National Institute of Technology Rourkela

Synopsis Seminar

Seminar Title	: Non-Water Infrared Refractance Window Drying of Malabar Spinach (Basella alba) and Enhancement of Nutritive Quality by Fermentation
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Venue	: CH 113
Date and Time	: 23 Sep 2025 (4:30 PM)
Abstract	: Malabar spinach (Basella alba), a perennial low-calorie green leafy vegetable, is a rich source of bioactive compounds, minerals, and vitamins. Despite being nutritionally dense, it is still an underutilized crop and highly perishable, leading to significant post-harvest loss. The cyclic vacuum-steam pulsed blanching (VSPB) pretreatment from 1 to 5 cycles was given to Malabar spinach. After four VSPB cycles, a maximum inactivation of peroxidase (90.23 %) and polyphenol oxidase (94.58 %) was observed along with higher retention of chlorophyll content (CC), total carotenoid (TC), and total phenolic content (TPC). The samples pretreated by four VSPB cycles were dried using a non-water IR-RWD method. The experiments were carried out using a hybrid design, and the response surface methodology was used for optimization. It was found that 1.2 mm sample thickness (ST), 40 % infrared power (IP), and 3.82 cm distance between the emitter and glass plate (D), results in dried product with 62.40 mg 100 g-1 ascorbic acid (AA), 5.53 color change (&DeltaE), 1.58 mg g^{-1} CC, 0.75 mg g^{-1} TC, 16.15 mg GAE g^{-1} TPC, and 1.63 mg QE g^{-1} total flavonoid content (TFC). The drying time was also significantly reduced by 55.45 % compared to the untreated sample. The non-water IR-RWD method showed superior retention of quality characteristics with minimum &DeltaE. The study further evaluates the effect of sugar-supported fermentation as another pretreatment on enhancing the quality characteristics of Malabar spinach. The sample fermented for 48 h with a 3 % salt and 3 % sucrose solution (SS) showed enhancement in TC, TPC, and TFC with higher lactobacillus growth and reduction in antinutritional factors, which was further dried using non-water IR-RWD. The experiments were conducted as per the hybrid design, and the response surface methodology gave the optimum conditions at 1 mm ST, 42 % IP, and 3.00 cm D with the response variables of 64.16 % AA, 3.83 &DeltaE, 0.75 mg g^{-1} TC, 20.79 mg GAE g^{-1} TPC, and 1.97 mg QE g^{-1} TFC. In all drying experiments, the Page model was fitted well to the experimental data, describing the drying behavior of Malabar spinach during non-water IR-RWD. The XRD pattern and SEM images of the 48 h SS fermented sample showed alteration in the crystalline structure with porous, clear, and round-shaped particles. Thus, the sugar-supported fermentation resulted in high-quality dried Malabar spinach compared to VSPB pretreatment. The shelf life of dried powder was estimated in high-density polyethylene (HDPE) and aluminium laminated packages (ALP) under storage conditions of 40 °C and 90 % RH. The results showed that the shelf life of dried powder prepared by VSPB in HDPE and ALP was higher than that of the fermented products. Although fermentation helped improve quality, the residual enzyme activity was slightly higher than that of VSPB-pretreated products. The VSPB reduced the enzyme activity by 90% whereas the fermentation reduced it by 81%, which affected the dried product's shelf life. Therefore, VSPB pretreatment followed by non-water IR-RWD was found suitable for longer shelf-life requirements up to 232 days, and the fermentation pretreatment was found suitable with a reduced shelf life of almost 16-17 %. In conclusion, this study introduced an effluent-free IR-RWD method as a sustainable solution to Malabar spinach drying.