.00 |
| **11** | 50 | $C_{15}H_{12}N_4O_3$ (296.28) | 60.81<br>61.00 | 4.08<br>4.30 | 18.91<br>18.60 |
| **12** | 40 | $C_{15}H_{12}N_4O_4$ (312.28) | 57.69<br>57.80 | 3.87<br>3.70 | 17.94<br>18.10 |
| **14** | 60 | $C_{15}H_{14}N_4O_3S$ (330.36) | 54.54<br>54.70 | 4.27<br>4.00 | 16.96<br>17.20 |
| **15** | 45 | $C_{15}H_{12}N_4O_2S$ (312.34) | 57.68<br>57.50 | 3.87<br>3.60 | 17.94<br>18.20 |

[a] Compounds **9**, ms: m/e 282 ($M^+$); uv: λ max (log ε max): 268 (5.07), 342 nm (4.79); **10**, uv: λ max (log ε max): 302 (4.92), 382 nm (5.02), **15**, uv: λ max (log ε max): 258 (4.71), 372 nm (4.38). [b] Compounds **14**, S, Calcd: 9.71. Found: 9.90; **15**, S. Calcd: 10.26. Found: 10.40.

Table 2

$R_f$ Values and Fluorescence Colour of Compounds **9-12** and **15**

| Products | 1-Butanol/ 5*N* Acetic Acid (2:1) $R_f$ | 1-Proponal/ 1% Ammonium Hydroxide (2:1) $R_f$ | Fluorescence [a] |
|---|---|---|---|
| **9** | 0.85 | 0.50 | V |
| **10** | 0.79 | 0.74 | BG |
| **11** | 0.86 | 0.66 | BG |
| **12** | 0.70 | 0.57 | BG |
| **15** | 0.72 | 0.63 | BG |

[a] V: Violet; BG: Bluish-green.

7-(2-Arylvinyl)-6-hydroxy-2,4(1*H*,3*H*)-pteridinediones **10-12**.

Each of compounds **6-8**, respectively (10 mmoles) was heated under reflux in 75 ml sodium bicarbonate for 1 hour, cooled and acidified with 1*N* hydrochloric acid. The product was crystallized from DMF into **10-12**, respectively, mp >300° (Table 1 and Table 2).

6-Hydroxy-7-styryl-2,4(1*H*,3*H*)-pteridinedione (**10**).

a) A mixture of 1.78 g (10 mmoles) of 5,6-diaminouracil hydrochloride (**1**.HCl) and 1.76 g (10 mmoles) of benzylidenepyruvic acid (**2**) was heated under reflux in 100 ml of 1*N* hydrochloric acid for 1 hour and cooled. The precipitate was collected, washed with water and crystallized from DMF into **10**, mp >300°, yield 50%.

b) Compound **15** (1 mmole) was heated under reflux in a mixture of 3 ml of concentrated hydrochloric acid and 5 ml of ethanol until no methanethiol evolved (1 hour) and cooled. The precipitate was collected and crystallized from DMF into **10**, yield 50%.

2-[(5-Amino-1,6-dihydro-2-(methylthio)-6-oxo-4-pyrimidinyl)imino]-4-phenyl-3-butenoic Acid (**14**).

A mixture of 1.72 g (10 mmoles) of 5,6-diamino-2-(methylthio)uracil (**13**) and 1.76 g (10 mmoles) of benzylidenepyruvic acid (**2**) was stirred in 200 ml of water for 2 hours at ambient temperature. The product obtained was crystallized from ethanol to give **14**, mp 220° dec (Table 1).

6-Hydroxy-2-(methylthio)-7-styryl-4(3*H*)-pteridinone (**15**).

This compound was prepared by the cyclization of **14** following the procedure described for the preparation of **10-12** and crystallized from DMF, mp >300° (Table 1 and Table 2).

Acknowledgement.

We are very thankful to Professor Dr. Wolfgang Pfleiderer, Fakultät für Chemie der Universität Konstanz, for his generous assistance in obtaining the spectral analysis for many of the new compounds.

## REFERENCES AND NOTES

[1] S. A. L. Abdel-Hady, M. A. Badawy, M. A. N. Mosselhi and Y. A. Ibrahim, *J. Heterocyclic Chem.*, **22**, 801 (1985).

[2] W. Pfleiderer, *Chem. Ber.*, **90**, 2588 (1957).

[3] W. Pfleiderer, *Chem. Ber.*, **90**, 2604 (1957).

[4] M. Semonsky, M. Bern, J. Neumannova, H. Skvorova, and V. Jelinek, *Collect. Czech, Chem. Commun.*, **32**, 4439 (1967).