ISSN NO: 2771-8840
Date of Publication: 30-05-2022

Analyzing Moisture at the Drying Process of Spice Plants

Djurayev Kh.F.
Doctor of Technical Sciences, professor, Bukhara engineering-technological institute, Uzbekistan, Bukhara city, djuraev_xf@mail.ru
Mizomov M.S.
Postgraduate student, Bukhara engineering-technological institute, Uzbekistan, Bukhara city, muhammadmizomov@gmail.com

Abstract. This article illustrates those recent developments in the production of high dried spices and herbs. Thermal and physical properties of the materials under study light-reflecting infrared drying in vacuum taking into account using the device of artichoke ends and spices and herbs developed efficient processing technology. Infrared extend electromagnetic field to the item being dried the development prepare is quickened by 4-5% due to the utilize of vibration recognized. Given negligible misfortune of inulin substance, convective within the drying strategy up to 33.3 mg% and by neighborhood producers up to 8-9 mg% within the strategy utilized, up to 45.4 mg% within the proposed strategy the sum of inulin substance stored. The sum of ascorbic corrosive remaining within the dried zest plant up to 0.77 mg% within the proposed strategy, 0.15 mg% within the hellion drying strategy up to 0.71 mg% within the drying strategy, within the convective drying strategy. Up to 0.12 mg% and within the way utilized by nearby producers Put away up to 0.59 mg% and endeavors to detail the relative merits of chosen as of late created drying procedures with center. Outlook for future research trends and challenges for dehydration of spices and herbs is also discussed.

Keywords: Product quality, process quality, nutritional value, amount of essential oils/aroma, constant drying rate, moisture content.

Introduction. Nowadays, one of the most important tasks in the world is the production of quality dried finished products that are safe through the processing of fruits and vegetables, spices. In particular, in developed countries such as Germany, Ukraine, Turkey, the Russian Federation, special attention is paid to the improvement of spice drying devices, which serve to increase the nutritional value (biological, energy, and digestibility) of food consumed. It is important to process spices, expand the field of application of developed products, create environmentally friendly, energy-efficient drying technologies. The cultivation of herbs in Poland is one of the newest sectors of plant production despite the centuries-old tradition of using herbs across the world. Contemporary herbal processing in Poland is primarily oriented to the production of herbal medicines, as in many other European countries. The cultivation, harvesting and processing of herbs in small and medium-sized farms require machinery and devices adjusted to the scale of production.. In addition the paper presents examples of the development of solutions using low-temperature herb dryers appropriate to small and medium-sized farms. This module should give the user a deeper understanding of the drying process of herbs and highlights the influencing factors on high product quality and efficient processing. The processing of herbal plants involves drying, which is one of the most important stages of herb preservation and the most energy-consuming process occurring in agricultural production [1]. A comprehensive review is presented covering the various methods used in agriculture to preserve herbal plants and the classification of solar-energy and hot-air drying systems. Dehydration is the most common method used to lower moisture content and hence the water activity to a safe limit which prolongs shelf life. However, consumers' demand on processed products with most of the original characteristics of the fresh plants has increased. Consequently, drying must be executed carefully in the interest of retaining the taste, aroma, color, appearance, as well as nutritional value of the plants to maximum possible extent. In addition to quality considerations, drying efficiency is another key aspect for evaluating drying performance. Spices and herbs are important parts of human daily food consumption and play an essential role in seasoning and/or preserving food, curing illness, and enhancing cosmetics. Proper processing is necessary because the fresh produce has high moisture content and often high load of microorganisms [2].

Fresh harvested spices and herbs contain a high mount of moisture and numerous microorganisms; immediate preservation should be carried out to prevent biological deterioration after harvesting due to their perishable character is-tics. Thermal drying is the most commonly used cost-effective means of post-harvest processing to avoid losses of these raw materials. It is also necessary to avoid potential safety hazard due to formation of toxins [3]. Drying is one of the oldest techniques for food preservation and it is an indispensable process in the food industry. It aims at lowering moisture content and water activity to safe limits that prolong shelf life, minimize packaging demand, as well as reduce shipping weights. Therefore, this technique is widely used for dehydrating foodstuff such as vegetables, fruits, spices, herbs, and other products. Nowadays, consumers ‘demand on processed products with most of the original characteristics of the fresh plants has increased. Consequently, drying must be executed care-fully in the interest of retaining the flavor, aroma, color, appearance, and nutritional value of the plants as much as possible.

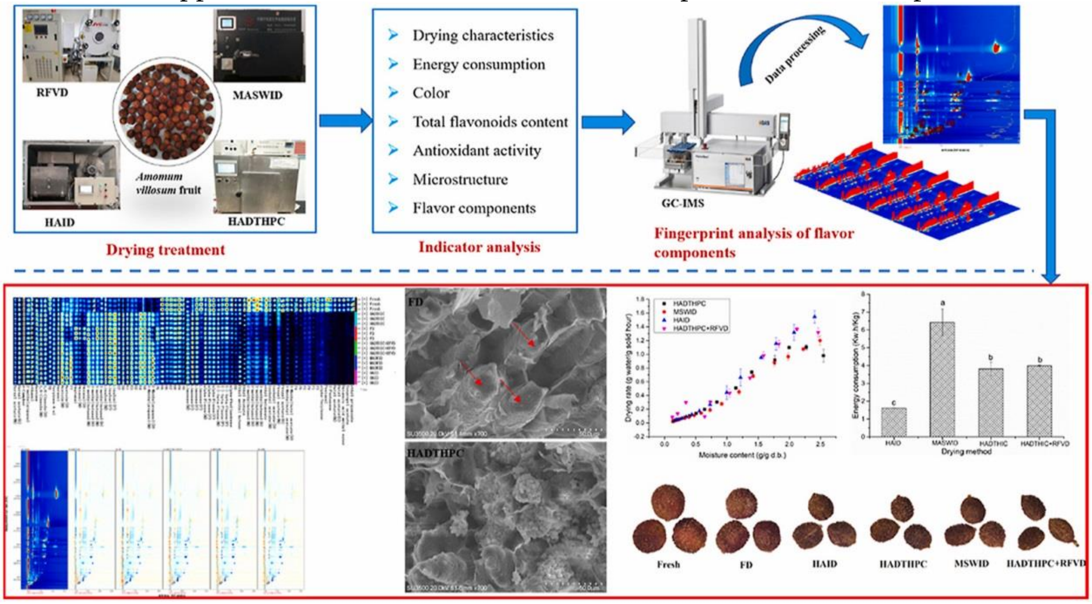

Figure1. Sequence of the process of obtaining the dried product

Materials and methods of research. In the air-drying process the herbs were evenly spread on a tray, covered with the cotton sheets to keep off dust and insects, turned occasionally and left to dry in the shade place (35°C) in appropriate air flow until the vegetables were brittle and considered to be dry (about two days). In the oven drying process each sample were spread on a tray and placed in the oven. The oven temperature was adjusted to 70°C for 4hthiss. In the Microwave-drying process, glass plates containing the plant materials were placed in a microwave oven with the power strength adjusted to 100 W for 3min. The method reported by Boyer and Hai Liu (2004) was used to determine total content of phenols in samples. One ml of extract was mixed with 5 ml of 10 % Folin-Ciocalteu reagent in distilled water and 4 ml of 7.5 % sodium carbonate solution. The samples were maintained at room temperature for 30 min, the absorbance at 765 nm was measured. The calibration curve was constructed within the concentration range 0.075−0.6 mg/ml of gallic acid. The measurement begins by the chopping of the medicinal plants to help the placement in the chamber [4]. The chopped plants are charged manually through the upper opening into the chamber, and the initial height of plants (H0) is measured before the measurement. Before measuring, the herbs initial moisture content is determined by small sample experiment (x0). The next step is starting the ventilator while the knife gate valve is completely open. In addition to quality considerations, drying efficiency is another key aspect for evaluating drying performance, which involves energy consumption, drying time, drying rate, and so forth. Previous studies have shown that the suitable drying temperature range was between 50 and 60 °C for herbal medicines rich in volatile oil components. Therefore, in the current study, five drying temperatures of 50, 55, 60, 65, and 70 °C were applied to evaluate their influence on drying characteristics and sample quality so as to obtain the optimal drying temperature of each drying technology accordingly.. During the drying process, the weight of samples was measured using an electronic balance with a sensitivity of 0.01 g. The samples were weighed every 15 min for the first 1 h, then every 30 min for 2 h, after 2 h of drying, the weighing was performed at

ISSN NO: 2771-8840
Date of Publication: 30-05-2022

60 min intervals. The sample moisture content at time t (Mt) during drying process was calculated according to the initial moisture content and initial weight, as well as the sample weight at time t. The moisture ratio (MR) of samples was calculated using:

$MR= M_t/M_0$

Where, M_0 represents the primary moisture content of the raw material such fruit samples, g/g; Mt is the sample moisture content at time t, g/g.

The dehydration rate of material between time t1 and t2 of samples for different dehydration techniques:

$DR= (M_{t1}-M_{t2})/(t_2-t_1)$

where; M_{t1} and M_{t2} are the moisture contents of fruits at the drying times t_1 and t_2, respectively, g/g.

Specific energy consumption according to the energy value indicated on the ammeter, the removed moisture of the material, and the maximum load of each system

$SEC= (1000\ W*\eta)/(m_1-m_0)$

where, W is the energy difference before and after the experiment, kW.h; m_0 and mi are the first and end masses of the materials, g; η is the utilization factor of equipment load [5].

DPPH radical scavenging capacity was measured following with a slight adjustment. Briefly, 10 µl of extract solution was added to 200 µl of DPPH solution (0.16 mmo1/L). After reaction at room temperature for 30 min away from light, the absorbance of the mixture was detected at 517 nm. DPPH radical scavenging capacity was expressed as inhibition percentage (I %) and calculated

$I\% = (A_{control}-A_{sample})/A_{control} * 100\%$

where Acontrol and Asample are absorbance values of the “DPPH with methanol solution” and “extract solution”, respectively.

Control of air velocity; Moisture removal rel. air humidity ≤ 70% above the bulk, equal air distribution, availability of enough air, product temperature controlled drying Phase drying: higher temperatures in the beginning until the surface is dry, further drying at quality saving temperatures, quality parameters have to be defined and critical temperature has to be known. There is a minimum air velocity, which is not worthy to go below, because it would reach the same result if the herbs dry with ambient air at natural convection. In addition, there is a maximum air velocity, which is not worthy to go above, because it does not cause significant improving during drying and occurs pneumatic transport of the medicinal plants. There is an optimum velocity what can be achieved the highest level of drying with, but to determine the actual air velocity further measurements and economic calculations would be needed.

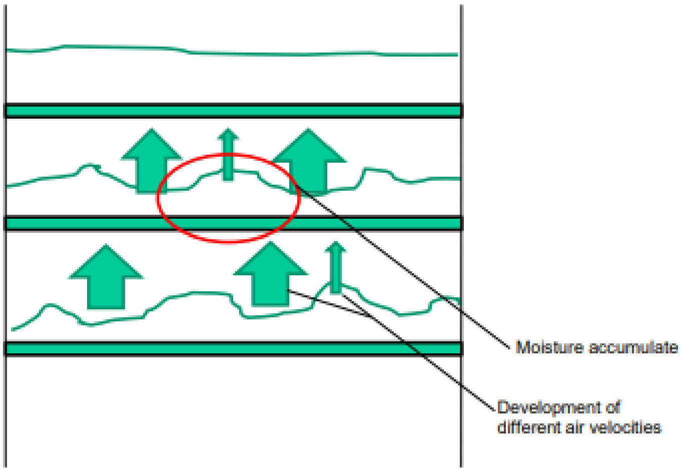

Figure3. Moisture accumulates

To maintain quality and improve the efficiency of drying, distillation or other processing, the raw materials have to be prepared by removing the spare parts before that. During the cleaning the needless and harmful substances are removed. The medicinal plants are disembarrassed of extraneous plants and plant parts, earth, sand and excess radicals by hand, sieve, washing or peeling. The larger, thicker plant parts, especially roots are prepared for drying and other processing operations by chopping. The moisture content of harvested plants is generally very high, around 60–80%. If the moisture content is not significantly reduced, it enables maturation of harmful biological processes. Because of this, the valuable active agent of herbs can be destroyed and the external properties of the drugs can become unfavorable. The fundamental requirement to prevent the harmful processes is the reduction of moisture content as quickly as possible. The advantage of the method is that cheap and does not require plus thermal energy. The disadvantage is that depends on the weather (sudden rain, storm). The drying time can be reduced for hours by artificial drying. During the work of drying the air is warmed, the moisture content is reduced. At drying with ambient air the controlled parameter is only the velocity of drying air, the air temperature is around 15–25 °C. The air flow maintains mechanically by a ventilator. The ventilator should be operated only in dry, warm weather and can be produced a better quality of drug, if the drying with ambient air is carried out in a building [6]. Depending on the moisture content of the herbs and the absolute humidity of drying air, the drying time can be 8–10 days. There are analytical techniques available that can provide some information about the relative fractions of water in different molecular environments. The herbs to be dried must be placed in a closed system, where the preheated air is flowing, and to be placed out of the air duct. The temperature, absolute humidity and velocity of drying air can be adjusted. The drying time is only a few hours, because the temperature of the drying air is about 30–80 °C. Generally at warm air drying the medicinal plants and the drying air move in opposite direction. The drying time is only 2–5 minutes, the temperature of drying air is between 200–100 °C, the material heats up to 60–70 °C. The advantage of the method is the high performance and specific heat consumption. The drawback is the temperature of air can be adjusted only by 50–100 °C, so the drying is complete only with a proper feeding of raw material.

Conclusions. During drying the moisture content decreasing was investigated at constant air velocity and from this an average drying rate was determined that is related to the volume of the material. The air velocity how influences the moisture content decreasing was also investigated. The air velocities were 1, 0.5, 0.25, 0.1 m/s and natural convection (0 m/s). The required air velocity can be determined by measurements for a particular process, which the effective drying can be achieved beyond economical operating.

References.

1. http://technologia.chem.elte.hu/hu/muvelettan/ Vegyipari_ Muvelettan_teljes.pdf (Chemical Operations, 2016.11.12.)
2. Krischer, O. & Kast, W., 1978. Die wissenschaftlichen Grundlagen der Trocknungstechnik, Bd. 1. 3. Auflage, Springer Verlag, Berlin, Heidelberg.
3. Martynenko, A., 2008. Computer Vision System for Ginseng Drying: Remote Sensing, Control and Optimization of Quality in Food Thermal Processing. VDM Verlag, Saarbrücken.
4. Abduraxmonov O.R., Mizomov M.S., Adizova M.R. “Analysis of the composition of fruits and vegetables during the drying process” Eurasian journal of academic research
5. Kh.Djurayev, M.Yodgorova, D.Khikmatov, Sh.Rasulov “Mathematicalmodeling of the extraction process of coniferous plants”
6. Khayrullo Djuraev, Mamura Yodgorova, Akhtam Usmonov and Mukhammad Mizomov, “Experimental study of the extraction process of coniferous plants” IOP Conf. Series: Earth and Environmental Science 839 (2021) 042019
7. Исаева, Л. Б. (2011). Некотрые аспекты процесса формирования профессиональной компетентности иностранных студентов российских технических вузов. *Вестник Казанского технологического университета*, (8), 322-327.
8. Исаева, Л. Б. (2012). Образовательная среда как предмет психолого-педагогических исследований. *Вестник Казанского технологического университета*, *15*(13), 280-284.
9. Сабитова, Р. Р., & Исаева, Л. Б. (2014). Экология: курс лекций с комментариями и упражнениями для иностранных студентов технических специальностей. *Казань: КНИТУ*.
10. Z.Z.Qodirov, I.A.Oripov, A.Tagiyev, G.Shomurodova, & M.Bobirova. (2022). WATER-SAVING IRRIGATION TECHNOLOGIES IN SOYBEAN IRRIGATION, EFFECT OF SOYBEAN ON

GROWTH AND DEVELOPMENT. *European Journal of Interdisciplinary Research and Development*, *3*, 79–84. Retrieved from http://ejird.journalspark.org/index.php/ejird/article/view/33

11. Egamberdiev M.S, Oripov I.U, & Toshev Sh.Sh. (2022). Development of a Method for Measuring the Layered Moisture State of Concrete and Various Bases. *Eurasian Journal of Engineering and Technology*, *4*, 82–84. Retrieved from https://geniusjournals.org/index.php/ejet/article/view/814
12. M.S.Egamberdiyev, I.U.Oripov, Sh.Hakimov, M.G.Akmalov, A.U.Gadoyev, & H.B.Asadov. (2022). Hydrolysis during hydration of anhydrous calcium sulfosilicate. *Eurasian Journal of Engineering and Technology*, *4*, 76–81. Retrieved from https://www.geniusjournals.org/index.php/ejet/article/view/812
13. Rajabov, O., Gapparova, M., Shodiyev, Z., & Inoyatov, I. (2020). Analysis of the technological process of cleaning raw cotton from small trash. *International Journal of Emerging Trends in Engineering Research*, *8*(9), 6022-6029.
14. Rajabov, O., & Shodiyev, Z. (2019). Analysis of Small Fluctuations of a Multifaceted Mesh under the Influence of Technological Load from the Cleaned Cotton-Raw. *International Journal of Advanced Research in Science, Engineering and Technology*, *6*(10), 11396-9.
15. Shodiyev, Z., Shomurodov, A., & Rajabov, O. (2020, July). The results of the experimental nature of the vibrations of the grid cotton cleaner. In *IOP Conference Series: Materials Science and Engineering* (Vol. 883, No. 1, p. 012169). IOP Publishing.
16. Shodiyev, Z. O. (2004). On mathematical modeling of the process of separation of cotton from the mesh surface of the cotton separator. In *Collection of reports of the Republican scientific-technical conference.–Tashkent: TTLP* (pp. 15-17).
17. Мухамедова, З. Г. (2020). СОВЕРШЕНСТВОВАНИЕ ПРИНЦИПОВ ПРОЕКТИРОВАНИЯ ОБОРУДОВАНИЯ МОНТАЖНОЙ ПЛОЩАДКИ АВТОМОТРИСЫ С УЧЕТОМ НОРМ НАДЕЖНОСТИ И РЕАЛЬНОГО СОСТОЯНИЯ. Известия Транссиба, (1 (41)), 83-91.
18. Мухамедова, З. Г., & Бахшиллоев, С. Х. (2021). СУЩЕСТВУЮЩАЯ ТЕХНОЛОГИЯ ПОГРУЗКИ И РАЗГРУЗКИ СКОРОПОРТЯЩИХСЯ ГРУЗОВ. Журнал Технических исследований, 4(3).
19. Мухамедова, З. Г. (2021). МЕТОДИЧЕСКИЕ АСПЕКТЫ ПОДГОТОВКИ КАДРОВ НА ОСНОВЕ ПОТРЕБНОСТЕЙ РЕГИОНОВ. ИННОВАЦИИ В ПЕДАГОГИКЕ И ПСИХОЛОГИИ, 4(9).
20. Мухамедова, З. Г., & Эргашева, З. В. (2021). ЭКОНОМИКО-МАТЕМАТИЧЕСКАЯ МОДЕЛЬ КОНТЕЙНЕРНОГО БЛОК-ТРЕЙНА. Журнал Технических исследований, 4(3).
21. Mukhamedova, Z. G. (2019). Analysis and Assessment of Power Efficiency of Special Self-Propelled Railway Rolling Stock. Acta of Turin Polytechnic University in Tashkent, 9(3), 104-109.
22. Хромова, Г. А., Мухамедова, З. Г., & Юткина, И. С. (2016). Оптимизация динамических характеристик аварийно-восстановительных автомотрис. Монография. Научный журнал:«Fan va texnologiya», Ташкент–2016.–253 с.[In.
23. Мухамедова, З. Г. (2015). Динамическая модель для исследования продольных колебаний главной рамы электровоза с учетом установки демпфирующего поглощающего аппарата в автосцепке. Известия Транссиба, (2 (22)), 18-23.