

Abstract

Green Approach in Obtaining Grape Extracts Displaying Cytotoxic Activity [†]

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Abstract: Background and objectives: Plant material is a real treasure of compounds possessing a spectrum of bioactivities. Their extraction is usually performed using toxic organic solvents, which causes serious environmental problems. For this reason, there is an aspiration to replace widely used organic solvents with greener ones. Natural deep eutectic solvents (NADES) were suggested at the beginning of this century as non-toxic, non-flammable and ecologically safe alternatives. Thus, the aim of the present study was to investigate the extraction efficiency of choline chloride (Ch)-based NADES (Ch with citric acid, molar ratio of 2:1, 30% of water, ChCit) in obtaining valuable extracts from grape skin. Materials and Methods: Eight different red grape varieties were collected. Skin separation was performed manually. Extraction was performed in an ultrasound bath under defined conditions (plant material/solvent ratio—1:10; time—30 min; temperature—50 °C). In parallel, acidified ethanol (EtOH) was used as a positive control. The total phenolic content (TPC) and the antioxidant and cytotoxic activities of the prepared extracts were explored. TPC investigations were performed using the Folin–Ciocalteu method. For antioxidant activity evaluation, four different in vitro assays were employed (DPPH, FRAP, ABTS and CUPRAC). Cytotoxic properties were tested against three cell lines (MRS-5, HeLa and LS 174T). Results and Discussion: TPC had a wide range (10.10–45.10 and 17.69–62.34 mg GAE/, for ethanol and ChCit, respectively), suggesting the strong influence of grape variety. ChCit showed higher efficiency in extracting polyphenols from grape skin compared with EtOH, probably since the low ChCit pH potentiates anthocyanin extraction. Antioxidant activities displayed a strong correlation with TPC values ($p < 0.05$), confirming that phenols strongly contribute to the antioxidant properties of grape skin. The results for cytotoxicity were more heterogeneous. ChCit extracts inhibited cell growth (IC₅₀ between 70.4 and 400 µg/mL), while EtOH extracts had no effect for the tested concentrations. There is no clear relationship between the polyphenol content and cytotoxic effects. Conclusion: Considering all of the mentioned results, it is concluded that the synergy between induced cell acidity and the present bioactives resulted in a cytotoxic effect of grape skin, but there is still a need to identify the specific compounds responsible for this.

Keywords: grape skin; NADES; polyphenols; antioxidant activity; cytotoxic activity



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