



## Final Year Project Showcase Batch 2020 Year 2024

<b>Department: Food Engineering</b> Programme: <u>Food Engineering</u>	
<b>1</b>	<b>Project Title:</b> Design and Fabrication of an Osmotic Dehydrator for the extension of shelf-life of Bananas
<b>2</b>	<b>Project Idea:</b> The project focuses on the concept of a novel non-thermal dehydration technique named "Osmotic dehydration" that works on the mechanism of osmosis to remove water from the fruit. This dehydration helps to preclude the damage of color, texture, flavor and nutrition caused by the conventional thermal dehydration techniques.
<b>3</b>	<b>Process:</b> Osmotic dehydration takes place in the tank where the fruit is placed on the mesh and immersed in an osmotic solution. The heating element is attached under the stainless-steel tank to provide temperature when necessary. A thermostat temperature controller is used to control the temperature provided to the osmotic solution in the tank. To keep the fluid in the tank in motion, a recirculation system is introduced, which circulates the fluid in the tank and avoids the formation of a boundary layer around the fruit  <b>Regeneration unit:</b> As osmotic dehydration takes place in the tank, changes in the brix of the osmotic solution are observed. This change in the brix of the solution reduces the concentration gradient between the fruit and the solution, which slows down the osmosis and increases the process time. To counter this problem, a regeneration unit has been introduced, which is composed of an RO membrane and diaphragm pump. The RO unit takes the solution from the tank, removes the excess water from it as permeate, and concentrate is introduced into the tank.
<b>4</b>	<b>Outcome:</b> <ul style="list-style-type: none"> <li>• Moisture Reduction: The osmotic dehydrator effectively reduced the moisture content of bananas from 78% to approximately 3%, without causing any thermal damage to the fruit.</li> <li>• Shelf-life Extension: The shelf life of bananas was significantly improved through osmotic dehydration.</li> <li>• Regeneration of the Osmotic Solution: The regeneration unit helped recycle the osmotic solution for it to be used for another batch of bananas, reducing the overall cost of the process.</li> <li>• Sensory Analysis: The sensory evaluation of osmotically dehydrated banana chips yielded an average score of 7.35 out of 9, expressing its overall consumer acceptability.</li> </ul>
<b>5</b>	<b>Evidence (Theoretical Basis)</b> The project finally focuses on the osmotic dehydration of bananas to preserve the sensory qualities of fruit. Fabrication of Dehydrator led the project towards osmotic treatment of bananas, however experiments were done for the optimization of the equipment and the optimum temperature and brix conditions were found to be 50°C and 50 brix along with agitation. After the successful performance of the osmotic dehydration of bananas the results achieved practically through physicochemical assessments clearly provide us with the information that osmotic dehydration not only improved the shelf life of bananas but also



	<p>preserved its sensory attributes such as texture and color. The initial moisture content is the main cause of the spoilage but after osmotic dehydration it is observed that the moisture content present in the bananas decreased to as low as 2% this decrement in the moisture content results in loss of water activity which inhibits the microbial growth and extends the shelf life of the bananas. The quality factor of bananas is color and it is observed that the browning in banana starts after it is peeled but the osmotically dehydrated bananas maintain their color till 22 days. The shelf life in terms of both microbial growth and color is much higher of the osmotically dehydrated bananas than the normal green bananas.</p>
6	<p><b>Impact on Sustainability of Urban Regions or SDG-11 “Sustainable Cities and Communities”</b></p> <p>In osmotic dehydration, concentration difference is the driving force that dehydrates the fruit and requires a very low amount of energy as compared to other dehydration techniques that dehydrate the fruit using only heat. This results in a lesser carbon footprint of the equipment for the environment.</p> <p>Also, the project targets the regeneration of osmotic solution to make it usable for multiple batches, or even if the regeneration is not done, then the osmotic solution can easily be used in any beverage industry, minimizing the total waste generation of the project and maintaining the sustainability of cities and urban regions.</p>
7	<p><b>Competitive Advantage or Unique Selling Proposition</b> (Cost Reduction, Process improvement, Attainment of any SDG (Sustainable Development Goal), increase of market share or capturing new market or having superior performance over a competitor. In summary, any striking aspect of the project that compels the industry to invest in FYP or purchase it. Some detailed description is required in terms of how, why when what. You can select one or more from the following dropdown and delete the rest of them). Please keep relevant options, delete the rest of them, and correct the sequence</p> <p>This equipment offers low cost option for dehydration of fruits and can contribute to export output of the country.</p>
a	<p><b>Attainment of any SDG</b> (e.g. How it is achieved and why it is necessary for the region) The following SDGs are targeted in our project:</p> <p><b>1) Good Health and Well-being:</b></p> <p>The Osmotic Dehydration (OD) of bananas is related to improving health and wellbeing since bananas as a product plays a crucial role in presenting an easily consumable as well as a preserved source of nutrients. Bananas possess a lot of vitamins and minerals along with dietary fibers and contain antioxidants that have a central role in reducing the risk of diseases in our body. Osmotic dehydration being a non-thermal technique, preserves these nutrients as it doesn't involve operating at high processing temperatures which are generally used in conventional drying methods. Moreover, bananas are low in fat and high in energy making them a perfect snack for both children and adults so making availability of such healthy snacks can be highly beneficial in eradicating malnutrition and improving the status of dietary habits in areas where fresh fruits and vegetables are scarce. Overall, the project contributes to improved eating habits and health since it offers better and healthier snacks to the consumers.</p> <p><b>2) Industry, Innovation and Infrastructure:</b></p> <p>The use of Osmotic Dehydration (OD) can easily be employed in dehydration of fruit slices. The idea of using a non-thermal technique for providing high nutrition snacks or meals can</p>



	<p>benefit the food industry exponentially because of its novelty. Through this method, bananas can be well preserved for a long time which in turn makes it open advanced market opportunities and ways to boost the country's economy by providing new business ideas and jobs which will ultimately result in sustainable practices and growth of the economy.</p> <p><b>3) Responsible Consumption and Production:</b></p> <p>Our project emphasizes reducing a major chunk of energy that is consumed by industries, as osmotic dehydration is a non-thermal technique and it requires less electricity than the conventional drying methods which minimize the carbon footprint of emissions making OD a responsible and a sustainable industrial practice. Since bananas are highly perishable and cause spoilage in a very small-time frame, OD significantly helps in decreasing post-harvest losses by converting bananas into a shelf-stable product.</p>
<b>b</b>	<p><b>Environmental Aspect</b> (e.g. carbon reduction, energy-efficient, etc.) <b>Responsible Consumption and Production:</b></p> <p>Our project emphasizes reducing a major chunk of energy that is consumed by industries, as osmotic dehydration is a non-thermal technique and it requires a lot less electricity than the conventional drying methods which minimize the carbon footprint of emissions making OD a responsible and a sustainable industrial practice. Since bananas are highly perishable and cause spoilage in a very small-time frame, OD significantly helps in decreasing post-harvest losses by converting bananas into a shelf-stable product.</p>
<b>c</b>	<p><b>Cost Reduction of Existing Product:</b></p> <p>Our product can be preserved for a longer period of time than the existing products, this reduces the food waste that is produced. This leads to further reduction in costs.</p>
<b>d</b>	<p><b>Process Improvement which Leads to Superior Product or Cost Reduction, Efficiency Improvement of the Whole Process</b> (e.g. What is the issue is current process and what improvement you suggests)</p> <p>The issue with the current process is the regeneration of the brix of the osmotic solution is slow. The efficiency of the regeneration of the RO unit can be further improved by using different RO membranes. This will lead to reducing the time of regeneration of the rbix of the osmotic solution.</p>
<b>e</b>	<p><b>Expanding of Market share</b> (e.g. how it expand and what is the problem with the current market.)</p> <p>Fruit chips can be used as a healthy snack alternative for kids and health conscious consumers.</p>
<b>f</b>	<p><b>Capture New Market</b> (e.g. Niche market or unaddressed segment)</p> <p>The project targets to capture the niche market of health-conscious consumers who pay attention to the food labels and are concerned towards the quality of food (nutrients) they eat.</p>
<b>g</b>	<b>Any Other Aspect (Please tag it like above options)</b>
<b>8</b>	<b>Target Market:</b> Food and Beverage Industry
<b>9</b>	<p><b>Team Members</b> (Names along with email address)</p> <p>Ilsa <a href="mailto:ilsa4305300@cloud.neduet.edu.pk">ilsa4305300@cloud.neduet.edu.pk</a> Maryam <a href="mailto:maryam4306195@cloud.neduet.edu.pk">maryam4306195@cloud.neduet.edu.pk</a></p>



# SUSTAINABLE URBAN REGIONS

NED University of Engineering & Technology



unesco

Chair

		Muhammad Fatiq Pervez Khan <a href="mailto:khan4306616@cloud.neduet.edu.pk">khan4306616@cloud.neduet.edu.pk</a>
10	<b>Supervisor Name</b> (along with email address)	Dr. Jawaad Ahmed Ansari <a href="mailto:jawaadahmed@cloud.neduet.edu.pk">jawaadahmed@cloud.neduet.edu.pk</a>
11	<b>Video (If any)</b>	<a href="#">Osmotic Dehydrator FYDP</a>

Pictures (If any)

