Pyridinium Salts

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1,7-Diaza[12]annulene Derivatives? 100-Year-Old Pyridinium Salts!

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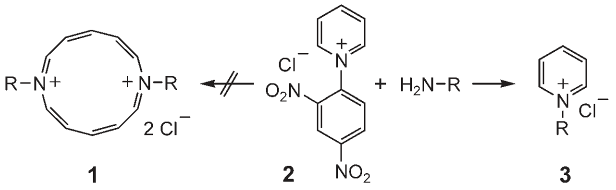
A Communication containing the formula of the 1,7-diaza[12]annulene derivatives **1**[1a] attracted my attention recently. When I read that Shi, Lundberg, Musaev, and Menger (SLMM)[1a] claimed to have prepared this interesting heterocycle from *N*-(2,4-dinitrophenyl)pyridinium chloride (**2**) and saturated primary amines, this reaction seemed to be familiar to me, and, thus, I looked expectantly into the only paper quoted with regard to the synthesis.[2] In 2006, Yamaguchi, Gobara, and Sato (YGS)[2] had described the treatment of **2** with primary amines, mainly anilines, and asserted to have obtained **1**. In a comparison with their results, YGS just mentioned the formation of 5-(arylamino)penta-2,4-dienal(aryliminium) chlorides from **2** and anilines cited in a review in 1980.[3]



Warning bells definitely started to ring, when I looked at the reaction conditions given by YGS, because these were virtually the same as those Zincke, Heuser, and Möller[4] utilized to prepare the *N*-substituted pyridinium chlorides **3** directly from **2** and primary amines (methylamine and anilines) 103 years ago. Ever since, this is the method of choice for the synthesis of *N*-arylpyridinium chlorides. This reaction has found its way into the handbooks of heterocyclic chemistry, and was also kinetically studied.[5]

That YGS made an error is evident from data in the literature. Thus, the melting point of an alleged **1** (R = 4-ClC_6H_4) coincides with two numbers previously given for the corresponding **3**.[4b,6] In addition, the ^{13}C NMR chemical shifts of four alleged salts **1** agree excellently with those of the respective salts **3**.[6] Only for one alleged **1** (R = 4-FC_6H_4), are there two deviations from the values of the corresponding **3**.[7] However, these can be traced back to the poor signal-to-noise ratio of the spectrum of YGS, as evident from the Supporting Information. Also, the ^1H NMR spectrum of an alleged **1** (R = 2,5-$Me_2C_6H_3$), depicted by YGS, is perfectly in accord with that of a pyridinium salt.

My criticism expressed by e-mail (10 September 2007) was answered by YGS immediately. They had noticed their insufficient knowledge of the literature by themselves or it had been pointed out to them by a third party. They conceded the similarity of their data with those of pyridinium salts and referred to a correction that they had submitted, but insisted in one case on "conclusive" evidence against a pyridinium salt based on conductivity measurements. Polymers containing moieties of the alleged **1** had also been described by YGS in an additional paper.[8] On my second objection (17 October 2007), YGS replied that they had sent an e-mail to the editor of *Organic Letters* for retraction of their work.[2]

To my e-mail (25 September 2007), pointing out the similarity of the ^{13}C NMR chemical shifts of the CH groups of their alleged compounds **1**[1a] with those of *N*-methyl- and *N*-ethylpyridinium chloride, SLMM responded with rejection at first, in particular, they advanced a rather futile mechanistic argument and emphasized the precise masses of their products. These had been determined by using ESI-MS, a method in which the association of particles is well known. My doubts in this respect (27 September 2007) made SLMM perform further experiments at once, resulting in the Corrigendum printed in this issue.[1b]

The errors of YGS and SLMM raise important questions. The bibliographies of the corresponding authors show that they are less interested in fundamental chemistry than in its applications. As a general rule, gaps in the knowledge of the discipline have to be accepted as the price for the specialization, however, this does not justify the failure to carry out thorough literature searches. In addition, it is astounding that the authors postulated unusual new compounds, such as **1**, relying only on the results of routine analytical methods, without having secured the structure beyond reasonable doubt.

A further question refers to the reviewing of the above papers. Presumably, at least four referees were entrusted with this duty, two of *Angewandte Chemie* and two of *Organic Letters*. They have provided conclusive evidence for their lack of knowledge of heterocyclic chemistry. However, the referees are probably chosen by the editorial offices according to the specialization of the corresponding authors and, thus,

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have the same gaps in the knowledge as the authors. In consequence, if the authors present results remote of their main projects, extreme misjudgments are inevitable, such as those in the papers of YGS and SLMM.

Chemistry as a science does not suffer damage by errors, since if they concern an important field of research these are recognized as such sooner or later, and if they occur in research niches they are without significance. For the reader of scientific work, however, it will become increasingly more difficult to separate the wheat from the chaff, if authors and referees do not do the preliminary sorting adequately.

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