DOI 10.31891/2307-5732-2022-315-6(2)-15-19
УДК 641.1 + 641.53

Artem ANTONENKO
Kyiv National University of Culture and Arts
https://orcid.org/0000-0001-9397-1209
e-mail: artem.v.antonenko@gmail.com
Galina TOLOK
National University of Life and Environmental Sciences of Ukraine
https://orcid.org/0000-0002-2971-1645
Dmytro SUKHOMLYN
Kyiv National University of Culture and Arts
https://orcid.org/0000-0002-2669-2573
Daniil TERNOVSKIY
Kyiv National University of Culture and Arts
https://orcid.org/0000-0002-8087-1492
Anna TYSHKOVSKA
Kyiv National University of Culture and Arts
https://orcid.org/0000-0002-8811-877X
Iryna MYKHAYLICHENKO
Kyiv University of Culture

FEATURES OF THE USE OF ROASTING AND BAKERY EQUIPMENT IN THE HOTEL AND RESTAURANT BUSINESS

The article describes the features of the interaction of thermal energy with food raw materials and food products and conducts an analytical review of the use of heat treatment for various technological processes in the food industry and hotel and restaurant business. The paper examines the peculiarities of the interaction of thermal energy with food raw materials and food products and provides an overview of the use of heat treatment for various technological processes in the food industry and hotel and restaurant business. Despite the number of scientific publications dedicated to the topic of technological equipment, in particular thermal heating, in Ukraine this is an insufficiently illuminated topic that requires research, taking into account the current conditions in the national economy. To create more rational technological processes, a combination of thermal heating with other energy carriers is used: steam, hot air, infrared heating, heated fat, vacuum, ultrasound. Heat treatment of food products in the cooking mode is divided into two stages: heating to a set temperature and maintaining this temperature until complete culinary readiness. The stepwise thermal heating method is also used, which ensures a high heating rate and avoids uneven heating of individual areas of the processed products. In this way, the possibility of temperature redistribution is ensured through the thermal conductivity of the material during its thermostating. One of the features of heat treatment is the possibility of rapid and relatively uniform heating of the product over the entire volume, which by its nature depends not so much on the thermophysical characteristics of the heated object as on the presence of moisture in it and the nature of its distribution by volume. The ability of dielectric heating is effectively used in the food industry when defrosting products. Defrosting in the microwave field allows you to speed up the process tenfold and to a large extent preserve the quality of food products. Good results are given by combined methods of defrosting microwave heating with ultrasound, as well as with the method of blowing the product with cold air. The use of microwave heating with other physical methods and energy carriers makes it possible to intensify technological processes, reduce the cost of finished products, as well as increase the nutritional and biological value of raw materials, semi-finished products and finished products.

Keywords: technological equipment, thermal equipment, thermal energy, thermal processes, microwave heating.

Артем АНТОНЕНКО
Київський національний університет культури і мистецтв
Галина ТОЛОК
Національний університет біоресурсів і природокористування України
Дмитро СУХОМЛИН, Даниїл ТЕРНОВСЬКИЙ, Анна ТИШКОВСЬКА
Київський національний університет культури і мистецтв
Ірина МИХАЙЛІЧЕНКО
Київський університет культури

ОСОБЛИВОСТІ ВИКОРИСТАННЯ ЖАРИЛЬНОГО ТА ХЛІБОПЕЧНОГО ОБЛАДНАННЯ В ГОТЕЛЬНО-РЕСТОРАННОМУ БІЗНЕСІ

У статті описано особливості взаємодії теплової енергії з продовольчою сировиною та харчовими продуктами та проведено аналітичний огляд використання теплової обробки для різних технологічних процесів у харчовій промисловості та готельно-ресторанному бізнесі. У роботі досліджено особливості взаємодії теплової енергії з продовольчою сировиною та харчовими продуктами та подано огляд використання термічної обробки для різних технологічних процесів у харчовій промисловості та готельно-ресторанному бізнесі. Незважаючи на велику кількість наукових публікацій, присвячених темі технологічного обладнання, зокрема теплового, в Україні це недостатньо висвітлена тема, яка потребує дослідження з урахуванням сучасних умов розвитку народного господарства. Для створення більш раціональних технологічних процесів використовується поєднання теплового нагріву з іншими енергоносіями: парою, гарячим повітрям, інфрачервоним нагріванням, нагріванням жиру, вакуумом, ультразвуком. Теплова обробка харчових продуктів у режимі варіння поділяється на два етапи:

нагрівання до заданої температури і підтримання цієї температури до повної кулінарної готовності. Застосовують також ступінчастий спосіб термічного нагріву, що забезпечує високу швидкість нагріву і дозволяє уникнути нерівномірного нагріву окремих ділянок оброблюваних виробів. Таким чином забезпечується можливість перерозподілу температури через теплопровідність матеріалу під час його термостатування. Однією з особливостей термічної обробки є можливість швидкого і відносно рівномірного нагрівання продукту по всьому об'єму, що за своєю природою залежить не стільки від теплофізичних характеристик об'єкта, що нагрівається, скільки від наявності в ньому вологи і характер його розподілу за об'ємом. Здатність діелектричного нагріву ефективно використовується в харчовій промисловості при розморожуванні продуктів. Розморожування в мікрохвильовій печі дозволяє прискорити процес в десятки разів і значною мірою зберегти якість харчових продуктів. Хороші результати дають комбіновані способи розморожування мікрохвильовим нагріванням ультразвуком, а також методом обдування продукту холодним повітрям. Використання мікрохвильового нагріву з іншими фізичними методами та енергоносіями дає змогу інтенсифікувати технологічні процеси, знизити собівартість готової продукції, а також підвищити харчову та біологічну цінність сировини, напівфабрикатів і готової продукції.

Ключові слова: технологічне обладнання, теплове обладнання, теплова енергія, теплові процеси, мікрохвильове нагрівання

Formulation of the problem

Currently, in the food industry and the hotel and restaurant industry, special attention is paid to physical methods of influencing raw materials, semi-finished products and finished products, which are capable of intensifying heat exchange processes, ensuring microbiological safety, as well as improving and increasing the nutritional value of food raw materials. A physical method capable of achieving these goals is heating in an electromagnetic field. The paper examines the peculiarities of the interaction of baking equipment with food raw materials and food products and provides an overview of the application of heat treatment for various technological processes in the food industry and hotel and restaurant business. Despite the number of scientific publications dedicated to the topic of technological equipment, in particular thermal heating, in Ukraine this is an insufficiently illuminated topic that requires research, taking into account the current conditions in the national economy.

Analysis of recent sources

A significant contribution to solving the fundamental issues of creating technologies and equipment for food products with complex raw materials as a means of preventing and eliminating micronutrient deficiencies was provided by the research of the following domestic and foreign scientists: O.O. Grinchenko, A.B. Horalchuk, A.M. Dorokhovych, I.Yu. Zhigalenko, A.V. Ziolkovskaya, P.O. Karpenka, M.B. Kolesnykova, V.N. Korzuna, M.V. Kravchenko, H.M. Lysyuk, L.P. Malyuk, L.M. Mostovoi, N.Ya. Orlova, M.I. Peresichny, P.P. Pivovarova, N.V. Prytulska, G.B. Rudavska, M.R. Ennis, J.C.F. Murray, G.O. Phillips, W.C. Weling, P.A. Williams and others [1-14].

The purpose of the article is to study the peculiarities of the interaction of thermal energy with food raw materials and food products and to conduct an analytical review of the use of heat treatment for various technological processes in the food industry and the hotel and restaurant business.

The object of research is the peculiarities of the interaction of thermal energy with food raw materials and dishes.

The subject of research is technological equipment, thermal energy, thermal processes, quality and safety.

Presenting main material

The heating of bodies, in particular food products, in an electromagnetic field differs from their heating due to heat conduction or convection in that the elements of the medium that separates the generators of electromagnetic oscillations and the objects of heating, as a rule, do not participate in the transfer of heat. Therefore, in such systems (generator – medium – heating object) the heat flow is not continuous and the energy is transferred in the form of electromagnetic waves. Heat arises in the objects of heating themselves due to its interaction with the electromagnetic field. Electromagnetic waves of the appropriate frequency v and length can be used in the production of food products to implement three main methods of heating bodies; infrared (IR), dielectric (DE) and induction (ID). It is worth noting that with IR and DE heating, food products are directly heated, while with IR heating, only some ferromagnetic part of the device is heated [1,2,4].

Modern classification: frying pans, fryers, frying pans, roasting and baking cabinets, grills, baking conveyor frying pans, continuous-acting devices intended for frying and baking. A special group of processes includes frying and baking in the field of microwave currents and IR radiation.

Frying pans Today, electric frying pans with only direct heating are widely used in restaurant enterprises - these are, for example, frying pans "CECM-0.2" and "CECM-0.5". In addition, there are SKE-0.3 frying pans in operation; CE-1 and CE-2, as well as "CE-0.45" and "CE-0.22" frying pans, are intended for work with functional capacities. Electric sectional-modulated frying pan "CECM-0.2" has a rectangular steel bowl, veneered with steel sheets covered with white enamel, installed on two pedestals. The bowl has a drain for draining fat. It is closed from above by a hinged cover, which is fixed by two tension springs placed inside the cabinets. A layer of asbestos and foil is laid between the cast-iron bowl and the cladding, which serves as thermal insulation. To automatically maintain the set temperature of the frying pan, a temperature regulator TR-4K is mounted on the back of its bowl. In the right cabinet there is a mechanism for overturning the bowl, which allows you to rotate it by 180° C. The capacity of the bowl is 36 dm 3 (l). Heating time to 350°C 45 min. Electric frying pan with indirect heating "SKE-0.3" differs from 35 "CECM-0.2" and "CECM-0.5" in the method of heat transfer to the loading bowl. Thermal energy is transferred to the surface of the bowl through an intermediate heat carrier - mineral oil. The oil is heated using 6 shades. In the "SGSM-0.5" sectionally modulated gas frying pan, the working bowl is heated due to the combustion chamber located directly below it. Gas frying pan "SKG-0.3" with indirect heating differs from a frying pan with direct heating in that its working bowl is heated with the help of an intermediate heat carrier - mineral oil.

Deep fryers. Electric sectional-modulated fryer "FESM-20" consists of a rectangular frying bath. The heating of fat is carried out by heaters immersed directly in it. Frying takes place in a stainless steel mesh basket immersed in a frying bath with hot oil. The fat heating temperature is regulated automatically using the TR-200 thermoregulator. On the front upper part there are signal lamps and a packet switch. The green lamp shows the inclusion of shadows, and the yellow one - reaching the set temperature of the fat. Productivity - 12 kg/h. The amount of oil to be poured is 20 liters. The time for heating the oil to 180°C is 20 minutes. Continuous fryer "CHE-40" is designed for frying potatoes and fish. The fat in the frying bath is heated by heat exchangers, and the temperature is maintained automatically with the help of the "EKT-2" electric contact thermometer. Culinary products are fed by a conveyor from the loading hopper into the bath, where they are evenly fried, smoothly moving with the help of a rotating auger through a layer of hot fat [5-7].

Roasters Rotary electric frying pan "ZHVE-700" is intended for baking rectangular semi-finished pancakes. In it, a hollow cast-iron frying drum, as well as a tank and a dough tray and a cutting mechanism, are fixed to the top of the table on a bracket. Heating of the frying surface of the drum is carried out due to radiant energy released by quartz electronic heaters installed inside the drum, and its temperature is maintained automatically using a thermoelectric thermometer. The tray is used to form the dough strip and feed it to the frying drum. A scraper knife is located below the drum, which separates the finished test tape. The pancake tape is cut on the pancake with the help of control mechanisms and a knife and placed on the pallet. Productivity – 720 pieces/hour. The dimensions of the pancake are 280 x 240 mm. The capacity of the dough tank is 3 liters. The working temperature of the drum is 160 ÷ 190°C.

Features of arrangement of roasting and baking cabinets, their classification. Frying cabinets are designed for frying meat and fish products, as well as for baking vegetable dishes made from cereals. Baking cabinets are designed for baking meat, bakery and confectionery products. Frying and confectionery cabinets differ in the number and size of working chambers, temperature in the chamber. Frying cabinets "ShZhESM-2K", "ShME-0.85", "ShKe-0.51", 36 "ShZhE-1.36", "ShK-2A" and baking cabinets "ShPESM-3" are in operation. "ESH-3M", "KEP-400". The electric sectional-modulated frying cabinet "ShZhESM-2K" consists of two frying sections of the same type, unified with thermal insulation. The sections are made of steel sheets and are equipped with shelves for decks inside. Sections are heated with the help of shades installed in the inner box of 3 pcs. from above and 3 from below. The upper shade is open, the lower shade is covered with a black leaf. Vapors and gases generated during heat treatment of products are removed through the ventilation hole. On the right is a block of electrical equipment, separately for each section on its front panel there are 2 packet switches for separate control of the upper and lower tenas. Batch switches change the power of adjusting the upper and lower tones in a ratio of 4:2:1. The thermostat automatically maintains the set section temperature in the range from 100°C to 350°C [8-10].

Electric confectionery oven "KEP-400" is designed for baking small bakery and confectionery products. The oven is divided into two halves: in the left part there are shades, a fan, a steam generator, a control system and an alarm system, in the right part there is a baking chamber with a door. In the lower compartment there is a steam generator, which is heated by heaters, a feed pipe and a pipe for draining condensate. Baking takes place on pallet sheets mounted on a rack cart that rolls into the baking chamber of the oven. Steam dehumidification of the baking chamber is carried out by steam obtained in its own steam generator. The limb of the thermostat is set to the required temperature, and with the help of package switches, the working chambers are turned on to strong heating, then switched to weak or strong heating. Productivity – 400 kg/shift. The number of trolley racks is 6. The total power is 50.5 kW, the weight is 2000 kg.

Devices with infrared heating. Electric devices with infrared heating are divided into periodic and continuous devices. The first include grills and universal frying cabinets, the second - a conveyor frying oven.

Electric grill "GE-3" is a parallelepiped-shaped grill with IR generators in the form of a chrome-nickel spiral located in a quartz tube. In the working chamber on the drive shaft with a square socket, a spit with two sliding holders and a set of eight skewers for barbecue is strengthened. Frying schnitzels, cutlets, chops and other products can be done on the grates included in the grill set. The working chamber of the grill is closed by a hinged door made of heat-resistant glass.

Electric grill "GE-2". The grill has two working chambers: the upper - frying and the lower - thermal. Five IR generators ("KI-220-1000") are installed in the frying chamber under the ceiling. Culinary products are mounted on five fork-shaped skewers that perform a complex movement: around their own axis and around the axis of the two disks on which they are fixed. This movement is carried out with the help of a planetary transmission and ensures uniform frying of products. The temperature in the frying chamber is maintained by a thermostat. In the lower part of the frying chamber, a 300W heating element is installed, on which logs are burned, emitting aromatic substances that give the finished product a specific taste and smell. The lower (heat) chamber is heated by three heaters with a total power of 1050 W, and the finished products are kept hot in it [11].

Universal frying cabinets "Oven-0.51" and "Oven-0.85". The cabinets consist, respectively, of three and five chambers, each of which houses one deck. The chambers are heated using IR generators (a nichrome spiral in a quartz tube) located in the upper and lower parts of the chamber. The temperature inside the chambers is regulated with the help of temperature relay sensors in the range from 100 to 300° C. Cabinets are designed for frying, baking and preparing culinary products and work with the use of functional capacities. These cabinets are part of a parametric series of universal infrared heating cabinets, which includes cabinets with the number of decks 3, 5, 6, 8, 9 and 10, to suit catering establishments of various capacities.

Ovens conveyor frying PKZH. The furnace is a device of continuous action. Its main nodes are the conveyor, the frying chamber itself and the blocks (upper and lower) of IR generators. In the working mode, the chain conveyor, on which the tray with products is installed, makes a step (intermittent) movement, which is achieved with the help of a special time relay. IR generators, assembled in blocks of 6 pcs. (block power 4.5 kW), made in the form of a chrome-nickel spiral placed in a quartz tube. The generators are protected from below by a metal mesh that prevents glass from entering the product. Decks have a size of 420x285 mm. From above, the products are heated due to radiant energy, from below - by contact with heated trays. The oven is used in large catering enterprises for frying semi-finished meat products.

Microwave. A microwave oven or UHF oven is an electrical appliance designed for quick cooking or heating of food, defrosting of household products using electromagnetic waves of the decimeter range (usually with a frequency of 2450 MHz). In industry, these furnaces are used for drying, defrosting, melting plastics, heating glues, firing ceramics, etc. In some industrial furnaces, the radiation frequency can vary (so-called variable frequency microwave, VFM). In contrast to classic ovens (for example, an oven or a Russian oven), heating of products in a microwave oven does not occur from the surface, but from the entire volume of the product containing polar molecules (for example, water), since radio waves penetrate quite deeply into almost all food products [12-14]. This reduces the product's heating time. Types of microwave ovens: with grill, with convection (means that a 38 microwave oven can blow hot air on the product in the same way as a conventional oven). The power of microwave ovens varies in the range from 500 to 2500 watts and higher. Almost all household stoves allow the user to adjust the level of radiated power. For this, the heater (magnetron) is periodically turned on and off, according to the setting of the power regulator (that is, the magnetron itself has only two states - on/off, but the longer the duration of the on state relative to the off state, the greater the radiant power of the furnace per unit of time - the so-called wide pulse modulation method, the same is used for the same purposes, for example, in the power regulator of the iron). Microwave radiation cannot penetrate metal objects, so it is impossible to cook food in metal dishes. Metal dishes and metal devices (spoons, forks) in the oven during heating can cause it to malfunction. It is not recommended to microwave dishes with metal coating ("gold stripe") - even this thin layer of metal is strongly heated by eddy currents, and this can destroy the dishes near the area of metal coating. At the same time, metal objects without sharp edges, made of thick metal, are relatively safe in the microwave oven. Liquids in hermetically sealed containers and whole bird eggs should not be heated in a microwave oven: due to the strong evaporation of water, high pressure is created inside them, and as a result, they may explode. For the same reasons, it is undesirable to strongly heat sausage products covered with polyethylene film. When heating water in a microwave oven, you should also be careful - water can overheat, that is, it can heat up above the boiling point. Overheated liquid can boil almost instantly from careless movement. This applies not only to distilled water, but also to any water that contains few suspended particles. The more uniform the inner surface of the water vessel, the higher the risk. If the vessel has a narrow neck, there is a high probability that at the moment of boiling, superheated water will spill out and burn your hands.

Induction electric stove. Today, a new product - induction stoves - is being actively promoted on the household appliances market. When cooking on a regular electric stove, you can use any utensil (steel, aluminum, ceramic, glass). The spiral in the stove heats up and heats the bottom of the dish. A significant disadvantage is the need to buy expensive dishes so that the food burns. A set of good pots and pans can cost more than classic tableware. In such ordinary stoves, there is no protection against human inattention, the result of which can be a burnt pot and a short circuit. Induction stoves work on a different principle, they do not have a heating element at all. The coil creates a magnetic field in which the dishes themselves begin to heat up. The disadvantage of such plates is that it is necessary to buy only dishes with a flat bottom, which is "magnetized". Cooking absolutely does not require a double bottom, the latest developments in the design of the pan, etc. Also, the stove will not turn on if you put unsuitable dishes on it, but it will turn off if the water "ran" or if you remove the pan from it. So it is difficult to start a fire with an induction stove, if the employee forgets that something is being cooked on the stove, the surface temperature sensor is activated, and the stove is turned off. The next advantage of induction stoves is that they cook twice as fast with the same power as resistance stoves (2 liters of water boil in just 3 minutes). With the constant rise in electricity prices, the issue of saving is becoming more and more urgent every day.

Conclusions

So, the studied data on the use of thermal energy in various technological processes allow us to talk about the effectiveness of this physical method of processing products. The use of thermal heating, as well as its complex with other physical methods and energy carriers, allows to intensify technological processes, reduce the cost of finished products, as well as increase the nutritional and biological value of raw materials, semi-finished products and finished products. At the same time, the mechanisms of the effect of thermal energy on food products remain unexplored.

References

1. Mazaraki A.A. (2012). Tekhnologiya harchovih produktiv funkcional'nogo priznachennya. Kiïv: KNTEU. 1116 s. [in Ukrainian].

2. L'vovich I.YA. (2016) Perspektivnye trendy razvitiya nauki: tekhnika i tekhnologii. Odesa: KUPRIENKO SV. 197 s. [in Ukrainian].

3. Antiushko, D., Bozhko, T., Shapovalova, Nutritional value of a dry soluble gerodietetic product for enteral nutrition. Eastern-European Journal of Enterprise Technologies. 2021. № 5. C. 35–42. [in Ukrainian].

4. Cherevko O.I. (2017). Innovacijni tekhnologiï harchovoï produkciï funkcional'nogo priznachennya. Harkiv: HDUHT. 591 s. [in

Ukrainian].

5. Yatsenko V.M. (2017). Financial-economic and innovative support of entrepreneurship development in the spheres of economy, tourism and hotel-restaurant business. Agenda Publishing House, Coventry, United Kingdom. 619 s. [in United Kingdom].

6. Gamayunova V.V. (2020) Innovacionnye tekhnologii v zhizni sovremennogo cheloveka. Odessa: KUPRIENKO SV. 209 s. [in Ukrainian].

7. Preobrazhenskij A.P. (2019) Uroven' razvitiya tekhniki i tekhnologii v HKHI veke. Odesa: KUPRIENKO S.V. 227 s. [in Ukrainian].

8. Lvovych Y.Ia., Nekrasov V.A., Preobrazhenskyi A.P. Perspektyvni trendy razvytku nauky: tekhnika i tekhnolohii. Odesa. KUPRIENKO SV. 2016. 197 s. [in Ukrainian].

9. Chepurda H.M. Stratehii staloho rozvytku v turyzmi ta hotelno-restorannomu biznesi: mozhlyvosti i problemy zaprovadzhennia v Ukraini. Cherkasy. ChDTU. 2021. 189 s. [in Ukrainian].

10. Wissenschaft fьr den modernen Menschen: wirtschafts, management, marketing, tourismus, rechts und politikwissenschaften. Monografische Reihe «Europдische Wissenschaft» [Brovenko T.V., Antonenko A.V. and others] Buch 4., Teil 6. 2021. [in Germany].

11. Kryvoruchko M.Iu. (2012). Strukturno-mekhanichni vlastyvosti prisnoho tista z boroshna proroshchenoho zerna pshenytsi. Mizhnar. nauk.-prakt. zhurn. «Tovary i rynky». № 1. 82–88.

12. Mykhailyk V.S. (2016). Tekhnolohiia ta yakist pechyva zi shrotamy oliinykh kultur. Kharchova nauka i tekhnolohiia: naukovo-vyrobnychyi zhurnal. № 1. 72–77.

13. Antonenko A.V. (2014). Boroshno z proroshchenoho zerna vivsa yak osnova dlia boroshnianykh kondyterskykh vyrobiv. Naukovi pratsi Odeskoi natsionalnoi akademii kharchovykh tekhnolohii. № 46 (1). 149–153.

14. Zemlina U.V. (2019) Tekhnologiya boroshnyanih strav na osnovi netradicijnoї sirovini. Naukovij zhurnal «Vcheni zapiski» TNU im.V.I.Vernads'kogo. Seriya «Tekhnichni nauki». Tom 30 (69). №4. 77-82