National Institute of Technology Rourkela

Synopsis Seminar

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| Seminar Title | : Enzyme Inactivation, Microbial Decontamination and Drying of Garlic using Microwaves |
| Speaker | : Sudarshanna Kar ( Rollno : 516fp1001) |
| Supervisor | : Parag Prakash Sutar |
| Venue | : CH 113 |
| Date and Time | : 16 Jul 2025 (10:30 AM) |
| Abstract | : Garlic, a globally significant culinary ingredient and medicinal herb, is widely recognized for its unique flavor and numerous health benefits, including antioxidant, antimicrobial, and antidiabetic properties. However, garlic processing faces significant challenges, such as enzymatic browning, microbial spoilage, and inefficient peeling and drying techniques, compromising product quality and increasing wastage. The study investigates a two-stage sequential ultrasound (US) followed by microwave (MW) pretreatment to simultaneously inactivate PPO, POD, and *Aspergillus niger* to the desired levels and overcome the individual pretreatment drawbacks. The US treatment (58.43 $Wg^{\&minus 1}$ ultrasound power density for 40 min with an initial bath temperature of 60 °C) followed by MW treatment (3 $Wg^{\&minus 1}$ MW power density for 120 s) resulted in 90.37% POD and 92.38% PPO inactivation with 2.62 log reduction in *Aspergillus niger*. The research further evaluates microwave rotary drum drying for garlic, which combines drying and peeling in a single process, optimizing both energy consumption and product quality. This innovative approach minimizes enzymatic and microbial degradation, preserves bioactive compounds such as allicin and polyphenols, and addresses the inefficiencies and environmental concerns associated with conventional methods like hot lye and steam peeling. Using a five-level, three-variable central composite design (CCD), the effects of microwave power density and pulsation ratio on drying characteristics, bioactive compound retention, and peeling performance were analyzed. The study found that total polyphenol content, DPPH inhibition activity, and allicin content ranged from 3.971 to 5.448 mg GAE/g, 51.458% to 80.833%, and 117.824 to 132.000 mg/100 g, respectively. Peeling efficiency varied between 83.27% and 97.53%, with peeling losses as low as 0.13%. These results highlight the potential of microwave processing to achieve high-quality, sustainable garlic products with minimal environmental impact. In conclusion, this study introduces a sustainable and innovative solution to garlic processing challenges. Integrating ultrasound and microwave technologies enhances drying and peeling efficiency and ensures high-quality garlic products with preserved nutritional and medicinal properties. |