сульфитредуцирующие клостридии, масса продукта, в которой не допускается, г	Р=400 МПа, τ =5 мин.	0	12×10^4	-
	Р=400 МПа, τ =40 мин.	0	0	0

В соответствии с установленными нормативами показано отсутствие в обработанном вакуумом и давлением сырье грибов бактерий группы кишечной палочки (БГКП) в 1,0 г, а также золотистого стафилококка в 1,0 г, протея в 0,1 г.

Таким образом, с целью более полного обеспечения чистоты полуфабриката из грибов *Pleurotus ostreatus* (Fr.) Kumm его целесообразно обрабатывать давлением не менее 400 МПа с длительной экспозицией воздействия от 40 мин. и более.

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QUALITY ASSESSMENT BEND FINNED TUBES FOOD SYSTEMS HEAT TRANSFER

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Introduction. Technology bending of smooth pipe in various ways researchers engaged Albov IN, IF Bogachev, Grebenkin VG, Kalachev MM, AD Kovtun, A. Halperin, and other existing methods of bending smooth tubes are divided into three main groups: cold, hot, and bend on stamps [1-3 and others].

The use of technology in the helical rolling of the edges of monometallic and bimetallic pipes of circular cross-section of high-and low-fin gives the coefficient on the fin φ_o = 1 ... 20 for the different sizes of finned tubes. To roll the outer helical fins are used as a blank thick-walled seamless tubes of circular cross section, preferably of plastic material.

Statement of the Problem. As the heat-removing elements (cooling) for the construction of systems of heat transfer (CT) are the most promising pipe with outer and inner fins, curved in a coil element (coil). Due to the outer area of the helical fins of heat transfer surface in contact with the cooling medium annulus may be increased in 7 ... 20 times, compared with a smooth tube.

Main results. To ensure the compactness of the coiled element and increase the heat transfer characteristics of the CT, it is necessary to bend the pipe with the minimum and the minimum possible radius of curvature [1-6].These finned tube bending radius depends on its diameter, wall thickness, fin, fin pitch and mechanical properties of pipe material and other factors. Fig. 1 show the scheme to the calculation of bending finned tubes with minimal and minimal bending radii.

In the process of bending of a bimetallic or monometallic finned tubes inside of the fibers of her shortened, lengthened and external. Then the length of the neutral layer of "live" section of finnedtubes is determined by: $l_0 = \pi \cdot R_0 \frac{\alpha}{180}$.(1)

For this reason the length of the fibers outside of the "living" section of finned tubes after bending is determined by the equation: $l_1 = \pi \frac{\alpha}{180}(R_0 + r_H)$(2)

Then the length of the fibers inside of the "living" section of the finned tube after the bend is determined by: $l_2 = \pi \frac{\alpha}{180}(R_0 - r_H)$,(3)

where $r_{вн}$ - the radius of curvature of the neutral layer finned tubes (at the geometric axis), mm; α - angle of the edges after the bend, in degrees; r_H - the outer radius of finned tubes without fins, mm.

The average elongation or contraction of the pipe at the bend is determined by obtaining the dependence: $\varepsilon_{cp} = \frac{l_1 - l}{l} = \frac{l - l_2}{l} = \frac{r_{вн}}{R_н}$. (4)

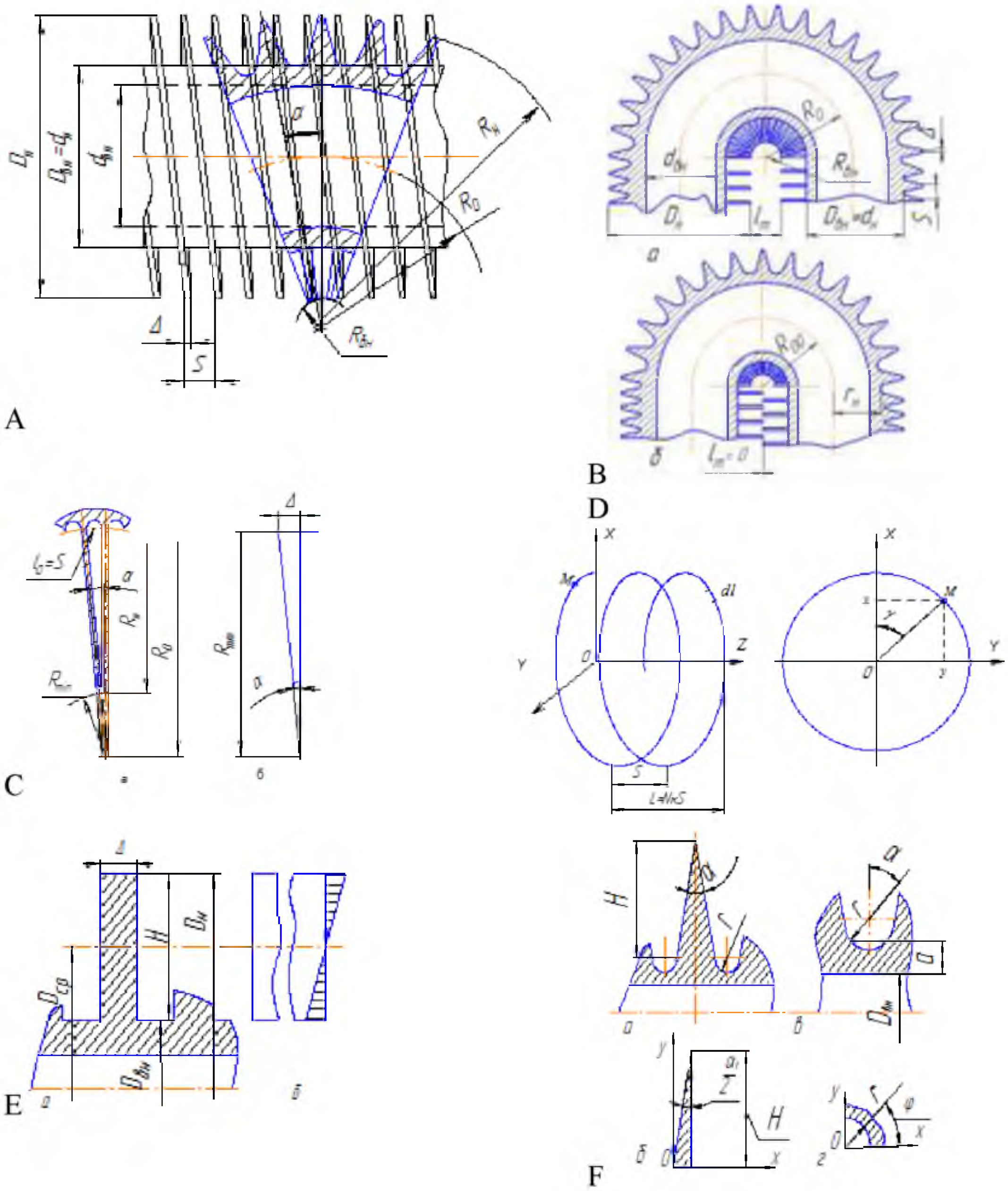
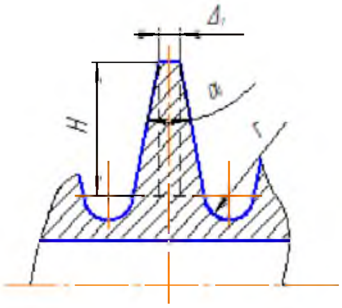


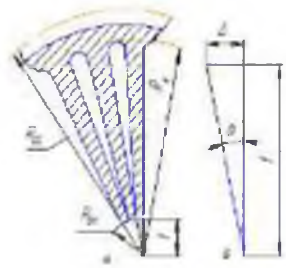
Fig. 1.*A- scheme to calculate the main parameters of finned tube bending;B - scheme to calculate the radius of curvature finned tubes: a - with a minimum of b - with minimal bending radius; C - scheme of the calculation of the angle of bending of the edges after a finned tube; D - scheme to calculate the length of the sweep fin tube; E - diagram to calculate the area of the lateral surface of the finned tube of rectangular section fins; F - scheme to calculate the area of the lateral surface of the finned tubes of triangular section edges*

The arc length in the neutral layer bend measured along the generatrixof the pipe between adjacent two points of the helix fins will be approximately equal to the turn fin tube S. Then the formula (1) takes the form: $l_0 = \pi \cdot R_0 \frac{\alpha}{180}$. (5)

When bending monometallic and bimetallic finned tubes limiting factor to obtain the minimum and the minimum bending radii possible, be touching the adjacent edges of the inside of the bend pipe (see Fig. 1).



A



B

C

Fig.2. *A - diagram to calculate the area of the lateral surface of the finned tube trapezoidal cross-section profile of the edge; B - diagram to calculate the minimum possible radius of curvature finned tubes; C - samples - witnesses*

The angle of bending of the edges after a finned tube between two adjacent ribs (Fig. 1) is determined by: $\frac{\Delta}{R_{\min}} = tg\alpha$. (6)

Solving the system of equations consisting of equations (5) and (6) define an internal minimum bend radius of finned tubes: $\begin{cases} S = \pi \cdot R_0 \frac{\alpha}{180} \\ tg\alpha = \frac{\Delta}{R_{\min}} \end{cases}$. (7)

From equation (6) $R_{\min} = \frac{\Delta}{tg\alpha}$ or as shown in fig. 1 $R_{\min} = R_0 - R_н$.

In view of the slope (Fig. 1,a and 1,b) for the bending section

$$tg\alpha = \frac{\Delta}{R_{\min}} = \frac{S}{R_0} = \frac{S}{R_{\min} + R_H} = \frac{S}{\frac{\Delta}{tg\alpha} + R_H}, \quad (8)$$

Then $R_{\min} = \dfrac{\Delta}{\dfrac{S}{R_{\min} + R_H}} = \dfrac{\Delta(R_{\min} + R_H)}{S}$, (9)

where Δ - finned tube fin thickness, мм; R_0 - the minimum bend radius of finned tubes, мм; $R_н$ - the outer radius of the finned tube, мм.

Get rid of the denominator in the last expression, for this we multiply both sides of the expressions on S: if $R_{\min} \cdot S = \Delta \cdot R_{\min} + \Delta \cdot R_H$.

By reducing the expression obtained in the R_{min}, we obtain: $S = \Delta + \dfrac{\Delta R_H}{R_{\min}}$.

From this $$R_{\min} = \frac{\Delta R_H}{S - \Delta}. \quad (10)$$

Then the bending radius in the neutral layer is determined by the formula

$$R_0 = \frac{\Delta R_H}{S - \Delta} + R_H . \quad (11)$$

To eliminate the intermediate calculations we transform formula (11) so that it included a designation of the diameter of the radius defined by the condition: $R_O = \dfrac{\Delta \dfrac{D_H}{2}}{S - \Delta} + \dfrac{D_H}{2}$.

(12)

The coefficient of finning φ is defined as the ratio of external surface area of finned tubes $F_{пн}$ the inner area $F_{пв}$ by the equation: $\varphi = F_{пн} / F_{пв}$,whence $F_{пн} = F_{тр} + F_p$;where $F_{тр} = \pi \cdot D_{вн} \cdot L - l \cdot \Delta$ - unoccupied area of the tube edges of the constant volume, defined as the difference of squares neorebrennoy smooth tube and fin area F_p, мм^2; $D_{вн}$ - outer diameter of the pipe at the bottom of the ribs, мм; L - length of the fin tube bending from the land, мм; l - length of the sweep fin tube bending from the land, мм.

Then the minimum possible radius of curvature is determined by:

$$R_{00} = R_0 - l_m = R_0 - 2R_{вн} = \frac{D_H}{2} , \quad (13)$$

whereL_T- the distance between the straight sections of pipe, mm.

When bending finned tubes with minimal bending radius (Fig. 2,a and *b*) define the inner radius bend the pipe according to the formula:

$$R_в = R_{00} - (R_{00} - t) = t . \quad (14)$$

Length of the cutting edges (Fig. 2) define: $l_2 = \pi \cdot t \cdot \kappa_з$,where $R_а$- radius of the remote edges of the sample мм; l_2 - length of the cutting edge, mm; $\kappa_з$ - safety factor for the length of the cut edges of the site.

Thus, the depth of cut on the edges of t will be equal to the inner radius bend finned tubes $R_{вн}$.

Payment schemes for finding the depth of cut and to determine the minimum possible radius of curvature are shown in Fig. 2. We present a system of equations in accordance with Figure 8then: $\begin{cases} S = \pi \dfrac{D_H}{2} \cdot \dfrac{\alpha}{180} \\ t = \dfrac{\Delta}{tg\alpha} \end{cases}$.

(15)

From the first equation in the system of equations (22) we express the angle α between two adjacent ribs as: $\alpha = \dfrac{S \cdot 360}{\pi \cdot D_н}$.

Length of the cutting edge is defined as the length of the arc radius equal to the outer diameter of the tube without fins, turned on the bending angle γ. The proposed method of calculation the main technological parameters of bending monometallic and bimetallic finned tubes with minimal and minimal bending radii, allows to make the necessary calculations to establish patterns of performance of the process of bending finned tubes and to establish patterns of influence of the radii of curvature on the formation of the bend in the pipe coil element:

$$l_{с.р} = \frac{\pi \cdot d_н \cdot \gamma}{180} . \quad 16)$$

Thus, the developed methodology allows for the necessary calculations to determine the basic parameters of the process of bending of finned tubes. The proposed technology of bending monometallic and bimetallic finned tubes, produces quality bends with a minimum and the minimum possible radius of the bend pipe.

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