3. $Q_н = Q_{ab} + Q_{bc} = 6{,}5P_0V_0$; КПД $= \frac{Q_н + Q_x}{Q_н} 100\ \%$

Получение численного результата (ПЧР). КПД $= \frac{Q_н - Q_x}{Q_н} 100\% = \frac{P_0V_0}{6{,}5P_0V_0} 100\% = 15{,}4\ \%$

Проверка полученного результата (ППР). Данный ответ согласуется с теоретическими данными для тепловых двигателей, работающих по такому циклу.

Заключение

Определены основные концептуальные положения научно-методической системы обучения физике:

– формирование предметных умений, а также обобщение и систематизация знаний – основные факторы формирования системы физических знаний;

– комплексный подход к формированию системы физических знаний в результате познавательной самостоятельной деятельности студента;

– проверка результатов обучения, как необходимый элемент процесса формирования физических знаний.

Использовать основы физических знаний студент сможет на практических занятиях, при тестировании, при выполнении контрольных работ. Нами разработаны алгоритмические предписания решения задач по любому разделу курса физики или профессиональных задач и продемонстрированы при решении задачи по термодинамике. Этапы решения задачи позволяют студенту показать уровень сформированности компетенций в зависимости от индивидуального уровня обученности. Подробный анализ физической модели и полученного результата задачи способствует развитию научно-исследовательского характера обучения.

Список литературы

1. Быкова В. П. Алгоритмические предписания к решению задач по физике. М., 16 с. Деп. в НИИВШ. 18.06.86. № 789–86.

УДК 004.652.4, 004.043, 004.942/.001.57

MODELING OF THE PARAMETERS OF THE FLUIDIZED BED IN ABSORBER AIR-CLEANING SYSTEM

E. M. Evsina

Astrakhan State Architectural and Construction University (Russia)

Создана математическая модель параметров кипящего слоя в абсорбере воздухоочистительной системы, с целью возможности его использования в качестве очистки воздуха от пыли и токсикантов.

Ключевые слова: абсорбер, кипящий слой, токсиканты, пыль, очистка воздуха, математическая модель, воздухоочистительная система, сорбент.

A mathematical model of the fluidized bed parameters in the absorber of the air purification system has been created, with the aim of its possible use as air purification from dust and toxicants.

Keywords: *absorber, fluidized bed, toxicants, dust, air purification, mathematical model, air purification system, sorbent.*

The processes connected with the interaction of gases with a layer of finely divided solid particles have received considerable application in industries. It should be noted that at relatively low speeds the granular layer remains stationary, and its characteristics do not change with a change in the flow velocity. However, when the velocity reaches a certain critical value, the layer ceases to be immobile, acquires fluidity, and passes into a fluidized state in which the solid particles move intensively in the flow in different directions.

The purpose of this research is to calculate the speed of the supplied air through the absorber and the system of absorbers, under which the fluidized bed would be provided. The particle size in the fluidized bed is d =10-15 mm, the particle density is $\rho = 2{,}4 \cdot 10^3\ кг/м^3$, the thickness of the layer is h = 20-25 cm, the pipe diameter is D= 0.5 m, through which air is supplied. The height of the absorber is H= 2 m, the diameter of the absorber d_1 =1 m. 100,000 air moves through the absorber per day, the dust content of the air is $0{,}1\ г/м^3$, with a dust particle size of $d_2 = 5 \cdot 10^{-3}$ мм, $\rho_1 = 2{,}4 \cdot 10^3\ кг/м^3$ The air contains toxicants: carbon monoxide, oxide and nitrogen dioxide at the concentration of each component - $n = 5\ мг/м^3$. The sorbent has a porous structure - this is claydite on the surface of which there is a layer of pyrolusite 0.1 - 0.5 mm thick.

To understand the heterogeneous structure of the fluidized bed and to construct models describing its features, first of all it is necessary to study the character of the motion of individual grains within the layer. On the body (of the spherical shape) with a weight $m\vec{g}$, a stream of air runs, moving from below upwards with such speed $\vec{\omega}$ that the body does not rise or fall, but it rests on the same level, as it hangs in the air. In this case, it can move in a horizontal plane under the action of lifting and lateral forces. The body will hang in the air. The speed at which this happens is called the speed of waking. This velocity is determined from the condition that the hydrostatic resistance of the layer is equal to the weight of all its particles. In the literature, a number of dependencies are proposed for calculating the velocity ω, obtained on the basis of various equations for calculating the hydraulic resistance of the layer. The hydraulic resistance is determined by Ergans formula [1, p. 68]:

$$\Delta p = H \cdot (150 \cdot \frac{1-\varepsilon}{\varepsilon^3} \cdot \frac{\mu \cdot \omega_{КР1}}{d^2} + 1{,}75 \cdot \frac{\rho \cdot \omega_{КР1}^2}{d \cdot \varepsilon^3}) \qquad (1)$$

where H is the height of the fluidized bed; $\omega_{КР1}$ - is the minimum speed at which the layer passes into the fluidized bed; μ is the dynamic viscosity of the gas; ρ is the density of matter; ε - is porosity of the layer (distance, gaps between the particles), for spherical particles with free backfilling of the layer ($\varepsilon \approx 0{,}4$). The main influence on the hydraulic resistance is the air flow rate, the optimum air flow rate is determined by the following expression [3]:

$$\upsilon = \frac{L}{3600 \cdot S}, \tag{2}$$

where S is the area of the pipe through which air is supplied; L is the air flow rate. The beginning of the transition of the stationary layer to the state of the fluidized bed is judged, first of all, by a change in the nature of the dependence of the resistance of the layer on the flow rate. Note that the weight of solid particles in the layer, referred to 1 cross-section of the apparatus S (with taking into account the Archimedean force), is equal to:

$$\frac{G_T}{S} = \frac{(\rho_T - \rho) \cdot g \cdot S \cdot H \cdot (1-\varepsilon)}{S} = g(\rho_T - \rho) \cdot (1-\varepsilon) \cdot H \tag{3}$$

Assimilating equation (1) and (2), we get:

$$150 \frac{(1-\varepsilon) \cdot \mu \cdot \omega}{\varepsilon^3 \cdot d^2} + 1{,}75 \frac{\omega^2 \cdot \rho}{\varepsilon^3 \cdot d} = g(\rho_T - \rho) \tag{4}$$

We convert the expression (3):

$$150 \frac{(1-\varepsilon)}{\varepsilon^3} \cdot \mathrm{Re} + 1{,}75 \frac{\omega^2}{\varepsilon^3} \cdot \mathrm{Re}^2 = Ar \tag{5}$$

By an approximate solution of the quadratic equation (5), O.M. Todes and O.B. Citovich obtained the following expression for the Reynolds criterion, at which the boiling layer begins:

$$\mathrm{Re} = \frac{Ar}{1400 + 5{,}22 \cdot \sqrt{Ar}} \tag{6}$$

When calculating the speed at which the layer acquires the properties of a fluidized bed, using equation (5), first, we calculate the values of the Archimedes criterion:

$$Ar = \frac{g \cdot d^3}{\nu^2} \cdot \frac{\rho_M - \rho_\Gamma}{\rho_\Gamma}, \tag{7}$$

where g is the free fall acceleration; d is the diameter of the material; ν is the kinematic viscosity; and ρ_M and ρ_Γ -are the density of the material and gas. Then the minimum speed at which the layer acquires the properties of the fluidized bed:

$$\omega_{KP1} = \frac{\nu}{d} \cdot \frac{Ar}{1400 + 5{,}22 \cdot \sqrt{Ar}} \tag{8}$$

where Re, Ar are the Reynolds and Archimedes criteria; ν is the kinematic viscosity of air; d is the diameter of the particles in the layer. Note that the speed of the velocity (the maximum speed) at which the particles do not leave the layer is determined by the following expression [2, p. 45]:

$$\mathrm{Re} = \frac{Ar}{18 + 0{,}61 \cdot \sqrt{Ar}} \tag{9}$$

$$\omega_{KP2} = \frac{\nu}{d} \cdot \frac{Ar}{18 + 0{,}61 \cdot \sqrt{Ar}} \tag{10}$$

As for the regard to numerical values score formula (6) produces a soaring velocity speed 28 m/s, at which the particles leave the layer, that phenomena of air entrainment of the particles is not happening.

Note that the borders of the existence of the fluidized bed are limited, below, by the speed of the start of the fluidized bed and above - by the speed of velocity, therefore the following characteristic of the fluidized bed is the intensity of mixing of particles, which is determined from the following expression:

$$K_{\omega} = \frac{\omega_{KP2}}{\omega_{KP1}}, \qquad (11)$$

where ω_{KP1} is the minimum velocity at which the layer acquires the properties of the fluidized bed; ω_{KP2}-is the speed of velocity (maximum speed), at which the particles do not leave the layer. The number of the fluidized bed was K_{ω} = 8.

It is known that, beginning with the speed of the beginning of the fluidized bed and higher, the pressure drop on the layer remains almost constant, this is because with increasing boiling agent speed, contact between the particles decreases and a greater possibility of chaotic mixing in all directions is obtained. In this case, the distance between the particles increases, that is, the porosity of the layer ε increases and, consequently, its height and pressure drop in the fluidized bed remains practically constant, the height of such an expansion of the layer can be determined:

$$h = \frac{(1-\varepsilon_0)}{(1-\varepsilon)} \cdot h_0. \qquad (12)$$

where ε_0 - is the porosity of the fixed layer; ε - is the porosity of the fluidized bed; h_0 is the height of the layer.

In order to relate the regime of the velocity of a single particle to the regime of the fluidized bed of particles, in [3, pp. 38-56] O.M. Todes proposed to take into account the influence of the constraint of the flow by multiplying the Archimedes number by the function of the porosity of the layer in a formula that takes into account the connection between the Reynolds and Archimedes criteria under fluidized bed conditions. The authors obtained an approximate solution for the porosity of the fluidized bed:

$$\varepsilon = \left(\frac{18 \cdot \mathrm{Re} + 0{,}36 \cdot \mathrm{Re}^2}{Ar}\right)^{0{,}21} \qquad (13)$$

For most processes in the fluidized bed, it is necessary $\omega_{KP1} > \upsilon > \omega_{KP2}$. The values can be estimated by the formulas (6), (7), (8). The optimum value of the speed and, the natural working number of the fluidized bed depends on the technical process.

Conclusions

1. The parameters of the fluidized bed are obtained: the Reynolds criterion, the Archimedes criterion, the hydraulic resistance, the air flow speed, the minimum speed at which the layer acquires the properties of the fluidized bed, the rate of flow (maximum speed) at which the particles do not leave the layer, the number of the fluidized bed, the expansion height of the fluidized bed, porosity of the fluidized bed.

2. The calculations were carried out using the criteria of Reynolds Re 1.16 and Archimedes Ar 3,738, the dynamic viscosity of air, the minimum speed at which the layer acquires the properties of the fluidized bed is 3.2 m / s, the rate of velocity (maximum speed) at which the particles not leaving the layer was 28 m / s, the number of the fluidized bed was 8, the fluidity of the fluidized bed was ε 0,9, the height of the layer expansion was h 1 m, the air flow speed was υ 5.9 m / s.

3. The obtained results are the theoretical basis for designing systems for cleaning the atmospheric air of industrial premises from dust and industrial toxicants.

References

1. Todes O. M., O.B. Citovich Apparatuses with a boiling granular bed: Hydraulic and thermal bases of operation. - L .: Chemistry, 1981 - 296 r., Ill.

2. Fluidization / Ed. I.F. Davidson, D. Harrison. - M. Ed. Chemistry, 1974 - 728 p., Ill.

3. Romankov P.G., Kurochkina M.I., Mozzherin Yu.Ya. Processes and apparatus of the chemical industry - L., Chemistry, 1989 - 560 r., Ill.

УДК 681.518

ОСОБЕННОСТИ УПРАВЛЕНИЯ IT-ПРОЕКТАМИ

А. С. Цицина, Б. Ж. Спанова

Карагандинский экономический университет Казпотребсоюза
(Республика Казахстан)

В статье рассматриваются ключевые аспекты управления программным проектом, способствующие контролю его реализации, оптимизации расходов ресурсов, достижению конечных целей. Менеджмент IT проектов обусловлен необходимостью реализации практических методов планирования работ на основе проектного управления и средств мониторинга организационных процессов.

Ключевые слова: проект, управление IT-проектами, риск, программное обеспечение.

The article discusses key aspects of software project management, contributing ultimately control the process of its implementation, the cost of resources, achieving the ultimate goals due to the need to implement practices for scheduling based on the project management and the monitoring of organizational processes.

Keywords: project management of IT- projects, risk, software.

Использование инструментов управления для управления проектами обеспечивает контроль за его реализацией, распределением ресурсов и достижением сквозных целей [1, с.4]. Планирование неэффективной работы плана увеличивает материальные и временные затраты проекта, усложняет его поток и приводит к разногласиям и конфликтам с клиентом. В настоящее время ситуация в области информационных технологий часто не соответствует бюджету запланированных проектов и проектов. В этом случае процессы планирования и мониторинга являются ключевыми для определения текущего состояния процессов в проекте и способов их достижения.

Использование иностранных технологий в Казахстане может оказаться не всегда эффективным. Несмотря на позитивные тенденции, Респуб-