

It was never suggested that free formic acid

has the structure : $\begin{array}{l} \text{OH} \\ \diagup \\ \text{C} \\ \diagdown \\ \text{OH} \end{array}$. The relevant

portion of my letter is, "In my opinion the exceptional properties of formic acid are due to the fact that in it the carboxyl is linked to a hydrogen atom whereas in its homologues the carboxyl is linked to alkyl groups and that *in the course of certain of its reactions formic acid is capable of undergoing isomeric change into dihydroxymethylene.*



Hence there seems to be no justification for Halasyam's remarks on basicity and parachor. There is again mention in his note of "unequivocal evidence from Raman spectra and Isomorphism of Formates and Nitrites" to support the new structure. I would refer him in this connection to Venkateswaran's paper,¹ which was published about the end of the same month to show that Raman spectrum evidence is decidedly against it. This question was not raised in my previous letter since it was felt that it required careful investigation which was being arranged for. Regarding isomorphism, I consider that the point is still to be established. A detailed discussion will be taken up later on.

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¹ *Proc. Ind. Acad. Sci.*, 1935, 2, 615.

It is admitted by Seshadri that formic acid with "the simple rational constitution, in the course of certain reactions, is capable of undergoing isomeric change into dihydroxymethylene." If this does not mean a labile structure, I wonder what constitutes one. Venkateswaran in the paper referred to by Seshadri suggests that the Raman line 1534 cm^{-1} observed in the case of lead-formate may be due to the possible dihydroxymethylene structure proposed by the latter. Although this is not the place to enter into a discussion of the case, as a

Raman line 1542 cm^{-1} is given by sodium acetate¹ the origin of this line is a matter of much uncertainty.

Further, the evidence adduced by Venkateswaran from Raman spectra in support of the classical formula for formic acid is by no means conclusive. The 2930 (strictly the 2960) line of the C-H linkage is likewise absent in his spectrograms; instead, the lines 2834 and 2732 are attributed to this linkage. Whether such a large shift, from 2960-2834, is normal in salt formation is uncertain. On the analogy of the higher homologues, acetic and propionic acids and the substituted chloroacetic acid and their metallic salts, where salt formation does not shift the line by more than a few wavenumbers,² one is more inclined to imagine a rupture of the C-H linkage in the formates.

It is a matter of deep regret that Seshadri does not "consider that formates and nitrites are" isomorphous, in the face of mixed crystal formation in these salts, cited by Sarkar and Ray.³ Either Seshadri disbelieves the work of these authors, or he is unable to throw away the shackles of age-long tradition.

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3, Y. M. I. A.,
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¹ Cf. Edsall, *J. Chem. Phys.*, Jan. 1936, 1.

² Edsall, *loc. cit.*

³ *Proc. Ind. Sci. Congress*, 1935, p. 109.

The Non-Protein Nitrogen of Pulses.

In a previous communication¹ attention was directed to the dietary significance of the easily assimilable non-protein nitrogen fraction occurring in appreciable percentages in some of the pulses. A study of the amino acid make-up of the fraction is important not only from the view-point of its nutritive value but also from the standpoint of its physiological relationship with the proteins of the pulse. The non-protein nitrogen of the three well-known pulses, *P. aconitifolius*, *Cicer arietinum*, *P. mungo*, has now been partitioned by the method of Van Slyke as modified by Damodaran² so as to include the dicarboxylic acid nitrogen. An independent estimation of arginine by arginase has also been carried out.