
Abstract

Utilization of banana peel waste in a productive manner is only possible through an effective extraction protocol which is optimized via series of principal factors that determine the outcome of the process. In this regard, the current research direction was towards investigating the efficacy of novel DES as an additive in conventional solvents for extraction of banana peel phenolics obtained from *Musa acuminata* cultivar and study the effect of various physical parameters on extraction protocol observing the yield and total phenolic content. Three different combinations of deep eutectic solvents (DES) consisting of citric acid and glucose based on different donor to acceptor ratios (0.25, 1.375 and 2.5 respectively) were prepared in airtight flasks maintained at 80°C for about 90-120 minutes with constant agitation until a homogenous transparent solution was obtained. Fourier Transform Infrared (FTIR) analysis marked significant hydrogen bonding between citric acid and glucose indicating successful preparation of DES. Four extraction parameters (Donor/Acceptor ratio, DES/Ethanol ratio, Solid/Liquid ratio and Particle size) were studied and optimized at three coded levels, a total of 21 experiments were conducted using conventional heating and stirring method followed by centrifugation and analysis of variance (ANOVA) was used to verify the integrity of the rotatable Central Composite Design (CCD) in Response Surface Methodology (RSM). Results obtained by UV-VIS Spectrophotometric and Liquid Chromatography–Mass Spectrometry (LC–MS) analysis displayed total phenolic content ranging from 13.01 to 43.75 mg/g dry weight of extract. DPPH assay and FRAP protocol indicated an appreciable antioxidant potential of the extracts with an IC₅₀ value of 156.06 µg/ml, 80.32 µg/ml, and 110.21 µg/ml for DES 1, DES 2 and DES 3 respectively against DPPH and a FRAP value of 23.1 µM, 25.52 µM, and 19.63 µM ascorbate per g dry extract obtained with DES 1, DES 2, and DES 3 respectively. The CCD proved the reliability of the model giving an R² value of 0.9955 for yield and 0.9969 for total phenolic content (TPC). Kinetic study established that all experimental treatments resulted in more extraction yields and overall phenolic content than the control. Henceforth, it was proved that the DES used was an effective additive and can be used to make the extraction process economical and efficient.