

do not depend on the value of the absorption coefficient are reproduced for $\text{LaCl}_3 : \text{Eu}^{3+}(0.3\%)$ in figure 4 which also show that the nonradiative processes increase in order of $D_2 > D_1 > D_0$ with the temperature.

The most probable explanation of the decrease in relative emission intensities of the 5D_3 state can be the temperature quenching of the higher state emission during electron bombardment. Although both the spectra were recorded at room temperature (290 K), in case of CRE the intensity ratio of D_1 and D_3 transitions correspond to a temperature of 305 K for PE. It seems that some sort of local temperature develops by 15°C approximately during CRE and results in the quenching of the D_3 emission. The other probability is that $D_3 \rightarrow D_j$ ($j = 0, 1, 2$) nonradiative crossing rate may be different in the two excitations.

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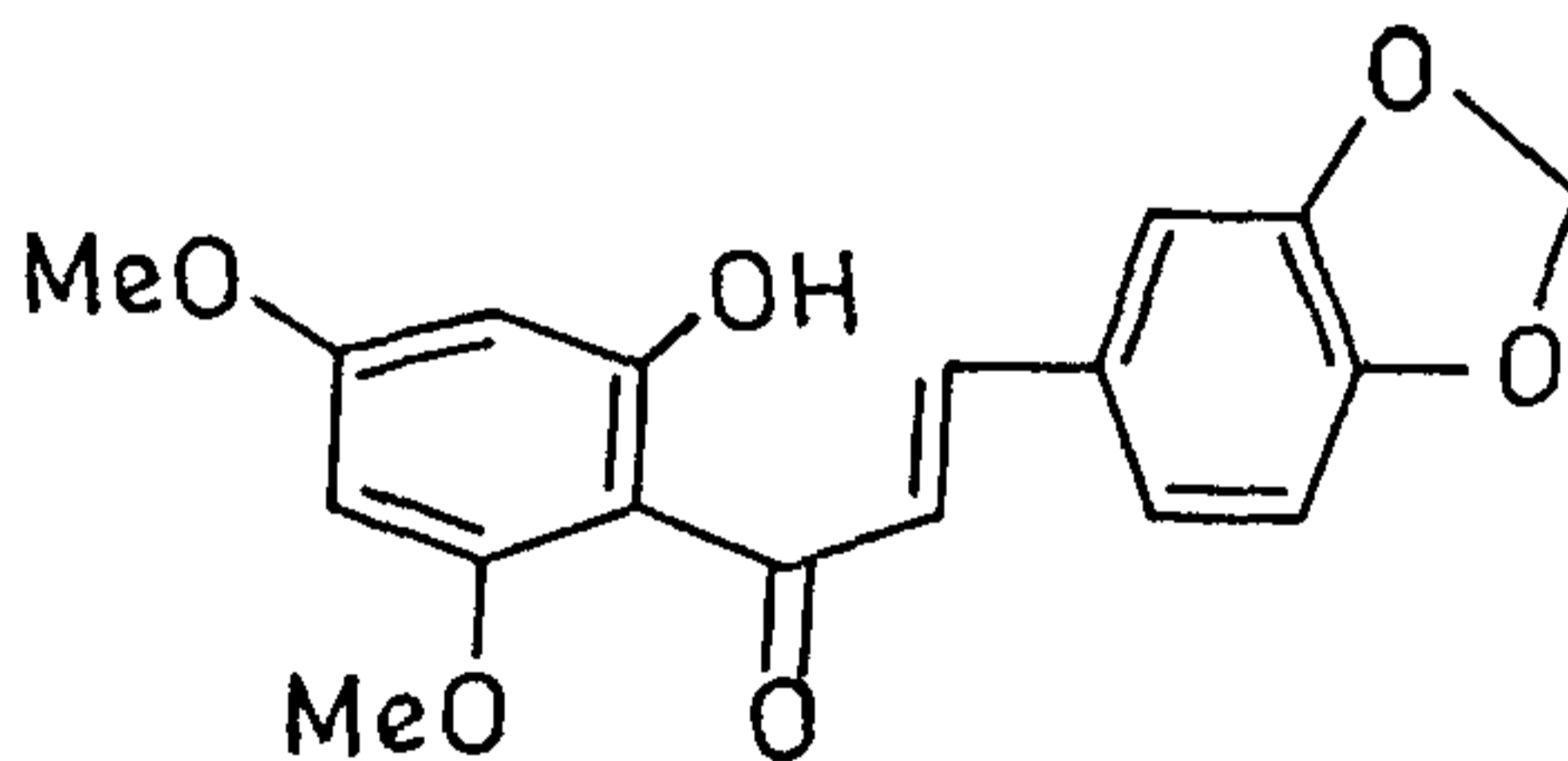
TEPHRONE, A NEW CHALCONE FROM *TEPHROSIA CANDIDA* SEEDS

S. S. CHIBBER AND S. K. DUTTA
Department of Chemistry, University of Delhi,
Delhi 110 007, India.

IN our earlier work on the chemical constituents of the seeds of *Tephrosia candida*, the isolation and identification of pongachin, candidin and candidol were reported¹⁻³. The present note reports the isolation and characterization of a new chalcone, tephron, from the same source.

The petroleum ether and benzene extracts of the seeds were found to be similar on TLC, hence combined and treated with ether. The ether soluble fraction was subjected to column chromatography over silica

gel. Elution with petroleum ether-benzene (7:13) yielded a yellow crystalline compound (40 mg), m.p. $165-6^\circ$. When analysed for $\text{C}_{18}\text{H}_{16}\text{O}_6$, it did not respond to Shinoda's test, but gave a greenish-brown colour with alcoholic ferric chloride and a green colour with gallic acid- H_2SO_4 , indicating chelated hydroxyl and methylenedioxy group, respectively. The former was further supported by absorptions at 3370 and 1635 cm^{-1} in IR and a singlet at $\delta 14.30$ in the NMR spectrum (CDCl_3) of the compound. The UV spectrum showed λ_{max} $224, 368\text{ nm}$ in methanol which was found to undergo a bathochromic shift of 44 nm with aluminium chloride suggesting a 2'-hydroxychalcone skeleton for the compound. That tephron is a chalcone was confirmed by two doublets ($J = 17\text{ Hz}$) at $\delta 7.44$ and 7.72 (characteristic of H_α and H_β of chalcones)⁴. NMR of the compound also showed two singlets at $\delta 3.78$ and 3.86 , integrating for three protons each, due to two methoxyls. A positive Gibb's test and two doublets ($J = 2.5\text{ Hz}$) centred at $\delta 5.90$ and 6.04 , corresponding to $\text{H}-3'$ and $\text{H}-5'$ respectively, established the 2'-Hydroxy-4',6'-dimethoxy substitution pattern for ring A. The presence of the methylenedioxy group was confirmed by bands at 925 and 1040 cm^{-1} in IR⁵ and a two-proton singlet at $\delta 5.95$ in the NMR spectrum. The fact that it must be present in ring B was indicated by an ABX system in NMR in the range $\delta 6.72-7.22$, characteristic of 3,4-substitution in ring B. The piperonyl residue⁶ was established by alkaline degradation of tephron which yielded a compound, m.p. $227-9^\circ$, identified as piperonylic acid. On the basis of the above spectral and chemical data, tephron is assigned the structure 2'-hydroxy-4',6'-dimethoxy-3,4-methylenedioxy-chalcone (I).



(I)

The identity of the compound was finally confirmed by its synthesis⁷ starting from 2-hydroxy-4,6-dimethoxyacetophenone and piperonal. Condensation of the two substances in the presence of 60% potassium hydroxide in aqueous alcohol yielded a yellow solid which agreed with the natural sample (m.p., m.m.p., co-TLC and co-IR).

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ENERGY TERMS OF f^2 -CONFIGURATION BY CONSTRUCTING THE PIGEON HOLE DIAGRAM

G. K. JOSHI

Department of Chemistry, Govt. P. G. College,
Nagaur 341 001, India.

THE energy terms of a f^N -configuration have rarely been determined by constructing a pigeon hole diagram by earlier workers¹⁻⁴. This is because the determination of the microstates is more cumbersome in the case of a f^N -configuration in comparison with a d^N -configuration. In the present communication the method has been described to determine all the energy terms in the case of f^2 -configuration. By using similar procedure, the energy terms for other f^N -configuration will also be determined. The energy terms for a f^N -configuration or a d^N -configuration are determined by applying LS or jj coupling scheme⁵.

Determination of energy terms.

(a) General Instructions:

In this method all the different possible ways can be given in which any number of electrons can be arranged with parallel or opposite spins obeying Pauli's exclusion principle¹. The different degenerate microstates for a f^N -configuration result when a pigeon hole diagram corresponding to each S value is constructed. These microstates then produce the various non-degenerate states or energy terms by applying the LS-coupling rules. In this way all the energy terms from all the possible S values for a f^N -configuration are determined. The energy term is given by $2S + 1L_J$ where S , L and J have their usual meaning. Various energy terms are then arranged in the order depending

upon the values of S (or $2S + 1$), L and J . When the value of $2S + 1$ (Spin multiplicity) is same for the different energy terms, then lower order is given for higher values of L . Further, if the configuration is one from f^1 to f^7 then the lower order is given for lower values of J . But if the configuration is from f^8 to f^{13} then the lower order is given for higher values of J .

In the case of different $(2S + 1)$ values, the lower order is given for higher values of $(2S + 1)$. But actually when energy level diagram is seen for $4f^2$ (or other $4f^N$)-configuration then what is observed is something different from the expected when this rule is applied. According to energy level diagram the energy terms for $4f^2$ configuration can be given⁶ as follows:

$4f^2$ -configuration (P^2 ion):-

3H_4 , 3H_5 , 3H_6 , 3F_2 , 3F_3 , 3F_4 , 1G_4 , 1D_2

3P_0 , 3P_1 , 1I_6 , 3P_2 and 1S_0

Here the energy terms 1G_4 and 1D_2 have lower position in comparison to the energy terms 3P_0 and 3P_1 . Also the energy term 1I_6 have a lower position in comparison to energy term 3P_2 . Probably this may be due to the smaller or the greater energy differences (ΔJ) between the energy terms of one multiplet to another multiplet.

(b) Determination of energy terms in a f^2 -configuration

In a f^2 -configuration two pigeon hole diagrams will be constructed as it has two S values *i.e.* 1 and 0 (figures 1 and 2).

The pigeon hole diagram when S equals one (figure 1) contains twenty one M_L values. These are the various microstates from which the nine non-degenerate energy states or energy terms can be obtained as follows:

(i) The eleven M_L values *i.e.* +5 to 0 to -5 correspond to $L = 5$, $S = 1$ and $J = 4, 5, 6$ indicated by the single underline (figure 1) form the energy terms given as 3H_4 , 3H_5 and 3H_6 .

(ii) The seven M_L values *i.e.* +3 to 0 to -3 correspond to $L = 3$, $S = 1$ and $J = 2, 3, 4$ indicated by the double underline (figure 1) form the energy terms given as 3F_2 , 3F_3 and 3F_4 .

(iii) The three M_L values *i.e.* 1, 0 and -1 correspond to $L = 1$, $S = 1$ and $J = 0, 1, 2$ indicated by triple underline (figure 1) form the energy terms given as 3P_0 , 3P_1 and 3P_2 .

The pigeon hole diagram when S equals zero (figure 2) gives twenty eight M_L values (or microstates) out of which four energy terms can be obtained which can be given as 1I_6 , 1G_4 , 1D_2 and 1S_0 .