

## The Influence of Ibuprofen, Diclofenac and Naproxen on Composition and Ultrastructural Characteristics of *Atriplex patula* and *Spinacia oleracea*

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**Abstract :** The effects assessment of environmental stress factors on both crop and wild plants of nutritional value are a very important research topic. Continuously worldwide consumption of drugs leads to significant environmental pollution, thus generating environmental stress. Understanding the effects of the important drugs on plant composition and ultrastructural modification is still limited, especially at environmentally relevant concentrations. The aim of the present work was to investigate the influence of three non-steroidal anti-inflammatory drugs (NSAIDs) on chlorophylls content, carotenoids content, total polyphenols content, antioxidant capacity, and ultrastructure of orache (*Atriplex patula* L.) and spinach (*Spinacia oleracea* L.). All green leafy vegetables selected for this study were grown in controlled conditions and treated with solutions of different concentrations (0.1–1 mg L<sup>-1</sup>) of diclofenac, ibuprofen, and naproxen. After eight weeks of exposure of the plants to NSAIDs, the chlorophylls and carotenoids content were analyzed by high-performance liquid chromatography coupled with photodiode array and mass spectrometer detectors, total polyphenols and antioxidant capacity by ultraviolet-visible spectroscopy. Also, the ultrastructural analyses of the vegetables were performed using transmission electron microscopy in order to assess the influence of the selected NSAIDs on cellular organisms, mainly photosynthetic organisms (chloroplasts), energy supply organisms (mitochondria) and nucleus as a cellular metabolism coordinator. In comparison with the control plants, decreases in the content of chlorophylls were observed in the case of the *Atriplex patula* L. plants treated with ibuprofen (11-34%) and naproxen (25-52%). Also, the chlorophylls content from *Spinacia oleracea* L. was affected, the lowest decrease (34%) being obtained in the case of the treatment with naproxen (1 mg L<sup>-1</sup>). Diclofenac (1 mg L<sup>-1</sup>) affected the total polyphenols content (a decrease of 45%) of *Atriplex patula* L. and ibuprofen (1 mg L<sup>-1</sup>) affected the total polyphenols content (a decrease of 20%) of *Spinacia oleracea* L. The results obtained also indicate a moderate reduction of carotenoids and antioxidant capacity in the treated plants, in comparison with the controls. The investigations by transmission electron microscopy demonstrated that the green leafy vegetables were affected by the selected NSAIDs. Thus, this research contributes to a better understanding of the adverse effects of these drugs on studied plants. Important to mention is that the dietary intake of these drugs contaminated plants, plants with important nutritional value, may also presume a risk to human health, but currently little is known about the fate of the drugs in plants and their effect on or risk to the ecosystem.

**Keywords :** abiotic stress, green leafy vegetables, pigments content, ultra structure

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