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ХАРЧОВИХ ТЕХНОЛОГІЙ

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за матеріалами
XVIII Всеукраїнської науково-технічної
онлайн-конференції
**«АКТУАЛЬНІ ПРОБЛЕМИ
ЕНЕРГЕТИКИ ТА ЕКОЛОГІЇ»**

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Розглянуто наступні напрямки досліджень: тепломасообмін; теплофізичні властивості робочих тіл енергетичного обладнання; нанотехнології в холодильній техніці; екологічні проблеми енергетики; теплові насоси. Системи опалення та кондиціонування; теплообмінні апарати; енергетичні та екологічні проблеми нафтогазової галузі; енергетичні та екологічні проблеми холодильної техніки; енергетичні та екологічні проблеми харчової промисловості; екологічна безпека; екологічні проблеми сучасності; раціональне використання природних ресурсів.

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Секція 1:

**«АКТУАЛЬНІ ПРОБЛЕМИ
ЕНЕРГЕТИКИ»**

- a) the temperature of the heating source (generator wall) $t_g = 65 \dots 95$ °C;
- b) the temperature of the "cold source" (ambient air temperature) $t_w = 25 \dots 45$ °C;

The water-ammonia solution (WAS) is used as the working fluid. The calculations assume the maximum operating temperature in the cooling area to be $t_{ob} = 10$ °C.

The analysis of received results shows that with the ambient air temperature rising, the minimum pressure in the system P_{min} (for a fixed WAS composition in the area of generation) increases, moreover the increase is higher for larger values of ammonia fraction in G-A (X_{min}). This suggests that the increase in ambient air temperature and pressure rise in the system means the temperature in the cooling area increases too, i.e. the cooling capacity of AWRU PO decreases. This dependency is even more noticeable at higher numerical values of X_{min} .

CONCLUSIONS

1. By increasing the temperature of heating source, the proportion of ammonia in the G-A zone is reduced, allowing to obtain higher potential capacity of absorption process during the cooling phase, i.e. to increase the specific cooling capacity of AWRU PO and the performance by water extraction from the air. Since the temperature rise of the heating source from 65°C to 95°C, minimal temperature in the cooling area decreases from 7°C to minus 17°C.
2. When the ambient air temperature increases, the specific cooling capacity of AWRU PO decreases, and this tendency is especially noticeable at higher ammonia fraction in the generation area.
3. The performed estimation of specific cooling capacity of the AWRU PO has shown that it increases along with the temperature of heating source, and at lower ambient air temperatures, this trend is more obvious.
4. At low ambient air temperature, the maximal values of specific cooling capacity of the AWRU PO can be obtained, by increasing the amount of ammonia in the generation area.

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THE SEARCH OF ENERGY-EFFICIENT OPERATION MODE OF AMMONIA-WATER-ABSORPTION REFRIGERATION MACHINES

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By a term a «seasonal refrigerator» is presently named cooling attachment, which utilizes in the work low temperature potential of air environment, being outside the heated bays. A term is not confessedly, because such refrigeration apparatuses are on the initial stage of development. Actuality of generation of seasonal refrigerator is delineated the problems of energy-savings during production activity of domestic and point-of-sale refrigeration devices. Domestic absorbing refrigerators that use low temperature potential of environment and work in the wide range of

temperatures, refrigerators of "seasonal" type, not suitable for work with the quick-changing loading, but declared oneself irreplaceable in the permanent mode at of long duration maintenance of preset parameter. During work in the permanent mode becomes the problem of maintenance of the even temperature field in all chilled volume. Even presence, so-called, super isolations in the corps of modern refrigeration devices during stabilizing of external and internal parameters are given by large running approach of temperature in the chilled volume and this running approach the more than greater ambient temperature. Researches showed that exactly an inertance of the systems on the base of diffusive for absorption refrigeration aggregates is reason of impossibility of creation of the even temperature field without additional modernization of cooling object. Modern domestic and point-of-sale refrigeration installation is designed for work in «hard» operation conditions for information climatic terms (in Ukraine is assurance of normative temperature characteristics in a condenser box at the temperature of air in a bay 32 °C. At the same time in our temperate climate basal time of production activity of apparatuses of the domestic and point-of-sale engineering drives at the temperature of air in a bay 16...22 °C. Such temperatures of air refrigeration apparatuses work not constantly, but with the cycling's cuttings-off, i.e. in position behavior. At lower temperatures of air in a bay (less than 10 °C production activity of modern domestic and point-of-sale refrigeration devices is n. In the case of compression designs it is related to the possible breaks of compression facility, because of gelling of butter, and in the case of absorption – with the complexity of start from a non-working condition and ineffectiveness of chilling cycle from high thermal drop on the departments of hauling of quenching agent in a condenser and vaporizer. At the same time, the decrease of temperature of air in a bay favorably influences on duties condensers of absorption class: at first, heat entrances diminish in a condenser box; secondly, a capability auxiliary to supercool a fluid quenching agent on the entrance of vaporizer and weak solution on the entrance of absorber appears, that improves power efficiency of work of condenser.

The known fact is and that almost a temperate climate has third of dry land with average annual temperatures from minus 5 °C to 12 °C. To utilize a natural cold for storage of food products presently developers offer collections with the original author name «HOLT» (refrigerator – heater), supposing to take away all or feature of refrigeration apparatus on the opened air.

Apparatuses suggest to place in window apertures so that one of walls of refrigerator box went out in an environment. It becomes firmly established that it allows to reduce of energy during production activity of refrigeration device on 50-66 %.

The known collections of «HOLTS» are completed by vapor compression machines refrigeration installations or thermobatteries. For the exception of freezing of products a heater thermo-couple and special collection of temperature control is utilized.

To the lacks of collections of «HOLT» it is possible to take the problems of their installation in small apartments – the typical condenser box of 200-240 dm³ will occupy all of window aperture of kitchen. The seasonal refrigerators of two classes are examined in developments of laboratory of the domestic refrigeration engineering of ONAFT: universal – exploited in the wide band of ambient temperatures, including below 0 °C (With, in dwellings and unoccupied bays, on a transport; traditional – exploited in dwellings bays with the temperature of air not below 16 °C).

As universal seasonal refrigerators the apparatuses of absorption class, workings with absorption refrigeration installations, are examined (ARI). It should be noted and such not unimportant presently fact - the working body of ARI consists of natural components (water-ammonia solution with the addition agent of inactive gas – hydrogen, helium or blend of hydrogen and helium) and has zero values of extents of ozone-destroying potential and potential of «hotbed» effect practically. Refrigeration apparatuses with ARI have a bank of such unique grades, as: quiet, high fail-safety and protracted resource, deficiency of jarring action, magnetic and electric fields during production activity; capability of the use in one apparatus of a few different thermal energy sources – both electric and alternative (heat of combustion of organic fuel, sun radiation, exhaust-gas of engines domestic combustion); capability of work with off-grade energy sources, including to the electric in the band of tension gridiron 160...240 V. To dignities of ARI it is necessary to take a minimum cost among analogues. Absorption condensers, equipped burn-uses attachments, are widely

utilized tourists and travelers, because there is not an alternative them in districts with deficiency of sources of electric power. The evaluation of consequences of experiments of experimental and serial designs of absorption refrigerators retained that them enhance able, as compared to compression analogues, the level of energy consumption is predetermined existent methodology of calculation and method of bureau during production activity. In accordance with existent calls to the domestic refrigeration apparatuses, above all things, it is necessary to provide the set temperature condition in a refrigerator box in «hard» operation conditions, here, as a rule, work of ARI is carried out in a continuous duty - at the coefficient of working hours equal to unit ($WHE = 1$), and into account not taken on value of energy consumption. At such approach the heat-expression components of ARI possess the supply of floor in the conditions of production activity at moderate 18...25 °C and low ambient temperatures. Stocked floors allow to improve cool making vaporizer of ARI for a bill: auxiliary supercooling of fluid ammonia in a condenser; buildups of purification of vapor-gas blend (VGB) efficiency are in an absorber; decreases of temperature of VGB on included in a vaporizer. At low ambient temperatures the steam current of ammonia fills up a refrigerator only partly, and an equal form concentration of ammonia in a water-ammonia grout (WAG) is bias in the band of low pressures. Both these the factor cause the decrease of complete pressure in collection and buildup of density of diffusive processes at evaporation and absorption, that auxiliary results in the buildup of cool making vaporizer. To the negative moments of work of ARI, it is necessary to take in the conditions of moderate and low ambient temperatures: partial condensation of steams of ammonia in a dephlegmator; supercooling hard (saturated an ammonia) WAG on an entrance in fluid heat changer (FHC); buildup of thermal drop from the components of generator component. All of these factors at the unchanging extent of the fed thermal duty on a generator-thermosiphon result in the decrease of discharge of ammonia in a vaporizer, I.e. cause the decrease of refrigeration horsepower. Resulting effect on cool making vaporizer of ARI of ambient temperatures delineated the characteristics of construction, behaviors and field of refrigeration apparatus conditions.

In spite of the manufactures affecting of ambient temperature work of components of AKHA synonymous is its influence on the values of heat entrancing in the cooled barrels, I.e. on the value of required cool making in behavior of storage.

So, during production activity of refrigerator box with the level of temperatures of storage plus 5 (With in a bay with a temperature 19 °C (With required approximately in two times less cool making, what drastic production activity).

At the generation of seasonal refrigerator of absorption class, it is necessary to consider the characteristic characteristics of starting cycle in behavior of position bureau.

These characteristics are related to the specific of realization of without pumping of chilling cycle, above all things, with the characteristics of gravity circulation of currents of working body, and consist in the following.

In an off-period due to thermal drop in an environment and steam no-flow conditions the temperature of components of direct circuit of ARI (generator-thermosiphon, rectifier, dephlegmator) declines. It is accompanied cooling hard and weak and by partial condensation of steams in a condenser and dephlegmator of ARI. VGB drives in a condenser and lifting highway of dephlegmator, which to this moment was blocked in the circuit of gravity circulation (CGC) of ammonia a steam current. What anymore time of off-period, the below a temperature will go down and the greater feature of dephlegmator will be occupied by VGB.

At the inclusion of thermal duty on the generator component of ARI VGB entrance through a equality highway in CGC by the current of steam. The dynamic discharge head of steam current depends on density of generation of steam in PTS and thermal behaviors of a transport highway. In the period of start the several of steam of ammonia is utilized for heating of frappe components of a transport highway (rectifier, dephlegmator, condenser). Duration of infilling of condenser steam of ammonia in the period of start will be delineated the degree of cooling of components of generator component of ARI in an off-period, I.e. by duration of off-period and level of ambient temperatures. It talks that the well-known thesis – «than anymore time of off-period, the anymore economy», straight inapplicable to the refrigerators of absorption class.

Detectable in this case there is a consequence about non-admission of the considerable supercooling of components of construction of generator component of ARI in an off-period.

This condition comports and with the consequences of bank of researchers and developers of the domestic absorption refrigeration engineering.

Decreasing the degree of supercooling of components of generator component is possible either due to the buildup of thermal resistance head heat-insulation or due to their heating in an off-period.

The first way is related to the buildup of weight size attributes, second - perspective, but presently it is not enough studied.

Questions, related to hunting of energy-savings duties absorption condensers, were examined from middle of 50th of the last century. Likhareva N.V. offered the method of work of ARI with a two sectional heater one section of which is included constantly, and the second is periodically connected by thermouser. A decrease of energy consumption is 10-15 %. Such method of bureau was afterwards realized in the doublecamera refrigerators of "Sibir" company, including in the licensed designs of "Crystal-9" and "Crystal-9M".

A few other situations in refrigeration apparatuses with the high thermal resistance head of non-load-bearing constructions of condenser boxes, for example, in low temperature barrels (LTB) with «superinsulation».

Unlike singlcamera or doublecamera designs in which correlation of temperatures is regulated in barrels, LTB potentially have large functional capabilities, because can, at presence of the fit collections of control, used in all of band of temperatures of storage, in-use in the way of life – from minus 18 °C to plus 12 °C, I.e. to become a multifunction refrigeration device.

In any case the heat-insulation coating of LTB must be designed considering work of ARI in «hard» operation conditions, therefore a multifunction design will possess the considerable supply of cool making at the positive temperatures of storage in the conditions of moderate and low temperatures of environment.

In multifunction LTB, executed on the class, behaviors of refrigeration storage can be realized with a minimum or with complete deficiency of теплопритоков, for example, temperature in a barrel plus 5...12 °C, and ambient temperature plus 10 °C. The time there is in this case a far fewer on-period non-working, therefore to carry out the permanent heating of components of generator component becomes inadvisable, I.e. in such terms more economical there will be position behavior of bureau.

Thus, it is possible to draw a conclusion about perspective (from positions of energy-savings) of investigations in area of follow-on of starting and transitional processes practical escape of which will be become by automated control the system universal seasonal condensers of absorption class.

УДК 66.021.3

МОДЕЛЮВАННЯ ПРОЦЕСІВ ТЕПЛООБМІНУ В СИСТЕМАХ ПЕРВИННОГО НИЗЬКОТЕМПЕРАТУРНОГО ОХОЛОДЖЕННЯ ДРІБНОСЕМ'ЯНИХ КУЛЬТУР

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Серед усіх типів зернових продуктів особливий інтерес для низькотемпературної сушіння представляють сорти дрібного зерна (ріпак, льон, просо, гірчиця, амарант і ін.). Вони через незначну характерного лінійного розміру найбільш схильні до пошкодження при сушінні нагріванням. В даний час відсутні будь-які дані з кінетики охолодження зерна і процесів тепломасообміну в цих умовах.

ЕКСПЕРИМЕНТАЛЬНІ ДОСЛІДЖЕННЯ ТЕМПЕРАТУРНОГО ТА ВОЛОГІСНОГО СТАНУ ПРИМІЩЕННЯ ПРИ РІЗНИХ ВАРІАНТАХ ТЕРМОІЗОЛЯЦІЙНИХ МАТЕРІАЛІВ <i>Мороз М.В., Басок Б.І.</i>	128
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ЗБІРНИК НАУКОВИХ ПРАЦЬ

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