As shown previously, N-vinyl lactams are active substances and take part both in ionic reactions (hydrolysis [1], dimerization [2]), and in free-radical reactions (polymerization [3], addition of hydrogen sulfide [4]). With the view of extending the ionic reactions of N-vinyl lactams, in the present work we studied the reaction of these compounds with hydrogen chloride and alcohols.

In the action of hydrogen chloride on N-vinyl lactams there is a vigorous reaction with the evolution of much heat. By the interaction of equiomolecular amounts of these compounds extremely unstable adducts are formed, already after 2-3 hours they are decomposed almost completely into lactam, hydrogen chloride, and resinous residues. Such decomposition is accelerated by heating and the action of atmospheric moisture. The lactams and hydrogen chloride liberated react immediately with formation of crystalline hydrochlorides. Under the action of water the adducts are hydrolyzed with liberation of acetaldehyde and hydrochloric acid. Reaction in a similar way has been observed previously in the hydrolytic decomposition of alkyl 1-chloroethyl ethers [5]:

\[ \text{H}_2\text{O} \quad \text{CH}_2\text{=CH}_2\text{OR} + \text{HCl} \rightarrow \text{CH}_2\text{=CH}_2\text{ClOR} \rightarrow \text{CH}_3\text{CHO} + \text{HCl} + \text{ROH}. \]

By the action of alcohols on the adducts it was proposed to obtain N-l-alkoxyethyl lactams. However, in this case the adducts decomposed with the liberation of lactam hydrochlorides and resin just as in the case of treatment with atmospheric moisture. Hence, attempts to establish the structures of the products of the reaction of N-vinyl lactams with hydrogen chloride by chemical means were not successful. It was impossible to carry out spectroscopic investigation because of the high fluorescence of the solutions to be analyzed. The experimental data available indicate that hydrogen chloride reacts with N-vinyl lactams by addition; the unstable products then formed appear to consist of a mixture of compounds, which may include the following:

\[ \begin{align*}
\text{CH}_2\text{=CHN(CH}_2\text{n CO} & \text{+ HCl} \rightarrow \text{CH}_2\text{ECHClN(CH}_2\text{n CO} \quad \text{H}_2\text{O} \\
\text{CH}_2\text{ECHClN(CH}_2\text{n CO} & \text{+ HCl} \rightarrow \text{CH}_2\text{ECHClN(CH}_2\text{n CO} \quad \text{H}_2\text{O} \\
\text{CH}_2\text{ECHClN(CH}_2\text{n CO} & \text{+ HCl} \rightarrow \text{CH}_2\text{ECHClN(CH}_2\text{n CO} \quad \text{H}_2\text{O} \\
\end{align*} \]

The action of catalytic, not equimolecular amounts, of hydrogen chloride on N-vinyl lactams was studied by Breitenbach and co-workers [6] for the case of 1-vinyl-2-pyrrolidinone. It was shown that small amounts of hydrogen chloride bring about the dimerization of 1-vinyl-2-pyrrolidinone. The following reaction scheme was proposed [6]:
The authors of the present communication have also observed the formation of dimers of 1-vinyl-2-pyrrolidinone and of N-vinylcaprolactam under the action of small amounts of hydrogen chloride. In the course of a study of the dienophile activity of N-vinyl lactams it was found that the dimerization of these monomers in good yield occurs not only on addition of pure hydrogen chloride, but also in a medium of hexachlorocyclopentadiene, in which traces of hydrogen chloride are always present [2]. In this last case, apart from dimers of N-vinyl lactams, no other products were isolated. In this connection it is interesting that alkyl vinyl and aryl vinyl ethers, which are usually readily activated under the influence of hydrogen chloride [7] (in hydrolysis, polymerization, acetal formation), form diene-synthesis adducts with hexachlorocyclopentadiene [2, 8].

This peculiar course of the reaction of N-vinyl lactams and the observed readiness of their activation by hydrogen chloride prompted us to reexamine the reaction of N-vinyl lactams with alcohols catalyzed by hydrogen chloride. Only isolated experiments have previously been carried out on the reaction of N-vinyl lactams with alcohols, and as a result of these N-1-alkoxyethyl lactams were obtained in about 10% yield [9]:

\[
\text{CH}_2=\text{CHN(CH}_2\text{n(O OR + ROH} \rightarrow \text{CH}_3\text{CNH(CH}_2\text{n(O OR}
\]

N-1-Alkoxyethyl lactams have been synthesized in better yield by the reaction of 1-chloroethyl ethers with lactams (up to 70% yield of N-1-alkoxyethylcaprolactams [9, 10] and up to 30% yield of 1-(1-alkoxyethyl)pyrrolidinones [11]).

A recent investigation of the ultraviolet spectra of N-vinyl lactams [6, 12, 13] showed that these substances have intense absorption maxima at 234-236 nm. This property has been made use of in the present work in the study of the kinetics of the reaction of N-vinyl lactams with alcohols in presence of very small amounts of hydrochloric acid or hydrogen chloride. As control experiments showed, the N-1-alkoxyethyl lactams formed as a result of this reaction have no absorption maximum in the ultraviolet. Hence, by studying the absorption curves of the reaction mixture after definite intervals of time we observed a diminution in the magnitude of the original maximum. By the extent of this diminution we could observe the start and the duration of the reaction leading to the formation of N-1-alkoxyethyl lactams. In all the cases that we investigated the character of the diminution in the intensities of the maxima of N-vinyl lactams in their reaction with alcohols in presence of hydrochloric acid or hydrogen chlorides was the same. By way of example we give one of the graphs obtained (Fig. 1).

Figure 1 shows the diminution in intensity of the ultraviolet absorption maximum of the reaction mixture in the reaction of N-vinylcaprolactam with methanol.

The measurements showed that the reaction of 0.05 mole of the N-vinyl lactam with 0.05 mole of the alcohol in presence of 0.02 g of concentrated hydrochloric acid at room temperature is complete in 30 minutes. Here, concentrated hydrochloric acid or dry hydrogen chloride can be used with equal success. Increase in the amount of catalyst, in the duration of the process, and in the degree of heating of the reaction mixture leads to various side processes. As a result of hydrolysis N-vinyl lactams