TYPES OF ENERGY AND WAYS OF USING THEM IN CHEMICAL TECHNOLOGY

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ABSTRACT
Depending on the progress of the reaction, the order (mode) in the reactor, some parameters in the equation have a very small value, so they can be ignored. Modeling of chemical processes and reactors. Before studying chemical technological processes in depth, it is necessary to know some concepts and laws that lead to understanding the essence of these processes. In order to determine the optimal parameters of the technological procedure, apparatus and devices, that is, to optimize the operation of the technological system, a modeling study of chemical processes and reactors is carried out during the design process.

Keywords: K is the heat exchange coefficient Q≠K, Q≠s and Q≠g are the amounts of heat coming out of the apparatus with the products, and the difference is called the convective heat flow. Qf and Q≠f are amounts of heat released and absorbed in the process of physical changes. Scream. and Qsarf. If we put the value in F - heat exchange surface unit;

INTRODUCTION
In the exchange of energy in the form of heat, a substance with a higher temperature transfers its energy to a substance with a lower temperature until the mutual movement is equalized[1]. Work, on the other hand, is a quantitative measure of ordered motion or directed force field, and is the displacement of a particle. For example, work "A" under constant pressure (R=const) expansion of the system from the initial volume V1 to the final V2 is expressed as follows[2]. Alternative energy sources are renewable energy obtained through the use of hydropower, wind energy, solar energy, geothermal energy, biomass and tidal energy[3]. Unlike fossil fuels such as oil, natural gas, coal, and uranium ore, these energy sources do not run out, which is why they are called renewable[4]. In 2019 alone, a total of 200 GW of renewable energy (TEM) facilities were installed worldwide[5].
Solar energy

The Sun is the main source of energy on Earth, with approximately 173 PV (or 173 million GW) of solar energy hitting the planet each year, which is 10,000 times more than global energy needs[6]. On your roof or outdoors, photovoltaic modules convert sunlight into electricity using silicon. Solar collectors are also used for heating and hot water production[7]. Solar panels can generate energy in cloudy weather and even when it's snowing. For maximum efficiency, they must be installed at a certain angle - how far from the equator and how large the angle of installation of the panels is important[8].

Energy balance of processes in chemical production

The initial equation in the reactor calculation is the heat balance equation that takes into account heat changes[9]. It is usually formed according to a constituent (component) substance in the reaction mixture[10].

In general, the heat balance can be written as follows:

Qspend = Qspend (1)

In this case: Q is the amount of heat entering the reactor per unit of time; Qsarf - the amount of heat consumed per unit of time[11].

A simple exothermic reaction process state:

A => B + Q (2)

In this case, the input of heat to the process will be:

Qkrish=> QK r.+ Qrcag (3)

In this case:Qk r. — the amount of heat released during the conversion of substance A into substance V (chemical reaction) within a unit of time, Qreag — the amount of heat entering the reactor with a substance (reagent) within a unit of time.

Heat consumption can be written as the following equation[12]:

Qsp.=> Qmax.* Qower *Q No (4)

Here: Qmax is the amount of heat leaving the reactor with the product in a unit of time; Heat is the amount of heat accumulated in the reactor within a unit of time; No. - the amount of heat consumed (lost) to the environment per unit of time[13].

Scream. and Qsarf. If we put the value in (4) into equation (1):

Qd. r. + Qreag. = Qmaxs + Qyig.+ QNo (5)

will be. If seats are changed:

Q ahead. =(Qmax.-Qreag.) Qyok+Qk.r. will be (6)

will be. The difference between the heat entering the reactor with the raw material and the heat leaving it with the substance heated as a result of the reaction — the product — is called the convective heat flow and is written as follows[14]:

Qconv. = Qmax. - Qreag. (7)

Equation (6) will have the following form:

Q ahead. = Qkonv- QNo+ Qk. r. (8)

The heat balance equation may take different forms depending on the type of reactant and the heat regime[15].

In the general case, process parameters (temperature, concentration, etc.) can change depending on the size of the reactor or change over time[16]. In this case, the heat balance is written and calculated as a differential equation[17].

For this purpose, the modified convective heat transfer differential equation is used:

$$\rho Cp \cdot \frac{ET}{E} = -C\rho\left(Wx\frac{ET}{Ex} + Wy\frac{ET}{Ey} + Wz\frac{ET}{Ez}\right) + \lambda \left(\frac{E_2T}{Ex_2} + \frac{E_2T}{Ey_2} + \frac{E_2T}{Ez_2}\right) - Fk\Delta T + U\Delta H \qquad (9)$$

Here, p is the density of the reaction mixture; Cp is the heat capacity of the mixture; X, U, Z - spatial coordinates; Wx, Wu, Wz - indicators of flow speed in the direction of X, Y, Z axes; X is the coefficient of heat transfer (molecular and turbulent) of the reaction mixture; F - heat exchange surface unit; K is the heat exchange coefficient[18].

AI Ta—Tis a, where: Ta is the temperature of the reaction mixture; Tis , temperature in the heat exchanger; U - chemical reaction rate; AN is the thermal effect of the reaction[19]

The group of indicators on the left side of equation (9) shows the heat rate at which the elements are collected in the volume. The value of Qyig in equation (8) corresponds to it[20]:

$$\text{Qyig'} = \text{pCp}\,\frac{ET}{ET} \qquad (10)$$

and the number of indicators on the right side of the equation reflects the convective-heat transfer in accordance with the coordinates (X, Y, Z) in eleincniin li.iim[21].

The second group of indicators on the right shows the change in heat depending on the thermal conductivity of the reaction mixture.

Qkonv of equation (7) corresponds to the total value of heat transfer with convective flow i, which reflects the effect of thermal conductivity. As a result, it can be written as follows originates. Solving equation (9) is often associated with great difficulties.

Depending on the progress of the reaction, the order (mode) in the reactor, some parameters in the equation have a very small value, so they can be ignored. As a result, the equation becomes simpler, and it is possible to obtain sufficiently accurate values (results) as a result of the calculation.

Equations (8) and (9) above are a mathematical representation of the heat flow in a non-steady (non-stationary) order (regime), where heat accumulation and temperature change with time.

Continuously operating reactors have the characteristic (characteristic) of steady (stationary) order, i.e. Qyig - 0.

In periodically operating reactors, the order is constantly changing, i.e. Q sum = 0.

The energy balance is based on the law of conservation of energy. Based on it, the sum of energies in a closed system is constant (has a certain amount), that is, the amount of heat

entering the chemical technological process is equal to the amount of heat consumed. A heat balance is created based on the indicators of the heat effect of material balance and chemical reactions. It takes into account the chemical reactions, physical changes, heat effect, external heat, heat coming out with the product and the heat consumed through the wall of the device.
The thermal effect is calculated as follows:

QQ + Qs+ QG + QF + Qr + Qk = Q ≠q + Q≠S +Q≠G + Q≠f + Q≠R + Q’V (11)

Here: Qk, Qs, Qg are the amounts of heat entering the device with solid, liquid and gaseous substances.Q≠K, Q≠s and Q≠g are the amounts of heat coming out of the apparatus with the products, and the difference is called the convective heat flow. Qf and Q≠f are amounts of heat released and absorbed in the process of physical changes.
Qr, Q≠r - the heat of endothermic and exothermic reactions and Qk-system heating, and Q"y - the amount of heat lost to the environment or through the cooler.
Qq, Qs, Qg and Q≠k, Q≠s, Q≠g - heat retention of the substance (materials). Usually, this quantity is calculated according to the following formula for each substance (material) entering and leaving the system:

Q = G≠st (12)

Here: G is the amount of substance (material), S is its average heat capacity, and t is its temperature.
Heat capacity m is specified in technical literature for a given temperature and substance.
Usually, the reactor (apparatus) can be supplied with more than one raw material (material - substance). In this case, the heat capacity of a mixture of substances is determined as follows:

$$CA = \frac{G1c1+G2c2+G3c3....}{G1+G2G3} \quad (13)$$

The amount of heat in physical processes is determined as follows:

Qf = G1f1 + G2f2 + G3f3+... (14)

Here: G1, G2, G3 - amount of substances, f1, f2, f3 - heats of spatial change, that is, condensation, crystallization, melting, etc.
The heat of exothermic and endothermic reactions is determined as follows:

A+V = D ±AN (15)

The heat of reaction between substances A and B is calculated by the formation of substance D and the heat effect AN.
The heat supplied or lost to the device, for example, by heating steam, or lost is determined as follows:

Qb = Gc (t6 - tox) (16)

Qb = Gfb (17)

Here: G is the vapor content, S is the heat capacity, Fb is the heat of evaporation or the amount of heat given (lost) through the device wall:

Qy = KF (ti - tc)t (18)

Here: K is the heat transfer coefficient, F is the heat surface, ti is the average temperature of the heating substance, tc is the average temperature of the heated (cold) substance, and x is time. This equation determines the amount of heat supplied or received to the process, lost to the environment.

Modeling of chemical processes and reactors. In order to determine the optimal parameters of the technological procedure, apparatus and devices, that is, to optimize the operation of the technological system, a modeling study of chemical processes and reactors is carried out during the design process.The first problem in modeling is to mathematically determine the functional relationship with the parameters - the quantities necessary to determine the rate of the process or the rate constant, or the output of the product. In determining (describing) the speed of a chemical technological process, the main indicators are the amount (concentration) of reacting substances in a given volume per unit of time. T, pressure - R, linear speed of movement - Wv, Ws, Wg, the degree of mixing of the interacting phase, the activity of the used catalyst Ak, the density of the component system Rk, Rs, Rg, dynamic - ts or static v (viscosity), surface tension or adhesion at the phase boundary - a, strength, shape of the system, height of the reaction volume N, main dimensions of the apparatus (diameter D, length - I) and others can be taken into account

In complex systems, the criteria of comparison (substance) are very complex and numerous, and it becomes difficult to determine the interdependence of their effects. The studied process is analyzed in several stages. On the basis of the comparison method, linear dimensions are studied in certain numbers - intervals, from small scale (sizes) to large scale. Criterion equations are developed on the basis of studies conducted on model devices. The comparison method (physical modeling) is used in the design of a relatively simpler process.

Mathematical modeling. The method of mathematical modeling can be applied to complex chemical-technological systems, processes and devices. A unique feature of the mathematical modeling method is their principle of isomorphism, that is, phenomena of different physical nature can be written in the same mathematical form.

When designing a chemical industrial enterprise, the main focus is on calculating the economic efficiency of production and choosing the most effective method. Economic efficiency is determined by 3 main indicators:

1. Capital costs.
2. Product cost.
3. Labor productivity.

Capital cost includes all costs incurred for the construction of a particular enterprise or plant. Calculating the share of capital costs in the description of capital cost allows for a more accurate analysis. The share of capital costs is equal to the ratio of the value of the enterprise, workshop or device (capital cost) to the annual production capacity:

$$R = K/Q \qquad (19)$$

Here: R - share of capital expenditures, soums/t year, K-capital expenditures, soums, Q - enterprise, shop or equipment capacity, t/year.

As can be seen from the equation, if the production capacity of the device, its structure, working principle is increased due to the change or intensification of the process, the share of capital costs can be reduced.

Cost - total cost is the value of the costs incurred for the production and disposal of the product in the form of money (currency). The costs of the enterprise, which are integrally related to the production of products, are called factory costs and they consist of the following:

1. Consumption of raw materials, semi-finished products and basic materials involved in chemical reactions.
2. Fuel and electricity spent on technology.
3. Salary of key production workers.
4.Depreciation - A - the cost allocated for the restoration of the main production funds (compensating for the breakdown of machinery, equipment, devices and buildings, etc.) (A=K/10Q = P/10).
5. Workshop expenses - expenses for maintenance of basic funds, repair (repair) (including the salary of auxiliary and repair workers), expenses for administrative and management (personnel) employees of the workshop, general equipment safety and labor protection .
6. Total factory costs. Based on the cost of the main product, general plant costs and the cost of additional products are calculated. is fully explained in the course of industrial economy.

The science of chemical technology and engineering is multi-faceted, and includes ergochemistry (the study of chemical reactions and chemical balance) and chronochemistry (the study of chemical reactions, rates of processes, i.e., kinetics and catalysis)) is one of its known parts.

Before studying chemical technological processes in depth, it is necessary to know some concepts and laws that lead to understanding the essence of these processes. Such concepts include heat and work, heat effect and enthalpy, chemical equilibrium and entropy, phase rule, and others.

Heat and work. The main property of matter is its movement. Its criterion is energy, which is manifested in different habits depending on the types of movement. The interaction of matter is manifested in movements, that is, in the exchange of energy. For chemistry, the most important thing is the exchange of energy between substances, that is, heat and work.

Heat is a quantitative measure of irregular, chaotic movements of particles that make up a substance or system (molecules, atoms, electrons, etc.).

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