ISGC 2022

N°694 / OC
TOPIC(s) : Waste and side streams valorization / Alternative solvents

Biocomposite film from Rambutan seed oil extracted by green extraction technologies

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PURPOSE OF THE ABSTRACT

Since more than ~250,000 tons of fresh rambutan are yearly produced in Thailand, the excess amount is fed to fruit processing factories. Rambutan peel and seed are removed and commonly discharged as wastes before producing the canned rambutan pulp in syrup. However, rambutan seed (RS) mainly consists of lipids and minorly contains flavonoids, tannin, and saponins. Nowadays, the RS oil has valorized in agricultural, food, and pharmaceutical applications [1]. For example, the extracted RS oil was used to moisturize and to prolong shelf-life of food and agriculture products. This work introduced mechanical and supercritical carbon dioxide (SCCO2) extractions as green technologies [2] to extract RS oil . The feedstock characterized results shown that fresh RS had moisture content of 46.74 % (w/w). After drying in a hot-air oven at 60°C for 6 hrs., the dried RS had moisture content of 1.86 %wt. and it had 30.48 % (w/w) of RS oil. A screw press machine was capable to extract only 6.29% (w/w) of RS oil at 40°C to 60°C and feed rate of ~10 kg/hr.; in other words, ~24 % (w/w). of the residue oil remains in the seed cake. Subsequently, the residue oil was recovered by SCCO2 with 25% of ethanol as co-solvent at 40°C and 15.0 MPa in a 10 L extractor. It was found that the SCCO2 extraction efficiently recovered 8.84 % (w/w) of residue oil. Extracted oils procured from Soxhlet apparatus using petroleum ether, screw press machine, and SCCO2 extractor; hereafter called RSO-S, RSO-M, and RSO-SC, respectively, were characterized by AOCS testing methods, measured antioxidant and antimicrobial activities, and formulated the bio-composite film [3]. The preliminary results shown that RSO-SC had the highest DPPH antioxidant activity, following by RSO-M and RSO-SC. The major fatty acids in all RSO samples were oleic (C18:0) and arachidic (C20:0) acids. The bio-composite films containing 0.00, 2.00, 4.00, and 6.00 % (v/v) of RS oils, 0.40% (w/v) Konjac glucomannan, 0.90% (w/w) Arabic gum, 1.10 % (w/w) Agar, and 0.48% (w/v) glycerol were successfully developed. The bio-composite films will be characterized for physical properties, e.g., color parameter, light transmittance, tensile properties, and swelling behavior, and chemical properties, e.g., functional groups by Fourier Transform Infrared Spectroscopy (FT-IR), morphology by Scanning Electron Microscope (SEM), and crystallinity by X-ray Diffraction (XRD).

FIGURES

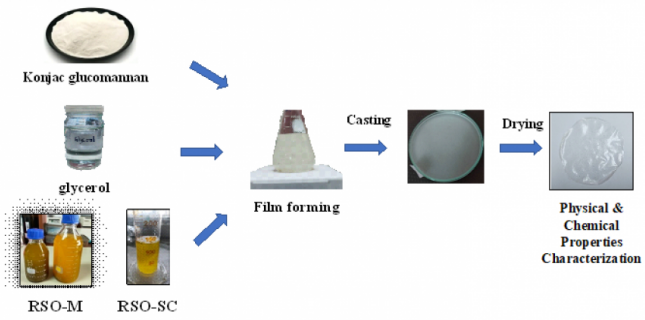

FIGURE 1

Schematic diagram of rambutan seed oil extracted by mechanical (RSO-M) and supercritical carbon dioxide (SCCO2) extraction (RSO-SC)

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FIGURE 2

General procedure of bio-composite film formation from rambutan seed oil obtained from mechanical extraction (RSO-M) and supercritical carbon dioxide extraction (RSO-SC)

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KEYWORDS

Antimicrobial activity | Biocomposite film | Rambutan seed | Supercritical carbon dioxide

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