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Determination of the nature of the interaction of calcium ions with amino acids by potentiometric titration

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Abstract

In work on the basis of potentiometric titration, the features of interaction of Ca^{2+} calcium ions with amino acids (AC), which are involved in biological and chemical processes in the human body, are established. The regularities of the complexes formed in the "Ca^{2+}-AC" system are studied theoretically by the example of mixtures of calcium nitrate with isoleucine (Ile), arginine (Arg), aspartic acid (Asn), glycine (Gly) and alanine (Ala). The conditions for titration are chosen, under which the quantitative destruction of the complex occurs. During the measures were used calcium-selective and chlorine-silver electrodes. In the process is established in which form Ca^{2+} and amino acids are existing on every stage of investigation. Also, there are highlighted possible processes in solutions during the adding of titrant, which are matching with the theoretical data. By results, semi-quantitative characteristics of the interaction of Ca^{2+} and the studied AC were established. It was shown that the stability of the corresponding complexes increases with increasing number of carboxyl groups – COOH and nitrogen-containing groups in the AC molecule (especially NH_2 groups in the α-position), and with the increase in the length of the carbon skeleton of the molecule and the appearance of bulky substituents – decreases. Also, on the base of Gran method and insertion of the new criteria δ are established comparative rates of formation and destruction of complexes in the "Ca^{2+}-AC" system. According to their lability, complexes of Ca^{2+} with these amino acids are located in the next order: δ (Ca^{2+} – Asp) < δ (Ca^{2+} – Ile) < δ (Ca^{2+} – Ala) < δ (Ca^{2+} – Arg) < δ (Ca^{2+} – Gly), so, the most labile complex is Ca^{2+} – Asp and the most stable is Ca^{2+} – Gly. The obtained results are in good agreement with the results of another theoretical researches, which is allows to use this laboratory facility as the base model for the establishing of the behavior of the interaction between Ca^{2+} and another amino acids and for the further improvements and variation of conditions of the experiment for the accurate establishment of the interaction between Ca^{2+} and amino acids in the whole.

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