EFFECT OF WATER AND HIGH PRESSURE ON VALYL-ALANINE AND ALANINE-VALYL DIPEPTIDES CYCLIZATION IN SOLID STATE

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Cyclic dipeptides (2,5-diketopiperazines) are currently of great interest to researchers in the field of medicine, as they have good cellular permeability and diverse biological activity. In addition, their ability to self-assemble into nanostructures with piezoelectric and luminescent properties makes it possible to use them in energy storage systems and OLEDs. Such properties make cyclic dipeptides promising compounds for research, which makes it an important task to develop new and improve existing methods for their synthesis. Widely used methods for obtaining 2,5-diketopiperazines, such as synthesis in solutions or under the influence of microwave radiation, and separation from living organisms, are still quite laborious. In the case of biological methods, in addition, synthesis of a limited number of compounds is possible. In contrast to the methods listed, solid-state cyclization of linear dipeptides upon heating leads to the production of cyclic dipeptides with high yield and low cost. However, the dependence of the thermal properties of linear dipeptides on their structure and heat capacity remains poorly understood, and the autocatalytic mechanism of cyclization has not yet been confirmed experimentally.

In this work, the cyclization reactions of $_{L}$-alanyl-$_{L}$-valine and $_{L}$-valine-$_{L}$-alanine dipeptides in the solid state under heating in closed and open systems were studied for the first time. The effect of high pressure on the onset point in the presence and absence of water vapor was established. Using non-isothermal kinetics approaches, the kinetic parameters of these reactions were calculated, and kinetic models describing these reactions were determined.

The structures of the products of solid-state reactions have been proven by physical and physico-chemical methods: FTIR, NMR, CD spectroscopy, HPLC-MS, PXRD.