INNOVATIVE TECHNOLOGICA
METHODICAL RESEARCH JOURNAL
ISSN: 2776-0987 Volume 3, Issue 5, May, 2022

EXPERIMENTAL TECHNIQUE TO STUDY HEAT TRANSFER DURING CONVECTIVE HEAT TRANSFER

Botir Usmanov
Associate Professor, Fergana Polytechnic Institute, Fergana, Uzbekistan
E-mail: b.usmanov@ferpi.uz

Abstract
The article provides information about the experimental technique to study heat transfer during convective heat transfer.

Keywords: Fluid flow, experimental section, measurement scheme, pipe wall, stream, heat mode.

Introduction

Studies of heat transfer in the viscous-gravitational regime of fluid flow were carried out on two experimental setups. The scheme of the experimental setup, where the heat supply was carried out according to the law tc=const, is shown in fig. 2.1. In this case, only the experimental section was changed, which was a single pipe and bundles with a staggered and in-line arrangement of pipes, immersed in a horizontal rectangular case in which water flowed [1–5]. The measurement scheme remained the same. At another installation, studies were carried out to study local and average heat transfer under boundary conditions of the second kind [6]. In this case, the heat was supplied by passing an alternating electric current from the TSD-2000 transformer directly through the experimental section, which is a pipe made of stainless steel 1Kh18N10T d=30x1, l=2200, immersed in a housing in which water flowed.

The Main Part

The length of the heated section is 70 calibers, and the length of the stilling section is 20 calibers [7-11]. The pipe for the test section was selected from a large batch of pipes as a result of measuring the outside diameter. Fifteen chrome-alumni thermocouples were embedded in the pipe wall [12-16].

When the thermocouples were embedded in the pipe wall, fifteen through holes 1 mm in diameter were drilled, eleven on the upper generatrix, at a distance of 200 mm from each other and a distance of 100 mm from the ends of the pipe, and four mm from the ends of the pipe [17-19]. The heads of thermocouple junctions were located in these holes, which were then hermetically welded, with the ends of the thermocouples passing inside the pipe and leading out through rubber seals at the ends of the pipe. In addition, as noted above, it was possible to rotate the pipe around the axis at an angle $\varphi=0°$, $\varphi=\pi/4$, $\varphi=\pi/2$, $\varphi=3\pi/4$; $\varphi=\pi$ ($\varphi=0$ - thermocouples were located on the upper generatrix of the pipe). This made it possible to obtain the most complete picture of the wall temperature distribution ts and heat transfer along the pipe perimeter [19–25]. The power in the working section was determined by the current I and by the voltage drop ΔU, which smoothly changed due to an increase or decrease in the gap in the transformer core. The current values varied within I=300-1000 A, which corresponded to the heat flux density W/m^2. The current value was determined using an I508MT current transformer and a connected ammeter, and the voltage drop in the experimental section was measured with a voltmeter. In addition, to identify the location of the pipe in the body of the apparatus on the nature of the development of the heat transfer process, it was possible to measure the position of the axis of the pipe along with the height of the channel [26-33]. Before installation, the experimental pipe was degreased, which was then treated with hot water vapour already in the condenser for 20–30 minutes. Previously, a small vacuum was created in evaporators (5) and (8), about 0.02 MPa, to suck non-condensable gases from the system [34–38]. The parameters under study were measured under a stationary thermal regime, which could be judged by the constant temperatures of the pipe wall and the temperatures at the inlet and outlet of the apparatus. Experiments on the study of heat transfer during condensation were carried out at different speeds of the heating steam. The Reynolds number varied from 3000 to 23000. Preliminary experiments were carried out on film condensation of vapour, and ammonium carbamate. The Revalue of the film varied in the range Re = 100 ÷ 600. In the study of heat transfer during the condensation of binary vapour mixtures in experiments, the content of the volatile component varied in the range Chl = 0.12 ÷ 0.88. To determine the effectiveness of rolled pipes with annular grooves, the study was carried out first on a smooth pipe. All experiments with full condensation [39-43]. After processing the results of the study on the film condensation of pure components and comparing them with the literature data, we proceed to the study of heat transfer during the condensation of binary vapour mixtures. In this case, the following sequence was observed [44-46]. Pour ammonium carbamate into tank 8 when steam condenses - ammonium carbamate into tank 5 according to the

ISSN: 2776-0987 Volume 3, Issue 5, May, 2022

level gauge. Turn on the vacuum pump and set the required vacuum in tanks 8 and 5. During the experiments, the vacuum was adjusted manually. Turn on the oil pump 17, which circulates the oil in the coil of tank 8. We turn on the tubular electric heaters of tanks 5 and 9; The required speed of the cooling water is set using a tap and a rotameter. The flow rate of ammonium carbamate is set, which is regulated by a valve at the outlet of the tank and measured by aperture 12. The readings of all thermocouples, the ammonium carbamate thermocouple and the heating steam are constantly monitored. After the establishment of a stationary thermal regime, which corresponds to the constancy of the readings of thermocouples and thermometers, we take the readings of the instruments.

The readings of instruments are recorded that determine the flow rates of vapours and cooling water, the temperature of the vapours at the inlet and the temperature of the condensate at the outlet, the temperature of the cooling water at the inlet and outlet of the apparatus, and the reading of the vacuum gauge. In each mode, the parameters are measured 3 times, and then the average value is determined.

Then the next mode is set, for this, we set the next speed of the cooling water, and the flow rates of the vapours of the extraction gasoline and water remain unchanged. After carrying out experiments for all cooling water flow rates at a constant Gr = G1 + G2, (G1 is the flow rate of water vapour; G2 is the flow rate of extraction gasoline vapours), proceed to the next series of experiments [45-46]. To do this, we set the following flow rate of extraction gasoline and water vapours, and by changing the flow rate of cooling water, we conduct research in the same sequence as in the first series. After carrying out all series of experiments on a smooth pipe, they were carried out in a similar sequence on four vertical pipes with transverse annular grooves on the outside and fused diaphragms inside. To assess the accuracy of experimental studies, the errors of the measured values were determined using a well-known method.

Conclusion

It is assumed that in experiments the distribution of errors in measuring instruments and systems obeys the normal distribution law [51-53]. The mass flow rate of the heating steam was measured using RS-5 and RS-7 flowmeters, the accuracy class of which is 1.0. The temperature of the coolant in the gas distribution device was measured with a mercury thermometer with a division value of 0.1℃, i.e. ΔT_{tar} = 0.05 ℃. The value of the hydraulic resistance of the layer was determined using an MMN-240 micro manometer, the reduced error of which is 1.0%.

References

1. Усманов, Б. С., & Кодиров, З. З. (2021). Влияние солнечных лучей на состав продуктов при хранении высококачественных растительных масел. Universum: технические науки, (2-2 (83)).
2. Усманов, Б. С., Кодиров, З. З., & Ибрагимов, Л. А. (2021). Способы использования высокочастотных лучей при длительном хранении сырья для производства растительных масел. Universum: технические науки, (5-3 (86)), 93-96.
3. Усманов, Б. С., Кадирова, Н. Б., Мамажонова, И. Р., & Хусанова, Н. С. (2019). Подбор эффективного щелочного реагента для нейтрализации сафлорового масла. Universum: технические науки, (12-3 (69)).
4. Усманов, Б. С., Медатов, Р. Х., & Мамажонова, И. Р. (2019). Интенсификация теплообмена при течении HNO3 В трубах с кольцевыми турбулизаторами. Universum: технические науки, (10-2 (67)), 35-37.
5. Медатов, Р. Х., Усманов, Б. С., Обидов, З. Ж. Ў., Эргашев, А. А. Ў., & Курбанов, Ж. Х. (2019). Экспериментальные установки для исследования теплоотдачи при конвективном теплообмене. Universum: технические науки, (11-2 (68)), 28-31.
6. Усманов, Б. С., Гоппиржонович, Қ. М., Сайтбековна, Қ. У., & Умурзақова, Ш. М. (2019). Особенности состава и свойств сафлорового соапстока, определяющие области его применения. Universum: технические науки, (12-3 (69)).
7. Абдурахимов, С. А., Усманов, Б. С., & Мамажанова, И. Р. (2020). Зараженность семян хлопчатника афлатоксином В1. Universum: технические науки, (6-2 (75)), 70-72.
8. Усманов, Б. С., Юнусов, О. К., & Отакулова, Х. Ш. (2020). Изучение влияние способа гидратации на цветность подсолнечного масла. Universum: технические науки, (11-2 (80)), 91-93.
9. Абдуллаева, С. Ш., Абдуллаев, А. Ш., Темиров, О. Ш., Аннаев, Н. А., Нурмухамедов, Х. С., & Усмонов, Б. С. (2019). Эффективность тонкого измельчения деформирующихся тел при скоростном измельчении. In

Энергоэффективность и энергосбережение в современном производстве и обществе (pp. 8-12).
10. Kodirov, Z. Z. (2022). To determine the quality indicators of fruits grown in vineyards. Development of preventive measures against diseases of the vine and their. Innovative Technologica: Methodical Research Journal, 3(01), 62-75.
11. Кодиров, З. З., & Кодирова, З. А. (2020). Влияние влаги при хранении высококачественного рафинированного, дезодорированного хлопкового, подсолнечного и соевого масел. Universum: технические науки, (10-2 (79)), 25-27.
12. Кодиров, З. З. (2021). Влияние концентрации NaOH и избытка щелочи на состав продукта при рафинировании хлопкового, соевого, подсолнечного масла. Universum: технические науки, (3-3 (84)), 50-52.
13. Кодиров, З. З., & Кодирова, З. А. (2020). Изучение процесса гидрогенизации сафлорового масла. Universum: технические науки, (10-2 (79)), 28-30.
14. Шодиев, Д. А. У., & Расулова, У. Н. К. (2022). Значение амарантового масла в медицине. Universum: технические науки, (1-2 (94)), 69-72.
15. Shodiev, D., & Hojiali, Q. (2021). Medicinal properties of amaranth oil in the food industry. In Interdisciplinary Conference of Young Scholars in Social Sciences (pp. 205-208)..
16. Шодиев, Д. А., & Нажмитдинова, Г. К. (2021). Пищевые добавки и их значение. Universum: технические науки, (10-3 (91)), 30-32.
17. Холдаров, Д. М., Шодиев, Д. А., & Райимбердиева, Г. Г. (2018). Геохимия микроэлементов в элементарных ландшафтах пустынной зоны. Актуальные проблемы современной науки, (3), 77-81.
18. Шодиев, Д. А. У. (2021). Нажмитдинова ГККА Специфические аспекты производства продуктов питания. Universum: технические науки, (3-2), 84.
19. Kholdarov, D., Sobirov, A., Shodieva, G., Sobirova, A., Abaralieva, S., Ibragimova, S., & Yakubova, N. (2021, July). On general characteristics and mechanical composition of saline meadow saz soils. In Конференции.
20. Кодиров, З. З. (2021). Физико-химические изменения и нормативные требования к хранению и доставке растительных масел населению. Universum: технические науки, (10-3 (91)), 8-12.

21. Кодиров, З. З., & Ибрагимов, Л. А. (2021). Исследование технологий экстракции растительного масла из гранулированного сафлорного семени. Universum: технические науки, (10-3 (91)), 13-15.
22. Кодиров, З. З., & Буранова, Д. Я. (2021). Изучение критериев безопасности экстрагированного хлопкового масла. Universum: технические науки, (10-3 (91)), 5-7.
23. Anvarjonovich, M. M. M. S., & Kodirov, Z. Z. (2021). Common oidium or un-dew disease in vineyards and measures to combat IT. Innovative Technologica: Methodical Research Journal, 2(12), 111-120.
24. Sattarova, B., & Alieva, F. (2022). Equipment for capillary electrophoresis (cef) for the production of soft drinks in the food industry control method using. Innovative Technologica: Methodical Research Journal, 3(01), 47-51.
25. Alieva, F., & Namunakhon, A. (2022). Current issues of product certification at the international level. Innovative Society: Problems, Analysis and Development Prospects, 86-90.
26. Алиева, Ф. А. К., Шодиев, Д. А. У., & Далимова, Х. Х. К. (2021). УФ-видимый записывающий спектрофотометр уф-2201 спектрофотометр исследование синтетических красителей в безалкогольных напитках. Universum: технические науки, (11-3 (92)), 66-69.
27. Саттарова, Б. Н., & Ибрагимов, Л. А. (2021). Химический состав и свойства куриного мяса. Universum: технические науки, (4-4), 36-37.
28. Ibragimov L. (2022). Quality of milk and dairy products. Archive of Conferences. С. 82-84.
29. Буранова, Д. Я., Кодиров, З. З., & Кенжаев, Ф. Я. У. (2020). Исследование кинетики и селективности экстракции хлопкового масла на основе модификации растворителя. Universum: технические науки, (11-3 (80)), 32-34.-
30. Саттарова, Б. Н., Кодиров, З. З., & Хусанова, Н. С. (2020). Синтез литиевых солей п-ферроценил-бензойной кислоты и их применение как биостимуляторов при выращивании кур. Universum: химия и биология, (11-1 (77)), 46-48.
31. Kodirov, Z. Z., Yakubzhanovna, B. D., & Saydillaevna, K. N. (2021). The physicochemical changes that occur uring storage of vegetable oils and standard requirements for their delivery to the population. Innovative Technologica: Methodical Research Journal, 2(11), 133-143.

32.Khamrokulovich, M. M., Kodirov, Z. Z., & Muzaffarovna, U. S. (2021). The importance of fish oil in the human body and methods for determining the quality of fats. Innovative Technologica: Methodical Research Journal, 2(12), 16-24.

33.Kodirov, Z. Z., Rakhmatovna, M. I., & Saydillaevna, K. N. (2021). Study of the process of sample refining and deodorization of sunflower and soybean oils. Innovative Technologica: Methodical Research Journal, 2(12), 8-15.

34.Хусанова, Н. С., Мамажанова, И. Р., & Кодиров, З. З. (2021). Роль питательных веществ в жизнедеятельности организма. Интернаука, (37-1), 11-13.

35.Сайдалиев, О. Т. (2021). Разработка эффективного катализатора гидроочистки легких нефтяных дистиллятов. Universum: технические науки, (10-4 (91)), 19-21.

36.Sattarova, B., Shodiev, D., & Haqiqatkhon, D. (2021). The determination of the composition and structure of ferrocenyl benzoic acids by mass spectrometric and potentiometric methods. Innovative Technologica: Methodical Research Journal, 2(11), 56-58.

37.Nabievna, S. B., & Adxamjonovich, A. A. (2021). The chemical composition and properties of chicken meat. Innovative Technologica: Methodical Research Journal, 2(10), 25-28.

38.Саттарова, Б. Н., Аскаров, И. Р., & Джураев, А. М. (2018). Некоторые вопросы классификации куриного мяса. Universum: химия и биология, (11 (53)), 36-38.

39.Саттарова, Б. Н., Аскаров, И. Р., Хакимов, М. У., & Мадалиев, Т. А. (2019). Влияние полученных биостимуляторов на повышение живой массы цыплят. Universum: химия и биология, (12 (66)).

40.Намозов, А. А., Аскаров, И. Р., & Саттарова, Б. Н. (2011). Анализ синтетических красителей в безалкогольных напитках методом капиллярного электрофореза. Вестник Белгородского государственного технологического университета им. ВГ Шухова, (3), 120-123.

41.Саттарова, Б. Н., Асқаров, И. Р., & Джураев, А. М. (2018). Товуқ гўштининг кимёвий таркибини ўрганиш орқали инсон саломатлигини муҳофаза қилиш. АнДУ Илмий хабарномаси, (3), 31-33.

42. Sattarova, B., & Xurshid, A. (2022). Importance of missella refining technology for vegetable oils. Innovative Technologica: Methodical Research Journal, 3(01), 42-46.
43. Sattarova, B., & Mokhlaroyim, K. (2022). Extraction of oil by pressing. Innovative Technologica: Methodical Research Journal, 3(02), 8-13.
44. Sattarova, B., & Saidmakhammadjon, J. (2022). Factors affecting the quality of vegetable products and canned vegetables. Innovative Technologica: Methodical Research Journal, 3(02), 14-19.
45. Sattarova, B., & Xurshid, A. (2021). Methods of cleaning micelles in the production of vegetable oils. In Interdisciplinary Conference of Young Scholars in Social Sciences (pp. 293-296).
46. Shodiev, D., Haqiqatkhon, D., & Zulaykho, A. (2021). Useful properties of the amaranth plant. ResearchJet Journal of Analysis and Inventions, 2(11), 55-58.