ANTIOXIDANT PROPERTIES OF THE SOLID DISPERSION SYSTEM OF HESPERIDIN OBTAINED BY THE CENTRIFUGAL FIBER FORMATION METHOD

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In recent years, there has been increasing evidence that oxidative stress plays a key role in the pathophysiology of many diseases, including neurodegenerative disorders, inflammation, atherosclerosis and even cancer. The current pharmacotherapy for oxidative stress and related diseases involves the use of antioxidants. Phenolic compounds, particularly bioflavonoids, represent one of the largest classes of antioxidants. Among the many members of this class of biologically active substances, a well-known representative is hesperidin. However, the use of this bioflavonoid is limited by its low solubility. A promising approach for improving the solubility of many poorly water-soluble bioflavonoids, particularly hesperidin, is the formation of solid dispersed systems (SDS). This confirms the prospect of developing solid dispersions of hesperidin and studying their antioxidant properties.

The present study examines the influence of a polymer solid dispersion system based on hesperidin on the lipids peroxidation process. An innovative technology of centrifugal fiber formation was used to prepare a solid dispersion system of hesperidin. Polyvinylpyrrolidone K-17 (PVP K-17) was chosen as the polymer carrier for the preparation of SDS.

The influence of the polymeric SDS of hesperidin on the process of lipid peroxidation was studied using a standard determination with thiobarbituric acid (TBA). The method is indirect and is based on the ability of TBA to react with malondialdehyde (MDA), an intermediate product of the enzymatic oxidation of arachidonic acid and the final product of lipid oxidative degradation. The result of the reaction is a trimethine complex which has a characteristic absorption spectrum with a maximum at a wavelength of 535 nm [1].

As a result of the conducted research, it was established that the addition SDS of hesperidin, to the model biological system, leads to a decrease in the amount of the formed trimethine complex. Accordingly, the number of products of lipid peroxidation significantly decreases. The number of products of lipid peroxidation when adding SDS hesperidin at a concentration of 25 μM decreases by 1.4 times, at a concentration of 50 μM – by 2.1 times, and at a concentration of 100 μM – by 3.6 times ($C_{(0)}$ = 14.73±0.43 mM; $C_{(25)}$ = 10.84±0,43 mM; $C_{(50)}$ = 6.89±0.11 mM; $C_{(100)}$= 4.14±0.33 mM).

Thus, it has been confirmed that hesperidin in the composition of a solid dispersion system with PVP K-17, obtainned by the method of centrifugal fiber formation, effectively inhibits the process of oxidative destruction of lipids in a dose-dependent manner. Therefore, the studied polymeric SDS of hesperidin can potentially be used as an active pharmaceutical ingredient for the production of medicinal products with antioxidant effect.

[1] J. Aguilar Diaz De Leon, C. R. Borges. Evaluation of Oxidative Stress in Biological Samples Using the Thiobarbituric Acid Reactive Substances Assay. Journal of visualized experiments : JoVE, (159), 10.3791/61122 (2020). https://doi.org/10.3791/61122