Eco-Friendly Microbial Deodorization of Edible Oils: A Green Approach for Retention of Bioactive Nutrients and Improved Antioxidant Potential

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Abstract:

Deodorization or removal of odoriferous compounds is the most important step of refining of the vegetable oils, for human consumption. Conventional deodorization techniques, which rely on high-temperature vacuum steam distillation, though effective at removing undesirable volatile compounds, often result in the loss of vital nutrients such as γ-oryzanol, tocopherols, phytosterols, and phenolics. In this study, a low-cost, eco-friendly microbial deodorization approach of oils was developed using the extracellular lipase-rich culture filtrate of *Aspergillus heteromorphus*. Rice bran (RBO), mustard (MO), and sesame oils (SO) were treated separately under optimized conditions (10 mL culture filtrate, 150 RPM, 4 h for each oil). In Case of RBO, GC-MS analysis confirmed the efficient removal of many odoriferous compounds like naphthalene, aristol-1(10)-en-9-ylisovalerate, 1,6- dimethyl-4- (1-methylethyl), azulene, isoledene, β-myrcene by the fungal enzymes. In Case of MO, allyl isothiocyanate, butyl isothiocyanate and ethyl isothiocyanate which were the major volatile compounds of strong odor were removed and compounds like hexadecane, oxalic acid ester and 2-pentene, 2,4,4- trimethyl were produced after microbial treatment, which contained mild odor. Another study with SO revealed that the flavour compounds responsible for the characteristic odor of untreated sesame oil were stripped away by microbial deodorization. Importantly, γ-oryzanol content in rice bran oil was maintained at 3.89%, compared to a marked reduction during conventional refining (1.62%). Microbial treatment also led to a substantial increase in total phenolic content (TPC), with RBO increasing from 2.84 to 4.98 mg GAE/g, MO oil from 2.70 to 4.20 mg GAE/g, and SO from 1.83 to 3.29 mg GAE/g. Antioxidant activity, measured by DPPH and FRAP assays, improved notably across all treated oils, indicating enhanced free radical scavenging and reducing power. Moreover, Essential minerals like calcium, magnesium,

and manganese remained stable. This innovative low-energy, eco-friendly refining method offers a nutritionally superior and sustainable alternative to conventional deodorization practices.

Keywords:

Microbial Deodorization, edible vegetable oil, Aspergillus heteromorphus, Odiferous molecule, Antioxidant Potential, micronutrients retentions.