



ENZYME ASSISTED EXTRACTION OF PHYTOCHEMICALS FROM RED ONION SKINS AS AN APPROACH TO NOVEL EXTRACTION TECHNOLOGY

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Abstract: Large quantities of onion by-products are produced by consumption of onions both domestically and industrially. Red onion skins are a good source of valuable bioactive compounds such as polyphenols, flavonoids, particularly anthocyanins and flavonols, that possess antioxidative, anti-mutagenic and anti-inflammatory properties. The purpose of this study was to investigate the effect of enzyme assisted extraction of bioactive compounds from red onion skins using different enzymatic preparation (cellulases, xylanases and pectin metylesterases) and extraction times. The onion skins extract was evaluated in terms of total anthocyanins (TMA), flavonoids (TFC), total phenolics compounds (TFC) and the antioxidant activity (DPPH). The results showed that the highest yield of antioxidant activity was obtained with enzymatic preparation having cellulase activity (60.16 ± 0.78 mMol of Trolox/g d.w.) after 60 minutes of extraction at 40 °C. The maximal anthocyanins content was found using enzymatic preparation with pectin methylesterase activity after 60 minutes of extraction at 40 °C (66 ± 9 mg C3G/100 g d.w.). Also, the highest quantity of TFC (142.09 ± 10.87 mg QE/g d.w.) and TPC (60.47 ± 4.7 mg GAE/g d.w.) was obtained using enzymatic preparation with xylanase activity. Onion skins may serve as a new and natural food ingredient, due to the presence of bioactive compounds, which have health benefits.

Keywords: red onion skins, phytochemicals, enzymatic extraction, antioxidant activity.

INTRODUCTION

Onion skins are commonly disposed as solid by-products from the industrial processing of onions and almost every kitchen in Romania since it is one of the major vegetables consumed every day. Red onion skins are rich in beneficial bioactive compounds such as polyphenols, flavonoids, particularly anthocyanins and flavonols, which benefits to human health (Skerget *et al.*, 2009).

The major flavonoids found in dry skin of red onion, are effective antioxidants against the lethal effect of oxidative stress and also have immune enhancement potential and anti-infection, anti-stress, anti-cancer and other pharmacological properties (Singh *et al.*, 2009).

OBJECTIVES

The objective of this study was to investigate the effect of enzyme assisted extraction on the bioactive compounds content from red onion skins extract using different enzymatic preparation (cellulases, xylanases and pectin metylesterases) and extraction times.

MATERIALS AND METHODS

Red onions (skins) was provided from the local market (Galați, Romania).

The reagents used were acquired from Sigma (Sigma-Aldrich Co, St. Louis, MO). All other chemicals and reagents were used without any further purification.

The onion samples were first washed and the skins were manually separated, washed with distilled water and then blotted on paper towels. Skins were then dried for 2 hours at 40°C and ground and further stored at 4°C until extraction. Cellulase (E1) (pH=3,5) extracted from *Trichoderma viride* (Merck, Germany), xylanase (E2) (pH=6,5) extracted from *Thermomyces lanuginosus* (Sigma-Aldrich, Denmark) and pectin methylesterase (E3) (zymorouge -pH=5) extracted from *Aspergillus niger* (Sodinal, Romania) were used to extract phytochemicals from red onion skins.



Characterization of the onion skins extracts by the spectrophotometric analysis technique was used to evaluate:

Total anthocyanin content (mg C3G/g d.w.), TAC $\lambda=520$ and 700 nm

Total polyphenol content (mg GAE/g d.w.), TPC $\lambda=765$ nm

Total flavonoid content (mg QE/g d.w.), TFC $\lambda=510$ nm

Antioxidant activity- DPPH scavenging method (mMol Trolox/g d.w.), AA $\lambda=515$ nm

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RESULTS AND DISCUSSIONS

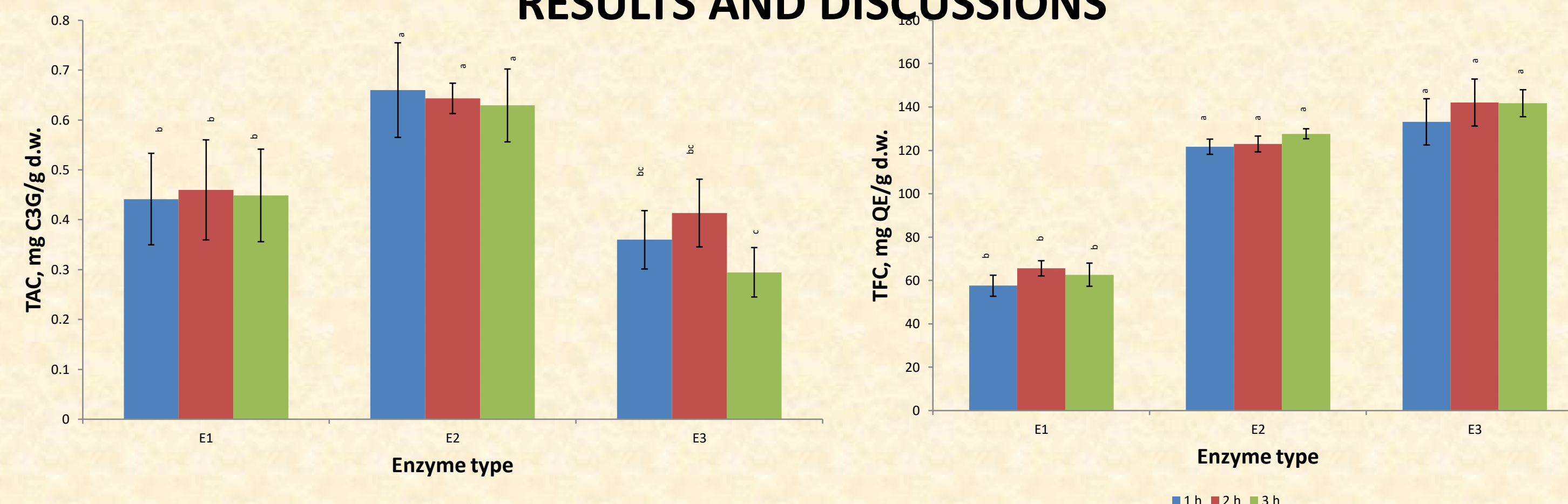


Figure 1. The TAC obtained by enzyme assisted extraction. Bars with different letters are significantly different ($p \leq 0.05$)

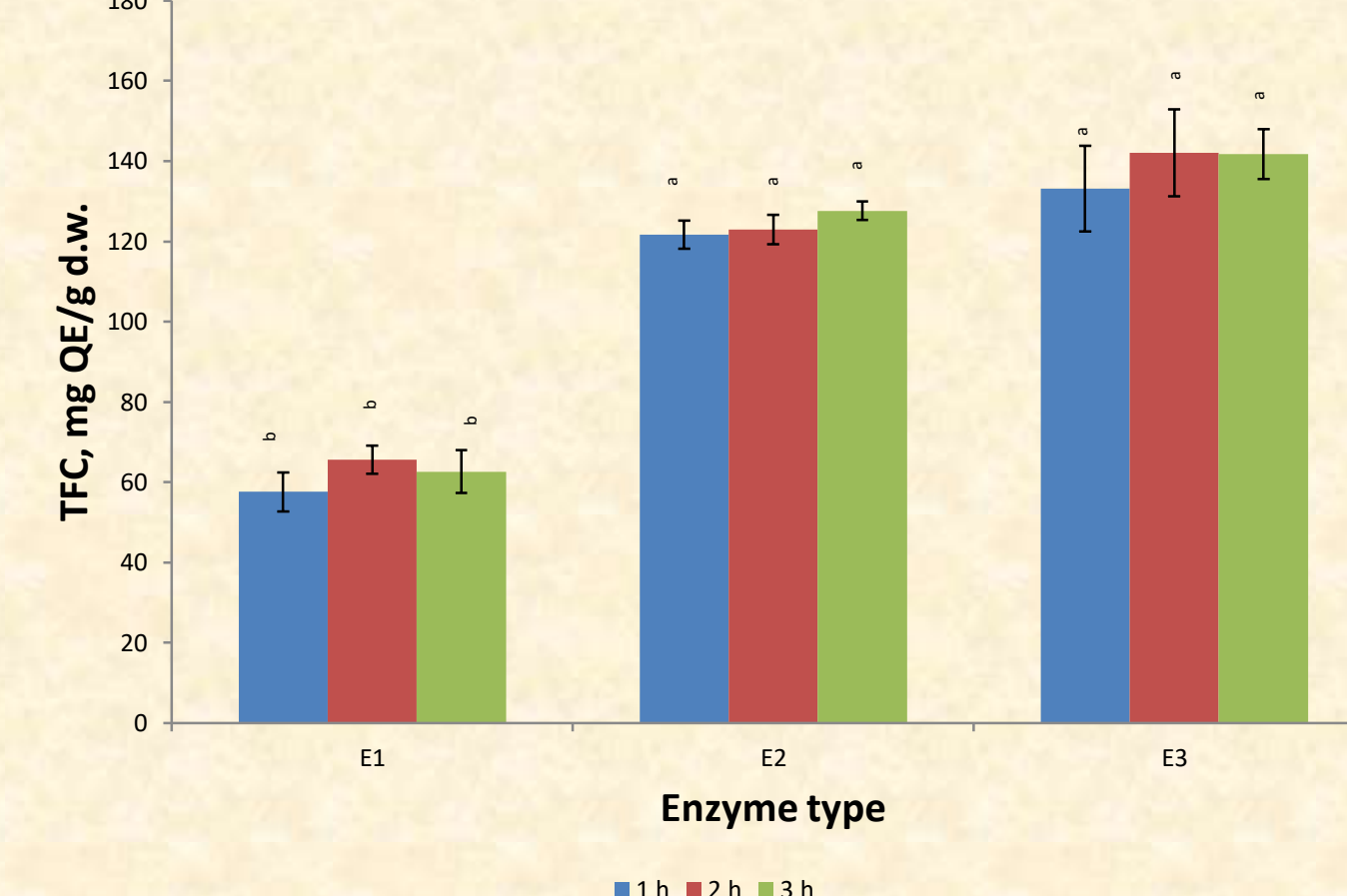


Figure 2. The TFC obtained by enzyme assisted extraction. Bars with different letters are significantly different ($p \leq 0.05$)

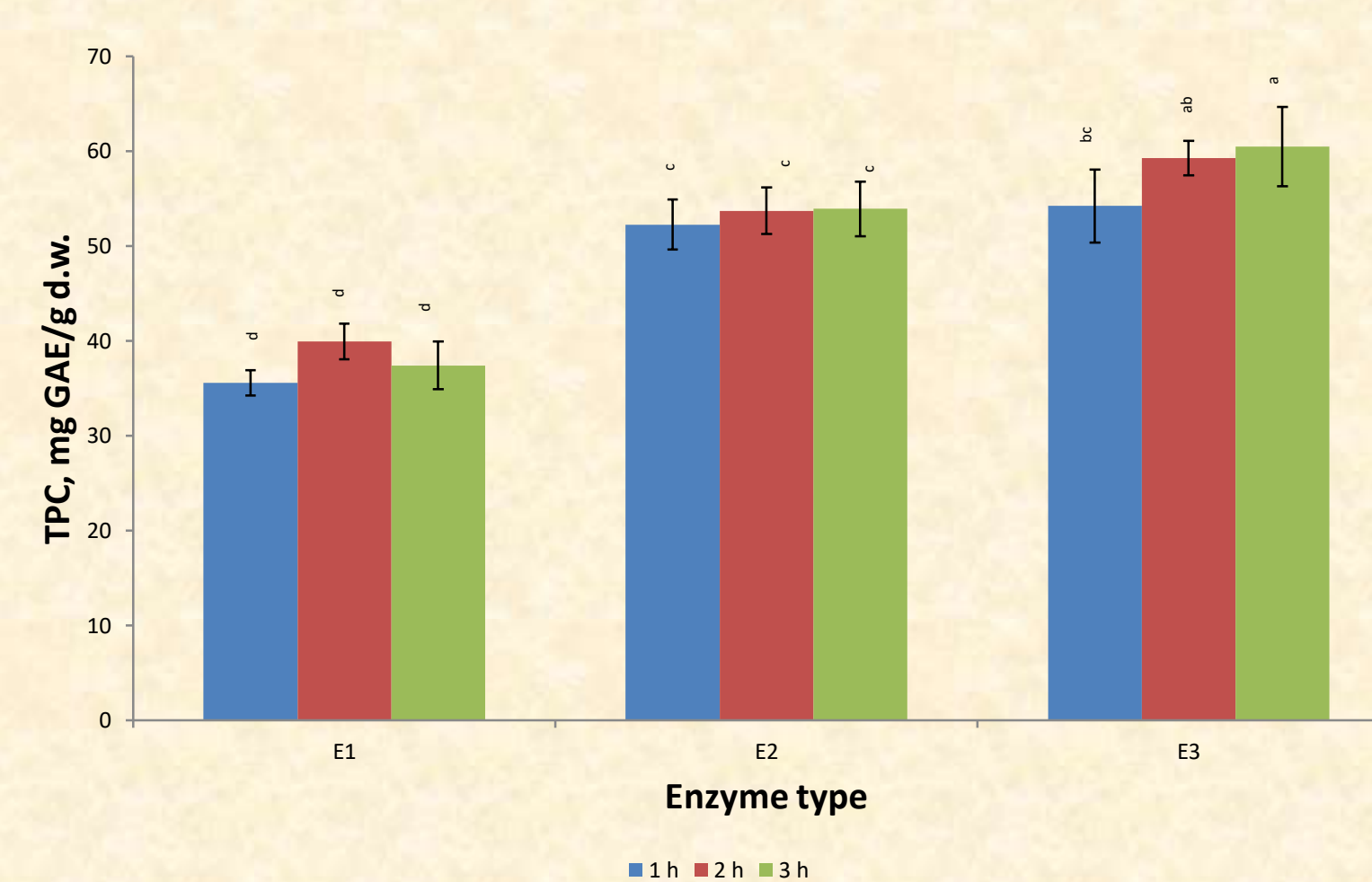


Figure 3. The TPC obtained by enzyme assisted extraction. Bars with different letters are significantly different ($p \leq 0.05$)

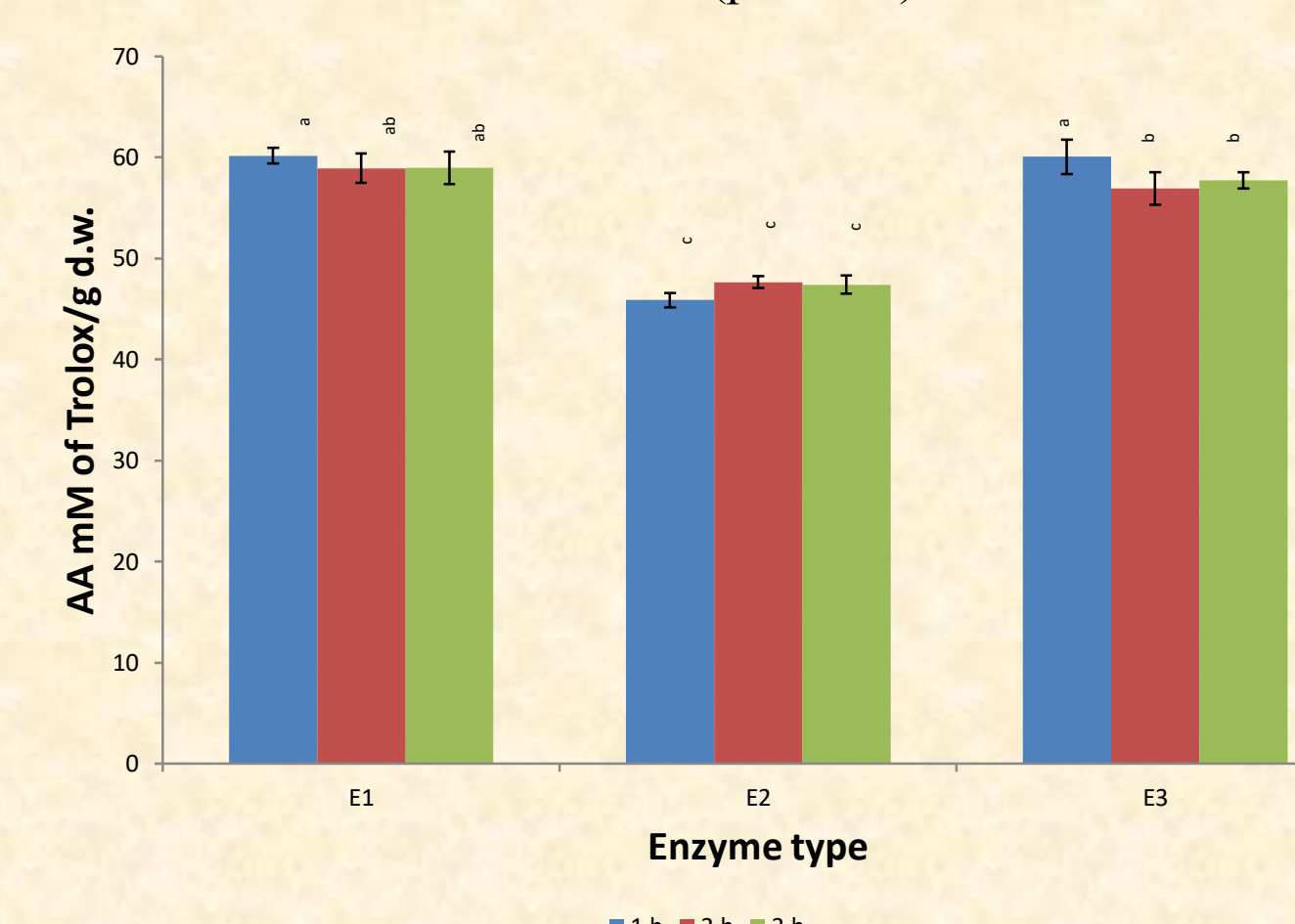


Figure 4. The AA obtained by enzyme assisted extraction. Bars with different letters are significantly different ($p \leq 0.05$)

As indicated in the figures above the highest quantity of TAC (66 ± 9 mg C3G/100g d.w.), was obtained by enzyme assisted extraction using enzymatic preparation with pectin methylesterase activity after 2 h of extraction. In the case of TFC the highest amount (142.09 ± 10.87 mg QE/g d.w.) was obtained by enzyme assisted extraction using enzymatic preparation with xylanase activity after 2 h of extraction. Also, the maximum extraction yield of TPC (60.47 ± 4.7 mg GAE/g d.w.), from red onion skins was obtained with enzymatic preparation having xylanase activity after 3 h of extraction. The enzyme assisted extraction with enzymatic preparation having cellulase activity after 1 h of extraction gave the highest antioxidant activity (60.16 ± 0.78 mMol Trolox/g d.w.) based on DPPH radical scavenging ability.

CONCLUSIONS

Data of the present study revealed that red onion skins, a food industry by-product can be a good sources of valuable bioactive compounds and antioxidants subsequently extend their potential uses in nutritional, food and therapeutic applications.

The red onion skin is rich in polyphenols, flavonoids and anthocyanins, compounds which high antioxidant properties and potential interest to develop of food colorant ingredients with antioxidant activity.

From this study it could be concluded that there is a real possibility of using red onion skins for developing natural and value-added functional ingredients with bioactive properties and several different biological activities.

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