Influence of pH and ionic strength on the colour parameters and antioxidant properties of an ethanolic red grape marc extract

(*Abbreviated running title:* ***Study of some medium factors influencing grape marc extract properties***)

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Highlights

- Gallic, protocatechuic, ferulic, chlorogenic and salicylic acids were identified
- $CaCl_2$ decreased antioxidant activity, but enhanced colour intensity
- Different pH values had slight influence on the antioxidant activity

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Keywords: grape marc extract, antioxidant activity, colour parameters, polyphenols, pH, CIELab

***Abstract*:** The aim of this paper was to investigate the influences of pH and several salts on the antioxidant activity and colour of an ethanolic grape marc extract. Furthermore, the phenolic content of the extract was analysed using HPLC and spectrophotometric methods, while the total antioxidant activity was assessed by reaction with ABTS radical. Gallic acid, procyanidin B1, polydatin, catechin, epicatechin, hyperoside, ferulic, chlorogenic, and salicylic acids were among the main identified polyphenols. Different pH values had slight influence on the antioxidant activity; the highest value being determined for the pH 3.7. The redness, blueness, chroma and hue were significantly enhanced at pH 3.7 and 2.6. The chromaticity decreased at pH=5.5 and pH=7.4, so the extract should be used with care in products with such media. The presence of salts did not significantly affect the antioxidant activity, except the higher concentration of $CaCl_2$, which decreased antioxidant activity, but enhanced colour intensity.

Practical application: The data presented in this paper could be used for the development of a new food dye with antioxidant properties of natural origin. The optimal medium conditions, i.e. pH and ionic strength for the use of an ethanolic red grape marc extract, have been identified. The information could be used in product development and product formulation, especially when functional foodstuffs are envisaged. Consequently, this paper would be of significant interest for food chemists, food technologists, food manufacturers and especially manufacturers of food dyes and all those using natural substances in their production process.

1. Introduction

The "clean label" is a growing global trend and involves aspects, which range from sustainability of food production to use of non-synthetic ingredients (Global Food Forums, 2017). The use of natural pigments is part of the latter and recent publications report that the global market will grow by 6.22% revenue until 2019 (Cortez et al., 2017). Furthermore, due to their structure and properties, these substances could play a double technological role in foods, i.e. act as both colourants and antioxidants. Many of these pigments/antioxidants can be sourced from the by-products of the food industry, which, at present, are not utilized at full potential. For example, in the process of winemaking, around 25% of the grape weight results in waste, most of which is afterwards composted and reintroduced in the vineyards (Dwyer et al., 2014). Studies suggest that, depending on the winemaking technique, around 70% of phenolics remain in that waste after processing (Ratnasooriya & Rupasinghe, 2012). These phenolics present also a source of valuable bioactive compounds, which may be used in