Final Year Project Showcase Batch-2021
For the Year 2025

Department of Food Engineering Name of Programme: Food Engineering		
1	**Project Idea**	Extending the shelf life of fruits using osmotic dehydrator through predictive modelling This project aims to design and implement an improved osmotic dehydration process for extending the shelf life of fruits like apples and bananas. By integrating ultrasound pretreatment, computational modeling (ANSYS 16.0), and predictive modeling (Arrhenius equation), the project provides an innovative, energy-efficient, and nutritionally-preserving approach to fruit processing.
2	**Process**	Fruits were pretreated using 40 kHz ultrasound to enhance mass transfer, then osmotically dehydrated in 50–60 °Brix sucrose solutions at 35–50 °C. Moisture loss and solid gain were monitored every hour for 4 hours. Quality parameters—including pH, titratable acidity, moisture content, and color—were evaluated during storage. ANSYS simulations modeled solid and water diffusion, while Arrhenius modeling was used to estimate shelf life based on temperature and degradation kinetics.
3	**Outcome**	Optimized dehydration conditions for osmotic solution and temperature. - Simulated moisture diffusion in apple slices using ANSYS. - Developed a kinetic model to predict shelf life based on moisture, pH, color, and titratable acidity - Produced two shelf-stable products: apple chips and banana powder. ***75% dehydration time reduced.***
4	**Evidence (Theoretical Basis)**	Based on mass transfer theory: diffusion and osmosis drive water removal. Ultrasound enhances water diffusivity via microchannel formation in tissues. Predictive modeling used Arrhenius equation for kinetic degradation studies of pH, TA, and color. Simulation used density-based species transport model in ANSYS to map concentration gradients. For evidence https://doi.org/10.1016/j.ifset.2016.05.001
5	**Competitive Advantage or Unique Selling Proposition** Process Improvement: Ultrasound-assisted osmotic dehydration significantly reduced processing time and improved mass transfer efficiency. Simulation and predictive modeling ensured process control and reproducibility. Attainment of SDG: This project aligns with SDG 3 (Good Health and Well-being), SDG 9	

	(Industry, Innovation & Infrastructure), and SDG 12 (Responsible Consumption and Production) by reducing post-harvest losses, enhancing food security, and promoting sustainable practices. Environmental Aspect: The process is low-energy, minimizes waste, and promotes reuse of osmotic solution, contributing to carbon and energy reduction goals.	
a	**Cost reduction of existing Product**	Total Cost per Batch Version Total Cost Original (4 hr batch) Rs. 1,205 New (1 hr + ultrasound) Rs. Rs. 836
b	**Process Improvement which leads to superior product or cost reduction, efficiency improvement of the whole process** (e.g. What is the issue is current process and what improvement you suggests)	The integration of ultrasound pretreatment enhances water loss and solute gain, reducing dehydration time and energy consumption while maintaining product quality. Simulations improved accuracy in sucrose diffusion and optimized the process further.
c	**Attainment of any SDG** (e.g. How it is achieved and why it is necessary for the region)	Achieved SDG 3 (Good Health & Wellbeing), SDG 9 (Industry, Innovation, and Infrastructure), and SDG 12 (Responsible Consumption and Production) by reducing food waste and improving preservation techniques.
d	**Expanding of Market share** (e.g. how it expand and what is the problem with the current market	N/A
e	**Capture new market (**e.g. Niche market or unaddressed segment**)**	Our ultrasound-assisted dehydrated apple chips offer a healthy, preservative-free snack with enhanced shelf life and natural taste—perfect for health-conscious consumers, clean-label markets, and premium export segments."
f	**Any Environmental Aspect** (e.g. carbon reduction, energy-efficient, etc.)	By reducing energy usage and water activity, the process lowers postharvest losses and carbon footprint.
g	**Any Other Aspect**	Shelf life modeling helps in inventory and supply chain optimization. Simulation and predictive modeling provide scalable solutions for industry.
6	**Target Market** (Industries, Groups, Individuals, Families, Students, etc) Please provide some detail about the end-user of the product, process, or service	Industries: Fruit preservation companies, snack manufacturers, dehydration technology producers. Groups: Food processors, SMEs involved in fruit exports. Individuals: Consumers looking for nutritious dried fruit alternatives. Institutions: Food R&D centers, academic institutions.
7	**Team Members (Names & Roll No.)**	Alishah Naz - fd-21005 Maham Abbasi- fd 21008

		Maha Rehman- fd 21012 Hira Malik- fd 21028
8	**Supervisor Name**	Dr. Jawaad Ahmed Ansari jawaadahmed@cloud.neduet.edu.pk
10	**Pictures (If any)**