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BOOK OF ABSTRACTS

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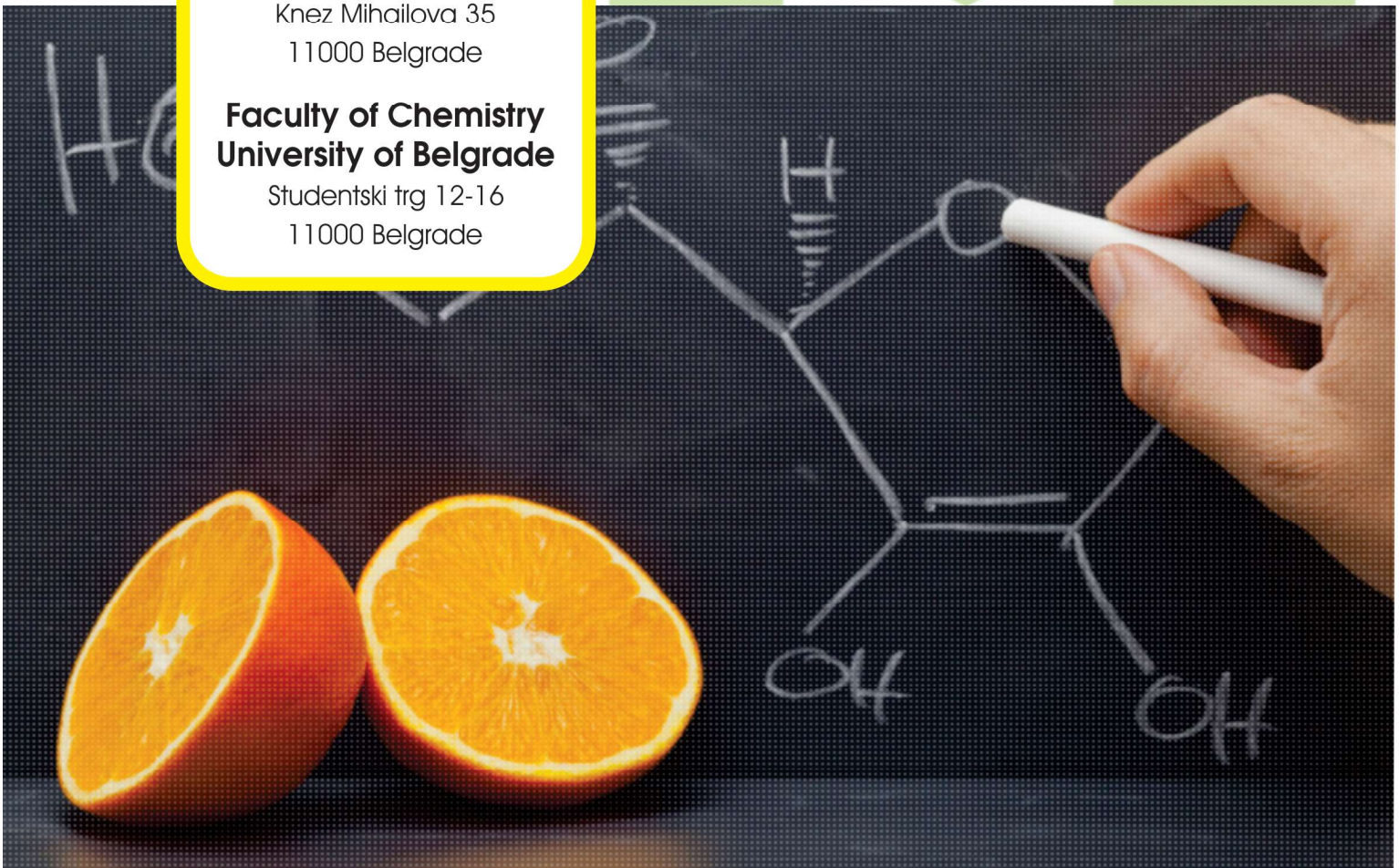

Binding and corona formation of ovalbumin to polystyrene and polyethylene terephthalate microplastics under neutral and acidic conditions

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Microplastic represents one of the major types of pollutants in modern era. Over several years of research in the field of microplastic, there are still many unknown gaps, including the effects and mechanisms of action of these particles on human health. Studies in this field conducted experiments on cells and human tissues or animals like rats and mice. While these studies suggest the toxic effects of microplastic, it is not clear if concentrations used for exposure are relevant for humans. Also, most of the studies used spherical polystyrene, which does not reflect well the diversity of microplastic particles found in nature. Another gap is lack of studies describing direct interactions of microplastics and proteins. While it is generally known that proteins form corona around microplastic particles, affinity studies and consequences on protein structure are usually missing.

The aim of this work was to analyze interaction of a major egg white protein and allergen, ovalbumin to several to microplastic particles, including polystyrene (PS) of 120 and 500 μm in size and polyethylene terephthalate (PET) of 120 μm in size. Binding affinity was determined at both acidic, pH 3 and neutral, pH 7 conditions, at the room temperature, by measuring bulk ovalbumin concentration in supernatants at the equilibrium time. Several binding models, including Langmuir, Freundlich, Redlich–Peterson and Guggenheim-Anderson-de Boer (GAB), were used to determine binding parameters. The formation of soft and hard corona was analyzed according to the published protocol [1]. Structural analysis was performed using near and far-UV CD spectrometry.

Obtained results showed that ovalbumin binds to both PS and PET. All binding models indicated that ovalbumin binds with higher affinity to tested microplastics on pH 3, compared to pH 7, with the highest affinity being calculated for PS 120 μm. Further analysis showed that ovalbumin forms both soft and hard corona onto the surface of all three microplastics. Structural alterations of ovalbumin as a consequence of its interaction with microplastic was shown to be both pH and microplastic type dependent. Also, more pronounced effect on its tertiary structure was observed, compared to secondary. At pH3, tertiary structure of bulk ovalbumin becomes destabilized, especially in the presence of PET 120 μm and PS 500 μm, while at pH 7, structural stabilization is observed, especially in the presence of PS 120 μm.

Considering that the microplastic was discovered in eggs [2], obtained results suggest that direct interactions of native ovalbumin with microplastic particles could have influence on its structure and thus affect its techno-functional properties.

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References:

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