

Sławomir Makowicz,<sup>a\*</sup> Ewelina Najda,<sup>a</sup> and Karolina Janikowska<sup>a</sup>

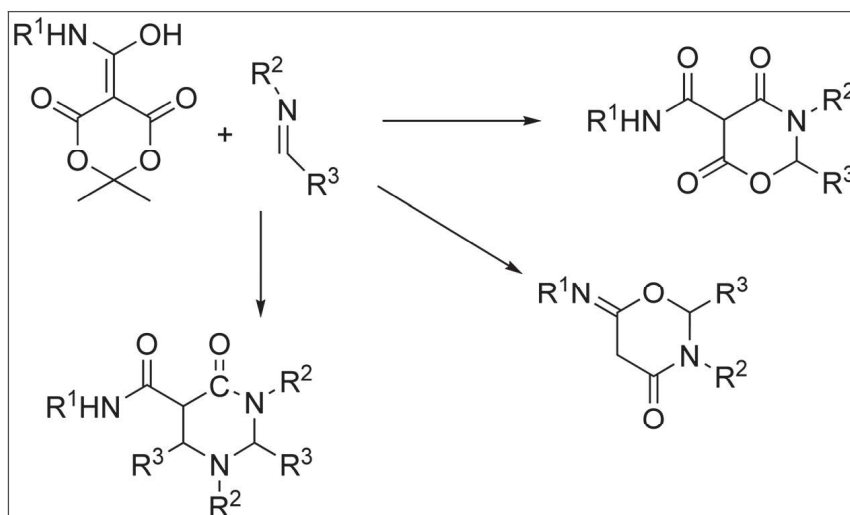
Department of Organic Chemistry, Faculty of Chemistry, Gdansk University of Technology, Narutowicza 11/12, 80-952 Gdansk, Poland

\*E-mail: mak@pg.gda.pl

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The ability to undergo [4+2] versus [2+2] cycloaddition was under investigation for ketenes thermally generated from carbamoyl Meldrum's acid. Usually, 1,3-oxazino-5-carbamoylo-4,6-diones are formed when carbamoyl Meldrum's acid reacts with imine. However, in some cases, a reaction takes an unexpected course, leading to the formation of tetrahydropyridines alkaloids derivatives or cyclic iminoethers.

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## INTRODUCTION

Derivatives of Meldrum's acid have a broad scope of application in heterocyclic chemistry [1,2]. Depending on the type of Meldrum's acid derivative used and in addition the conditions of the process, various compounds can be prepared, for example,  $\beta$ -lactams [3,4], 1,3-oxazinones [5], pilicides [6,7], isooxazolols [8], tetramic acid derivatives [9], cyclic nitrones [10,11], prodigiosin family antibiotics analogs [12], or substituted pyridines [13]. Also, valuable noncyclic compounds can be easily prepared using Meldrum acid as a  $\beta$ -ketoacylium synthon, for example, we can cite formation of 1,3-diones [14], ketoesters [15–19], and ketoamides [20,21]. The main stream of the aforementioned reactions of Meldrum's acid derivatives is connected with their tendency to form ketenes during thermal decomposition; once formed, ketene may react with various types of nucleophiles. When the nucleophile is an alcohol or amine, the ketene simply forms an  $S_N$  acyl product, whereas nucleophile is an imine, vinyl ether [22] or other  $\pi$ -electronic system reaction can take place by a [4+2] or [2+2] cycloaddition pathway. Both types of cycloaddition lead to valuable products; however, it is difficult to unambiguously predict which kind of product

will be formed after the use of a new combination of reagents or a slight change in the reaction conditions. This unpredictability prevents a reliance on the results of similar experiments in planning new syntheses and sometimes can lead to erroneous conclusions. Almquist and co-workers suggested that acyl Meldrum's acid in combination with imine in the presence of HCl should give a [2+2] cycloaddition product [3], mistakenly recognizing the product of the reaction between  $\Delta^2$ -thiazoline and acyl Meldrum's acid as a 6-acylpenam [23], which was only later correctly identified as a bicyclic 1,3-oxazinone [24]. The reaction of ordinary ketenes with imines is properly described by a stepwise mechanism leading to an azetidone ring as the only product [25], whereas thermolysis of acyl Meldrum's acids produce 3-oxo-ketenes or even 3-oxo-2-carboxyketenes [5,22], which allow six-membered heterocycles to be formed through [4+2] cycloaddition. Moreover, our own research results seem to indicate that the reaction of acyl Meldrum's acid with nucleophile may take place even before a loss of acetone and  $CO_2$  [26].

Recently, we have focused on the synthetic application of carbamoyl Meldrum's acid thus developing protocols for forming 3-carbamoyl- $\beta$ -lactams [4] or pseudopeptides [27]. In our most in-depth research, we focused on possibly