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Pressurized hot water extraction of bioactives

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HIGHLIGHTS

- Review of pressurized hot water extraction of bioactive compounds, 2009–14
- Chemical and physical properties of pressurized hot liquid water
- Equipment, method optimization, applications, coupling and future prospects
- Challenges with degradation and other chemical reactions during extraction

ABSTRACT

The purpose of this review is to give the reader a thorough background to the fundamentals and applications of pressurized hot water extraction (PHWE) for the analysis of bioactive compounds. We summarize the field in the period 2009–14, and include fundamentals of water as a solvent: equipment; method optimization; applications; coupling; and, future prospects. We highlight that solvent properties of water are tunable by changing the temperature, particularly self-ionization, dielectric constant, viscosity, diffusivity, density and surface tension. Furthermore, important aspects to consider are the risk of degradation of the analytes and other potential reactions, such as hydrolysis, caramelization and Maillard reactions that may lead to erroneous results. For the extraction of bioactive compounds, we report PHWE methods based on using water of 80–175°C and short extraction times. In conclusion, PHWE provides advantages over conventional extraction methods, such as being "greener", faster and more efficient.

Keywords:
Anthocyanin
Bioactive compound
Diterpene
Extraction
Polyphenol
Pressurized hot water extraction
Pressurized liquid extraction
Solubility
Subcritical water
Superheated water

Abbreviations: CED, Cohesion energy density; DPPH, 2,2-diphenyl-1-picrylhydrazyl; FC, Folin-Ciocalteu; HSP, Hansen solubility parameters; MRP, Maillard reaction products; PHWE, Pressurized hot water extraction; PLE, Pressurized liquid extraction; USWE, Ultrasound-enhanced subcritical water extraction
D, Diffusion coefficient; K_w, Dissociation constant; H_v, Heat of vaporization; P, Pressure; π^*, Polarisability; ε_r, Relative static permittivity (dielectric constant); $C_{p,m}$, Specific heat capacity (isobaric, molar); T, Temperature; η, Viscosity, dynamic

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