PBCG-O2

The use of poly(styrene-*alt*-maleic anhydride) as a new membrane lysis agent for effective water-based extraction of natural antioxidants from coffee leaves

Sattawat Boonchaleaw, Pattana Kakumyan, Natsaran Saichana and Patchara Punyamoonwongsa*
School of Science, Mae Fah Luang University, Chiang Rai 57100, Thailand
*E-Mail: patchara@mfu.ac.th

Abstract

Plant bioactive compounds, including polyphenols, flavonoids and tannins, are secondary metabolites from plants that have long been used as traditional medicines for centuries due to their impressive biological activities, such as anticancer, antibacterial and antioxidants. The commonly used extraction protocol for these compounds involves the use of toxic organic solvents, which limits their use in nutraceuticals and at the same time, induces environmental hazards. Therefore, there is a need for a new solvent-free extraction method that can recover the active compounds at high product yields, while maintaining their biological activities. This study demonstrated the use of a new membrane lysis agent, poly(styrene-*alt*-maleic anhydride) or PSMA, for water-based extraction of plant antioxidants from coffee leaves (*Coffea robusta* Pierre ex Froehner L.). All crude extracts were evaluated in terms of the total contents of proteins, phenolic compounds and flavonoids, by using the BCA protein assay, Folin-Ciocalteu colorimetric and aluminium chloride colorimetry, respectively. The DPPH assay was used for a determination of the IC50 of antioxidant activity. The crude extracts by the PSMA-containing lysis buffer showed increased contents of the proteins (74.46 ± 4.01 mg/g sample), phenolic compounds (11.59 ± 0.60 mg/g sample) and flavonoids (9.60 ±0.92 mg/g sample), as compared to those obtained by the PSMA-free buffer media (protein of 12.35 ±0.64 mg/g sample, phenolic compounds of 5.75 ±0.12 mg/g sample, and flavonoids of 3.24 ±0.05 mg/g sample). The PSMA crude extracts showed the IC50 value of around 3.70 µg/ml, significantly lower than those of the blank sample (9.5 µg/ml) and the positive controlled ascorbic acid sample (16.4 µg/ml). The impressively strong radical-scavenging ability of the crude extracts by the PSMA-based extraction implies the preserved biological functions. This could potentially be due to possible formation of the biomimetic PSMA/lipid reservoirs that allow encapsulation of those active compounds within their inner core structures and thereafter, protect them from undesired side reactions. PSMA had successfully proved its use as a new membrane lysis agent for the improved efficiency of water-based extraction protocols.

Keywords: Membrane lysis, Styrene maleic anhydride, Natural antioxidants, Water-based extraction