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DRYING TECHNOLOGY – CURRENT RESEARCH AND INDUSTRIAL APPLICATIONS

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Review Based Book Chapter

INFLUENCE OF VARIOUS FACTORS IN DRYING PROCESS ON QUALITY OF FINISHED PRODUCT

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REVIEW BASED BOOK CHAPTER

INFLUENCE OF VARIOUS FACTORS IN DRYING PROCESS ON QUALITY OF FINISHED PRODUCT

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Abstract

The drying process is critical in the food industry for the preservation and processing of various food items while many optimized drying operations are using response surface methods, resulting in higher product quality. Understanding the elements influencing drying processes is essential for improving product quality, shelf life, and energy efficiency in the food business. It also focusses the important aspects to govern drying process that include food material qualities such as moisture content, composition, and physical structure. Furthermore, the effect of process factors such as temperature, airflow rate, drying time for better drying efficiency and food product quality has been investigated along external influences on the drying process, such as pressure, and the inclusion of additives or pre-treatments. The interconnections between these parameters and their consequences on drying kinetics, product quality features (e.g., color, texture, and nutritional content), and energy consumption are affecting the end product in multiple ways. Breakthrough technology and creative techniques to improve drying processes in the food business such as freeze-drying, microwave drying, and vacuum drying are optimizing drying operations to make it more sustainable.

Keywords
Drying Technology, Processing Operations, Drying Kinetics, Drying Factors

1. Introduction

The process of drying is an essential stage in the various techniques applied within the food industry. It is utilized to draw moisture out of food, which inhibits the proliferation of bacteria and other microbes that shorten the shelf life of food goods, causing spoilage. Foods that have been dried are easier to store and transport whilst retaining their flavor, texture, and nutritional content [1, 2]. Drying is known as the removal of moisture from a substance through heating, cooling, or exposure to air or other gases. In the food sector, drying is a frequently employed technique that is used to turn a surplus crop into shelf-stable produce. In the food industry, food products are dried to lower their moisture content to a level suitable for storage and transportation. The food industry utilizes a variety of drying techniques, each with particular advantages and disadvantages [3, 4].

Drying processes and techniques are essential in the food sector as they are employed to maintain the integrity and security of food products, control deterioration, and minimize waste. Food goods can be made more cost-effective to transport and store by reducing their weight and volume through drying methods. Additionally, drying can improve the flavor, texture, and nutritional content of foods, increasing their consumer appeal. Several drying methods have undergone successful testing to see if they may be used in food preparation. For instance, a high-efficiency drying technique that has the potential to be utilized within the food industry is the microwave-assisted thermal process [5, 6].

2. Significance of Drying Process

According to previous documented research, using innovative drying technologies can enhance the quality of food products by maintaining their nutritional value, color, and consistency. Vacuum drying, for example, may significantly reduce the drying process as well as improve the ability of fruits and vegetables to rehydrate [7, 8], while freeze-drying can preserve the nutritional content of food products, such as vitamins and antioxidants [9]. Several cutting-edge methods have been proposed and researched for their possible application in the food sector, including Elliot and symmetric Elliot extreme learning machines, artificial neural networks, spray-drying of bioactive components, and freeze-drying methods [6, 7]. These methods seek to preserve the nutritional value of food while improving product quality and lowering energy costs. Furthermore, advanced drying techniques can raise the standard of food product safety. For instance, by removing the requirement for physical handling of the product, spray-drying can lower the risk of contamination [10]. To decrease the possibility of microbiological contamination and prolong the shelf life of their products, McCormick

& Company, a leader in the world of flavor manufacturing, employed a vacuum belt dryer [11]. The need of novel drying method has been presented in Figure 1.

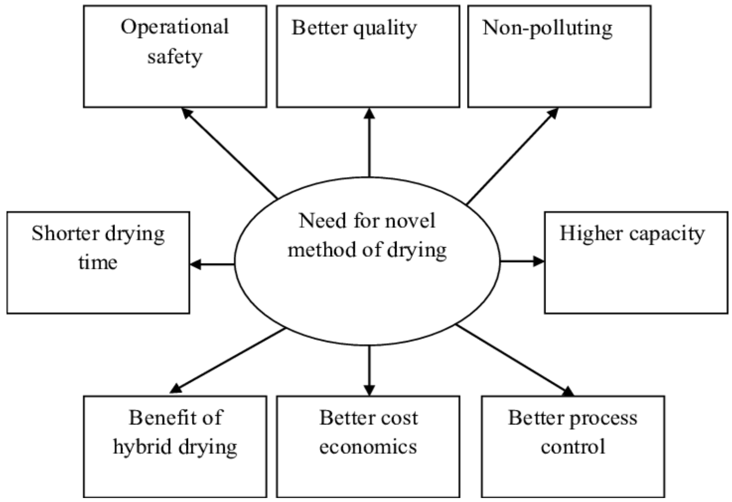

Figure 1 Advantages of novel drying methods [48]

In this chapter, we will discuss about the various factors and elements which affect the processing and production of food products, specifically during the process of drying. We will also look at the various applications of drying processes and technologies within the food industry, and what is the affect of drying on various food products as well as the stage of production at which drying is needed. The challenges pertaining to drying processes at an industrial level will also be discussed along suggested solutions.

3. Factors Affecting Drying Processes in the Food Industry

Following are certain factors which have certain affects upon the drying processes in the food industry:

3.1. Temperature

Drying is a major operation in the food business, and temperature is a critical aspect that can dramatically affect the efficiency and quality of the process. To maximize the production of premium dried food items, it is imperative to comprehend how temperature affects drying processes. In this section, the impact of temperature on drying operations in the food industry will be investigated, specifically looking into how temperature impacts the rate of moisture removal during drying by pinpointing the best temperatures for various drying processes, and assessing how temperature impacts the quality and shelf life of dried food products. By delving into these issues, we intend to offer a thorough understanding of the function that temperature plays in the process of drying and provide suggestions for how to produce dried food products of the highest caliber.

3.1.1. Affect on Rate of Moisture Removal

Temperature is a key drying element that influences moisture removal during drying processes. Temperature and relative humidity are the two key factors that affect the evaporation rate. It is commonly known that heat can accelerate evaporation, which raises the amount of liquid that the air can hold while lowering relative humidity [12]. Temperature can be changed to achieve distinct drying behaviors, and changing the drying parameters over time can also result in varied drying behaviors. With the use of low heat sources to promote moisture evaporation, intermittent or non-isothermal drying techniques have been claimed to be more effective than traditional continuous drying methods. The influence of temperature on moisture removal during drying processes has been investigated through drying tests at various temperatures and step-down temperature settings, with fixed air velocity. It has been noted that the drying temperatures now in use demand lengthy drying durations of up to 24 hours and use a significant amount of energy. Therefore, it is necessary to create innovative drying techniques that raise output and energy efficiency while preserving a satisfactory level of product quality. The development of computational techniques to forecast the temporal and geographical changes in temperature and moisture during processing can aid in the optimization of the dry process. For non-isothermal drying of leafy products, a model for simultaneous heat and mass transmission has been presented, and numerical findings have been verified using dehydration experiment curves. It has also been discovered that the drying properties of walnuts are greatly impacted by the non-uniformity of the drying circumstances around the product, specifically the air temperature and humidity along the column heights [13, 14].

3.1.2. Optimal Temperature

The selection of the appropriate temperature to achieve the best drying duration while maintaining the physicochemical, nutritional, and sensory qualities of the food product while drying, is critical. Higher temperatures ought to be avoided since they might cause food to cook rather than dry. The drying process takes place at temperatures ranging from 15°C to 37°C, with 140°F being the ideal temperature for food. The drying process shouldn't be accelerated by raising the temperature in order to reach the specified moisture content of 10% (on a wet basis) [15, 16]. For example, the generalized method for drying orange peels is done under sunlight for 48 hours at temperatures ranging from 30°C to 37°C in the morning and 15°C to 20°C at night. Low-temperature drying processes are advised for meat products to prevent microbiological and biochemical decomposition. High temperatures may shorten drying times but can cause heat-sensitive components to degrade, lose color quality, become more difficult to rehydrate and shrink at higher rates. Regardless of the drying technique, it's critical to pick a drying temperature that doesn't degrade the end product's quality and offers a respectable drying time [16, 17].

Freeze-drying can be done using an ultralow-temperature freezer that can reach up to 80°C and the drying process may be sustained at 80°C for 24 hours. The size of the dried powder obtained during freeze-drying is dependent on the granulometry operating conditions. The recommended temperature range for spray drying is between 110°C and 140°C; however, no evidence has been found on the best range for drying using alternative techniques. The vacuum spray drying process maintains an interior dryer temperature of 40°C to 50°C [16].

3.1.3. Affect on Quality and Shelf-life

In order to maintain the quality and shelf life of dried food products, temperature control is an essential feature. Based on the nature and sensitivity of the food material being dried, the ideal temperature range is determined. To maintain stability, it is advised to keep temperatures for heat-sensitive materials between 10-35°C. Although higher temperatures speed up the drying process, they can also induce material collapse and pore structure degradation. As a result, the right selection of shelf temperature should be determined based on the balance of input and the required heat. For instance, in the secondary stage of freeze-drying, greater temperatures might hasten the drying process. However, too high temperature may cause ice to melt during sublimation, resulting in structural changes such as shrinkage. The drying time for conventional freeze-drying has been demonstrated to be significantly reduced by over 50% with an increase in process temperature [18].

Case hardening, in which food seems dry from the exterior but is actually moist inside, can occur as a result of an increase in shelf temperature. High heat can also cause food to cook on the exterior before drying inside, which can lower the product's overall quality. The majority of dried fruits have a storage life of one year at 60°F and six months at 80°F. The storage duration shortens as the temperature rises. Vegetables also have a shorter shelf life than fruits, and beef jerky should be kept in a freezer or refrigerator for best results. The optimal conditions for storing dried food are below 60°F since low temperatures can increase the shelf life of dry food products. Room temperature, on the other hand, can cause dried food to degrade if not consumed within a particular duration, and exposure to moisture can also reduce the shelf life of dry food. The texture and mechanical resistance during transit of freeze-dried items are also greatly impacted by the mechanical stiffness of the product, which increases dramatically with greater shelf temperature. To maintain the highest possible quality and shelf life, the shelf temperature should be adjusted based on the individual food materials [15, 18].

Overall, the current study gives useful insights into the impact of temperature in drying processes and emphasizes the need of optimizing drying parameters to obtain optimal quality and shelf life of dried food items. Future studies in this field may examine how temperature affects various food components and create inventive drying methods to improve the quality and shelf life of dried food products.

3.2. Humidity

Humidity, in particular, may have a considerable influence on the drying process and the subsequent product quality. As a result, the purpose of this section is to investigate the influence of humidity on drying operations in the food business. We will specifically look at how humidity affects drying, determine the ideal conditions for drying food goods, and assess the difficulties in regulating humidity during drying. Understanding these characteristics allows the food business to improve its drying operations, improve the quality of its goods, and boost its efficiency.

3.2.1. Effect on Drying Process

Humidity greatly impacts the drying processes within the food industry. Low humidity can cause moisture to migrate from food to the air, resulting in flavor and texture loss. High humidity in the early stages of drying, on the other hand, may enhance the drying pace of some fruits, such as apricots. However, for fruits and vegetables including apricots, crambe seeds, carrot cubes, and onions, changing the relative humidity of the drying air might dramatically alter product quality and drying speed. For example, a moderate relative humidity of 30% to 50% resulted in improved product quality, but lower and higher relative humidity reduced the quality of the product or decreased drying speed [19, 26].

A step-by-step regulation of relative humidity can successfully avoid crusting and conserve energy. The adaptive hot air-drying system with temperature and relative humidity monitoring and control capability can optimize the stepwise control of relative humidity via a fuzzy logic controller designed to automatically adjust the relative humidity for optimal product quality and accelerated drying speed. Additionally, production is increased with humidity control equipment by reducing the time required for water to dry [19, 20]. The effect of relative humidity on microwave drying speed and product quality was studied, and it was discovered that low relative humidity increased the drying rate while high relative humidity slowed it [20, 21]. Low relative humidity, however, can lead to low-quality color and vitamin C content. Furthermore, moisture exposure can cause mold and bacterial development in dry goods, reducing their shelf life. Even in immaculate environments, moisture encourages the growth and spread of microbes, which can taint the finished product if not adequately managed. Therefore, in order to assure quality, efficiency, and safety throughout the drying process, humidity management is crucial in the food sector [19, 20].

3.2.2. Optimal Conditions

Specific temperature and humidity levels are necessary for optimal drying conditions for food products in order to guarantee that moisture is removed from the food without cooking or an external degree of hardness. Food should be dried at a temperature not more than 140°F to avoid burning the food instead of drying it. In order to avoid case hardening, the drying process should never be accelerated by increasing the temperature. Case hardening can happen when food cooks on the exterior and moisture cannot escape. Water travels from the food to the surrounding air during drying; therefore, low humidity is ideal for drying food products, and drying will be inhibited if the surrounding air is humid [22, 27].

During the drying process, air flowing over the food removes moisture; therefore, ideal circumstances call for a balance of temperature and humidity-warm temperatures, low humidity, and air current. Drying eliminates moisture from food, preventing the growth of bacteria, yeasts, and molds; however, enzyme function is delayed rather than inactivated throughout the process. The optimal drying method depends on factors such as climate, equipment availability, and food type [22, 23].

While room drying at room temperature works only if heat, humidity, and air movement are sufficient, sun drying is problematic in places with high humidity. Sun drying is best used in dry climes. Modern food dehydrators or convection ovens, which combine low heat with a fan to circulate the air, are excellent methods for drying food in the oven at a temperature of 140°F to 150°F (60°C to 65°C). It is critical to ensure that food is dried equally on both the interior and exterior, and vegetables are regarded as optimally dried when they are brittle, while fruits are considered optimally dried when they feel like leather. After drying, items should be allowed to cool for 30-60 minutes before being packed into clean, dry, insect-proof containers. The containers for dried meals should be packed as securely as possible without crushing the food in order to prevent insect contamination and moisture reabsorption. Dried foods must be appropriately packaged and stored right away [21-23].

3.2.3. Challenges Associated with Controlling Humidity

Controlling humidity throughout the drying process may be challenging. An excessive amount of humidity can cause drying processes to take longer, increased energy use, and reduce productivity. Humidity can also impact the drying process, lowering product integrity and damaging items and processing equipment as a result of moisture. This is crucial for processing hygroscopic food products or other objects that naturally collect moisture from their environment. Humidity control strategies need to be implemented by manufacturers during drying processes to prevent such issues [24, 25].

Relative humidity, or the difference between the quantity of moisture in the air at a particular temperature and the maximum amount that may exist at that same temperature, must be monitored for effective humidity control. Minor changes in humidity might result in costly and time-consuming procedure changes in industrial processing facilities. It may not be possible to maintain appropriate humidity levels for equipment functioning and product integrity with just air conditioning. A specific dehumidification system is required to remove unnecessary moisture to maintain the optimum room air temperature [25].

Uncontrolled air leakage can cause condensation and other moisture-related difficulties, but building a specialized continuous air barrier can help alleviate these challenges. Insufficient humidity levels during the drying process can result in problems such as cracking, fragility, and product deterioration. Excess moisture during the drying process might impair the product's quality and shorten its shelf life. During the hot summer months, manufacturers struggle to maintain constant humidity levels in their facilities because warm air currents bring more Gulf moisture to northern regions during these months, making it harder to regulate humidity levels during the drying process [24, 25].

3.3. Air Velocity

Air velocity is another significant factor in the food drying process because it impacts the rate of moisture removal from the food product. According to research, increasing air velocity increases the rate of water evaporation from food. The gradient of evaporation rate, however, changes with temperature while rising with velocity. To get the necessary quality and efficiency, it is crucial to choose an appropriate air velocity for a particular food product. Furthermore, optimizing process parameters such as air velocity is required to achieve the desired drying efficiency and food product quality [29, 30, 33].

3.3.1. Role of Air Velocity

The drying process is significantly influenced by air velocity, which also has an impact on drying efficiency and product quality. The rate of water migration and the heat stability of the chemical composition should be considered when determining air velocity during HAID (Hot Air Impingement Drying) [28]. The drying kinetics of lumber in the food industry is immediately impacted by higher air velocity because it accelerates evaporation during the drying process [29, 30]. The drying rate is increased throughout the constant drying rate phase as well as during the transition and falling rate periods by gradually raising air velocity from 0.5 m/s to 3.5 m/s. However, as the air velocity approaches 1.5 m/s, the influence on the drying rate is modest due to the balanced heat transfer rate and enthalpy change. The influence of velocity is substantial throughout this period, especially at high velocities. Air velocity also has an impact on the critical moisture content (CMC), with increased velocity being correlated with lower CMC and pushing it towards FSP. At high air velocities, the impact of temperature is less noticeable since the drying rate is not considerably affected by additional increases in air velocities due to reduced heat and mass transfer rates [29]. Furthermore, wood stacking may block the airflow channel and minimize turbulence at the air-lumber contact, leading to the substantial influence of velocity. Therefore, in order to optimize the drying process in applications for the food industry, experimental setups may be utilized to investigate the impact of air velocity on wood drying [30, 31].

3.3.2. Impact of Air Velocity on the Quality of the Dried Food Product

The effect of air velocity on the quality of dried food has been studied in food science and has a pivotal role. The maximum values of enzymatic response were achieved when samples were dried at 65°C with an air velocity of 6 m/s, according to a research. However, high air velocity might cause a long-term non-enzymatic response and reduce lightness owing to prolonged drying time. Therefore, it's crucial to choose an air velocity that strikes a compromise between the necessity to effectively dry the product and the need to preserve its color quality. In fact, increasing air velocity can enhance the color quality of dried items. Compared to other drying techniques, ovens with built-in fans for air movement have faster rates of moisture removal, and higher air velocities at the start of drying can improve overall efficiency and the quality of the finished product. As a result, careful consideration of air velocity is required to ensure the quality and efficiency of the dried food product [28].

3.4. Surface Area

The surface area of food items is critical in the drying process. Due to enhanced moisture transport, drying rates rise with surface area. Slicing, shredding, or grinding are methods used in the food business to increase the product's surface area. According to a previous publication [38], increasing the surface area of kiwifruit slices resulted in a faster drying rate and a shorter drying time when compared to whole kiwifruit. Similar results were found in another [39], which found that smaller potato cubes dried faster and more quickly than bigger potato chunks.

3.4.1. Affect on Drying Rate of Food Products

The surface area of food goods is a significant aspect in influencing drying rate. Food slices that are thin have more surface area, which speeds up the elimination of moisture during drying. This is because moisture may escape more quickly from the surface of the food. Comparatively speaking, thinner slices dry up faster than broader ones [35]. This is due to the fact that thinner slices have a greater surface-to-volume ratio, which means they dry more quickly as moisture has a shorter distance to travel from the food's surface to the air, where it may evaporate. Therefore, it is advised to cut food goods into thinner pieces to enhance their surface area in order to accomplish faster drying periods. Moisture removal is influenced by temperature as well. Increasing the temperature of food causes moisture to evaporate, but a balance of temperature and humidity is required for optimal food drying.

3.4.2. Increasing the Surface Area of Food Products

Various methods are used throughout the drying process to improve the surface area of food goods. Three of these important procedures are: (1) ultrasonic vacuum (USV), (2) vacuum dryer (VD), and (3) freeze dryer (FD). The content does not focus particular procedures for increasing surface area, although it does discuss various minced beef drying processes. Cabinet drying, for example, tends to diminish the material's surface area and permeability. Adding a hard coating to the food's surface, on the other hand, might result in less moisture escape and a longer drying time [36]. Ultrasound treatment, on the other hand, can cause micro channels and tissue breakdown, resulting in increased porosity and intercellular gaps in the dry product [39]. In research comparing USV and VD drying processes on minced beef samples, the USV approach produced a more open structure and more porosity than the VD technique. In comparison to VD and USV procedures, freeze-drying yields minced beef samples with greater porosity and open structure because it sustains less damage at low temperatures. Accordingly, depending on the particular requirements of the product being dried, these various drying techniques may be used to enhance the surface area of food items throughout the drying process [32, 34, 37].

3.5. Type of Food Product

The drying process in the food sector is greatly influenced by the kind of food product. Table 1 shows the various processing temperatures and drying periods needed for various foods [40]. Drying is a cheap and effective technique of preserving food, but it can have a negative impact on the end product's quality and safety. Fruits and vegetables include substances that make it simpler for microorganisms to survive the dehydration process, whereas certain sugars and amino acids can boost the survival rate of bacteria during preservation techniques [41].

Foods to be dried	Processing temperature and time
Fruits	
Cherries	70 °C for 2–3 h; 55 °C until dry
Coconuts	45 °C until dry
Pineapples	70 °C for 1–2 h; 55 °C until dry
Persimmons	60 °C for 1–2 h; 55 °C until dry
Pears (Asian)	60 °C
Vegetables	
Asparagus	60 °C for 2–3 h; 55 °C until dry
Beans, green	60 °C for 2 h; 55 °C until dry
Mushrooms	25–30 °C for 2–3 h; increase to 50 °C until dry
Onions	70 °C for 1–2 h; 55 °C until dry
Parsley	30 °C to 50 °C; may be room dried
Fish	
Carp	4 °C under high pressure for 15–20 min
Prawn	70 °C for 30 min
Meat	
All	80 °C for 2 h

Table 1 Processing temperature and time for different food products

To tackle this, many methods that inactivate microorganisms during the drying process have been developed. Acidic fruits with a low pH are particularly efficient in damaging microbes after drying [41]. However, drying can cause flavor, fragrance, and useful ingredients in some foods, such as vitamin C, thiamin, protein, and fat, to be lost. Despite these disadvantages, drying provides a number of benefits, including as lowering food weight and volume for simpler storage, packing, and transportation. Any sort of food may really be thoroughly dried out by spray drying, extending its shelf life at ambient temperature without refrigeration [40, 42].

Pathogens adhered to the surface of white cabbage, such as Salmonella spp., can be inactivated at different rates depending on the drying process used. For example, the decrease of microbial growth in vacuum microwave drying and the atmospheric pressure microwave processing combination method varies depending on the food product, but it has been demonstrated to be successful in decreasing microbial growth in freshly shredded carrots and parsley. Finally, as dry food containers can be opened and closed several times without the contents changing, they are a great strategy for minimizing food industry waste. To prevent infection, canned goods must be consumed right away after being opened [41].

3.5.1 Characteristics of Food Products that Affect the Drying Process

The drying of food products is a complicated process that is influenced by a number of variables. The initial moisture level of the product is one of the most important aspects since it impacts the drying process and duration. The outcome of the drying process is significantly influenced by the chemical makeup of the food. For instance, the drying time and rate are impacted by the presence of natural or added chemicals such as sugars, acids, and salts. The size and form of the food product also have an influence on the process, since bigger or irregularly shaped goods might take longer to dry [43]. The food's structure can also affect how quickly and how long it takes to dry. For instance, the density and porosity of food items are natural qualities that influence the drying process. Additionally, the process is impacted by the material's ability to develop pores as it dries, and poor temperature management can result in unintended structural changes to the material [43, 44].

Low humidity, low heat, and sufficient air circulation are only a few of the other requirements for successful drying [45]. The drying of numerous food items, such as fruits, vegetables, and dairy components, is covered in the Special Issue. The Special Issue may also cover the analytical techniques used in the drying operations [43]. Finally, understanding the features of food items that impact the drying process is critical for achieving optimal drying results. It is possible to increase shelf life while maintaining nutritional quality, texture, and sensory characteristics by regulating elements such as initial moisture content, chemical composition, and structural qualities.

3.5.2. Different Drying Methods Used in Food Industry

Depending on the kind of food product being dried and the intended end product quality, the food business uses a variety of drying techniques, such as sun drying, oven drying, spray drying, freeze drying, and vacuum drying. It is important to select the right drying technique for each product since it might affect the functional qualities and nutritional value of the food product. There are around 50 distinct types of dryers used for drying food items, and new drying technologies are being widely researched to evaluate their influence on the chemical and metabolic changes that occur throughout the dehydration process. Drying can improve material quality and provide value-added chemicals in spices, medicinal plants, herbs, bioactive enzymes, and nuts. It is critical to adopt an appropriate drying process for each product since various food items may require different drying methods to optimize drying parameters and assure product quality. Traditional drying techniques are more prone to physical and chemical deterioration in the finished product, which should be minimized by using an appropriate drying technique [46].

The drying techniques employed, such as sun drying, which is a natural process, while dehydrating with heat from a fire or other dryers is an artificial process, affect the physical characteristics of the drying process [47]. Intermittent drying can help preserve bioactive chemicals by reducing browning effects, hydro-thermomechanical stress, and chemical reactions in samples. Innovative or combination methods must provide high-quality dried goods while also taking the environment and energy efficiency into account. To remove water from food items, the food industry uses a variety of drying procedures, including mechanical dewatering, osmotic dehydration, and thermal drying [46].

Figure 2 Factors to be considered for dryer selection [49]

In Figure 2, some factors have been discussed regarding the selection of an appropriate dryer during various drying processes. One of the main factors when selecting a dryer is the type of food product to be dried and the optimum temperature need by the product such as vacuum drying is considered to be a good option for fruits and fruit related products.

4. Conclusion

Drying process is an important stage in the food industry working with various parameters, including air velocity, surface area, and developing technology, have considerable influence on the quality and shelf life of food items along an impact on the drying process's efficiency and sustainability. These parameters have significant influence on nutrient and flavor retention, as well as the environmental and economic consequences of drying techniques while significant insights for boosting the efficiency and sustainability of the drying process in the food sector can be achieved by giving case studies that illustrate effective optimization of drying operations using the response surface technique. Current research findings and practical ideas consolidates fundamental concepts of heat and mass transport processes; however, further investigations are needed to lead the creation of efficient and sustainable drying processes, allowing manufacturing of high-quality food items with prolonged shelf life.

Author Contributions

Conceptualization, A.J.; validation, M.S.H. and U.J.; writing—original draft preparation, A.J. and R.A; writing-review and editing, and..; visualization, U.J.; R.A; M.S.H.

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Conflicts of Interest

The authors declare no conflict of interest

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