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Modeling the process of separation of small contaminants into the stream of raw cotton moving in the area of treatment

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ABSTRACT: The article examines the structures of cleaners describing the separation of large and small weed impurities from the cotton mass, will determine the parameters for calculating the cleaning effect of having an elastic bond with cotton. The essence of the theoretical analysis of the separation of weed impurities from a fibrous material with dynamic effects with the working bodies of the baking powder is determined. The relationship between the forces acting on the mote of the working drum of the cleaner has been established and it is proposed to use the model of A.G.Sevostyanov to describe the process of cleaning raw cotton from weed impurities.

KEYWORDS: cotton, technology, machine picked cotton theory, equation, force, model, fiber, humidity, cotton seed, maturity, contamination, fiber contamination, neps, cotton cleaning, cotton drying, ginning mills, cotton lint.

I.INTRODUCTION

In our research, we consider the theoretical foundations of the brush drum that separates cotton and the equations of motion of the saw drum on the grate when cleaning cotton. Cotton with a large amount of weed impurities after it passes through the first row of the grate, the mass of cotton moves away from the saw drum. The maximum distance of the cotton from the grate does not affect the effect of some cotton, so it is necessary to wake up the following grate. During the cotton cleaning process, the maximum distance of the centrifugal force from the surface of the saw drum and the vibration of the cotton where the grate, cotton as much as possible cleared of trash.

If raw materials become too heavy or shrink, then the raw material will be affected by the raw material which in turn increases the intensity of its separation from its separation from its raw material composition. During the motion of the raw material contacts force between the particles and the net surface has been formed and the particles move in the spatial direction, resulting in some of them leaving out of the open space A.B Sevostyanov proposed a model for describing such a mechanism (1).According to this model the reduction in the amount of raw material on the net surface is proportional to the mass and volume changes. Based on this model we examine the process of separation of contaminants in the stream of raw cotton moving in the cleaning zone. Before modeling this process it is necessary to determine the pressure and intensity of the raw cotton shale flow on the substrate. Lets just assume that the cleaning chamber has a continuous flow of cylinder net surfaces get the product Q_0 (kg/sec).In the drum center of the coordinate head we assume the following assumptions:

1)The area of the cleaning cotton raw material is determined by cylindrical layer in the polar coordinate $R-h<r<r,\ \alpha_0 \le \alpha \le \alpha_{n-1}$ this is the branch of the sector where n and $\alpha_{j-1} \le \alpha \le \alpha_j$ is the number of pins $j=1..n-1,$

2) The thickness of the raw material in the motion is small enough to $r=R$ relative to the smallest $h<<R$.

3) The movement of the film is stationary and its stationary is and rational velocity is equal.

4) The speed of the pitch (surface) v does not depend on the radius of pole.

5) The pace of the raw material is considered to be equal to the angular velocity of the pile $v_b = R\omega$ of the pile at the beginning of each sector.

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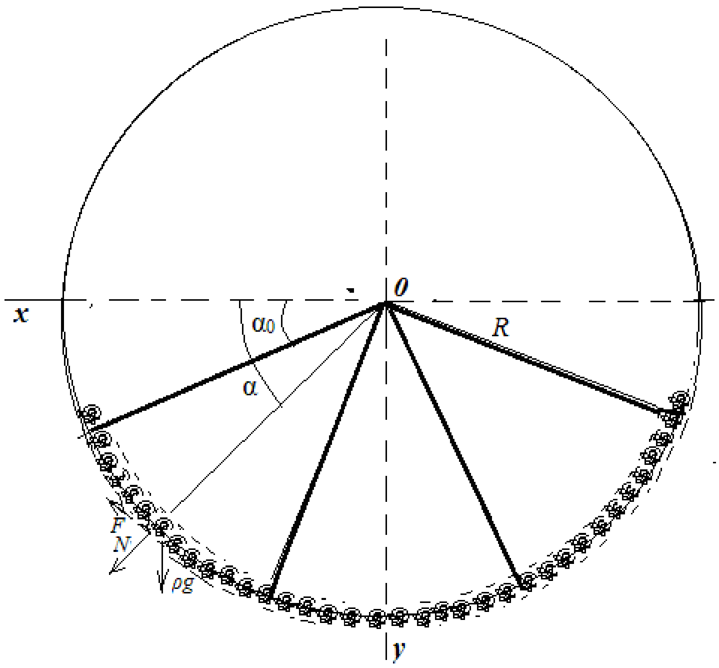
We write on the form of the Euler taking into account the strength and frictional force of the mass of the mass in each sector.

$$\rho_j v_j \frac{dv_j}{d\alpha} = -\frac{dp}{d\alpha} + \rho_j gR(\cos\alpha - f\sin\alpha) - f\rho_j v_j^2$$

Where: $\rho_j = \rho_j(\alpha)$, $v_j = v_j(\alpha)$ and $p_j = p_j(\alpha)$ is the rate and pressure of the raw material in the sector $\alpha_{j-1} \le \alpha \le \alpha_j$



Flow chart of cotton raw material along the net surface (n=4) in the equation there are there nominal ρ_j, v_j and p_j. We use two more additional links to identify them. The first contact is expressed by the law of conservation of the mass that is to be performed for the inpatient state at the discharge portion of the moving stream in the cleaning zone.

$$\rho_j v_j = Q$$

Where $Q = Q_0 / S$, $S = hL$, L -thelength of the cleaning agent the second one is the equation of the raw material.

$$\rho_j = \rho_{0j}[1 + A(p - p_{0j})]$$

Where we determine the raw material density and pressure in the given section on the basis of the experimental coefficient ρ_{oj} and p_{oj} - j punching Ratio of raw materials.

$$v_j = \frac{Q}{\rho_{0j}[1 + A(p - p_0)]} \approx \frac{Q}{\rho_{0j}}[1 - A(p - p_0)]$$

In view of the above mentioned 5th hypothesis (3) and (4) the definition of ρ_{oj} and p_{oj} is defined as quoted

$$\rho_{0j} = \rho_0 = Q / v_b,\ p_{0j} = p_0 = p_{00} - (1 - v_{00} / v_b) / A$$

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Where $p_0 = p_{00} - (1 - v_{00} / v_b) / A$, p_{00} and v_{00} the pressure and speed of the feedstock transfer to the treatment zone.

Thereby expressing the density in the cleavage zone by speed pressure over the following formulas:

$$\rho_j = \rho_0[1 + A(p - p_0)], v_j = v_b[1 - A(p - p_0)]$$

(4) In equations we use (1) equation for pressure:

$$\frac{dp}{d\alpha} - F_0(\alpha) = F(\alpha) \quad (5)$$

Where: $F_0 = \dfrac{A\rho_0[gR(\cos\alpha - f\sin\alpha) + fv_b^2]}{1 - A\rho_0 v_b^2}$,

$$F = \frac{\rho_0[gR(\cos\alpha - f\sin\alpha)(1 - Ap_0) - fv_b^2(1 + Ap_0)]}{1 - A\rho_0 v_b^2}$$

(5) The general solution of the linear first linear equation with respect to

$$p_j = \exp[F_1(\alpha)][C_j + \int_{\alpha_{j-1}}^{\alpha} F(t)\exp[-F_1(t)]dt] \quad (6)$$

Where: $F_1 = \dfrac{A\rho_0[gR(\sin\alpha + f\cos\alpha) + \alpha f v_b^2]}{1 - A\rho_0 v_b^2}$

(6) These conditions are determined by the initial part of the solution variables in the solution:

$$p_j = p_0, \quad \alpha = \alpha_{j-1}$$

If you find C_j using these conditions then the appearance of the solution will be

$$p_j = \exp[F_1(\alpha)][p_0\exp[-F_1(\alpha_{j-1})] + \int_{\alpha_{j-1}}^{\alpha} F(t)\exp[-F_1(t)]dt] \quad (7)$$

The density and speed of the raw material flow in each section is determined by the formula 4

We use Savestyan's model as shown above for the theoretical study of the process of separation of dirt particles from raw materials

$$\frac{dm_j}{m_j} = \lambda_j \frac{d\rho_j}{\rho_j}$$

Where $\lambda_j = \dfrac{1}{1 + a_j}$, a_j the positive constant that is determined by the experimental parameter (8) we define the interconnected mass and the density of raw materials diminished in the case of $m_j(\alpha_j) = m_0$ $\rho_j(\alpha_j) = \rho_0$ under constant

$$\frac{m_j}{m_0} = \left(\frac{\rho_j}{\rho_0}\right)^{\lambda_j}$$

(9) According to the formula analysis for the reduction of the raw material mass in each section, the density of the raw material should be inequality $\rho_j < \rho_0$

Detection efficiency is determined by this formula:

$$\varepsilon_j = \frac{m_0 - m_j}{m_0} = 1 - \left(\frac{\rho_j}{\rho_0}\right)^{\lambda_j}$$

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When calculating the calculation the friction coefficient between the surface of the surface and the surface is determined by this formula:

$$f = f_0(1-\beta)$$

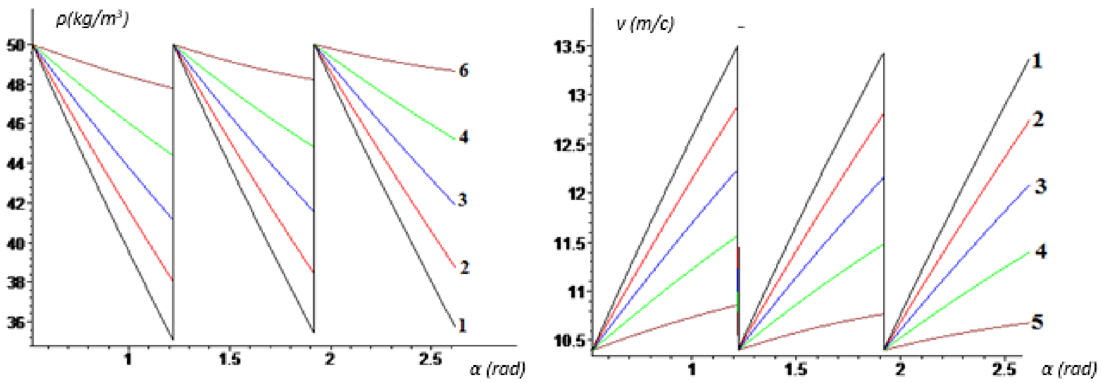
$\beta = S_0 / S_t$ -the surface of the open surface of the proposed substrate S_t

The calculations were made for the following parameters: $\alpha_0 = 30^0$, $n = 4$, $\alpha_3 = 150^0$, $Q_0 = 12000\ / 3600\ kg/s$, $R = 0.2\,m$, $\omega = 52\,s^{-1}$, $p_{00} = 1500\ Pa$, $v_{00} = 5\,m/s$, $f_0 = 0.3$, $h = 0.0038m$, $L = 1.7\ m$

2-figure graphs of the distribution of raw material intensity (a-bands) and velocity (b-strips) along the cleaning axis at two different values of the inctial density of raw materials v_{00} (initial velocity and unchanged) at different values of the coefficient $\beta = S_0 / S_t$ is listed below.

As a result of the pile impact of the analysis, there is a sharp decline and increase in the density and speed of the raw material flow across secfors.

a) b)



Graphs of distribution of raw materials intensity (a-lines) and a velocity) (b-strips)
$1-\beta = 0.1$, $2-\beta = 0.3$, $3-\beta = 0.5$, $4-\beta = 0.7$, $5-\beta = 0.9$ ρ(kg/m^3)

a) b)

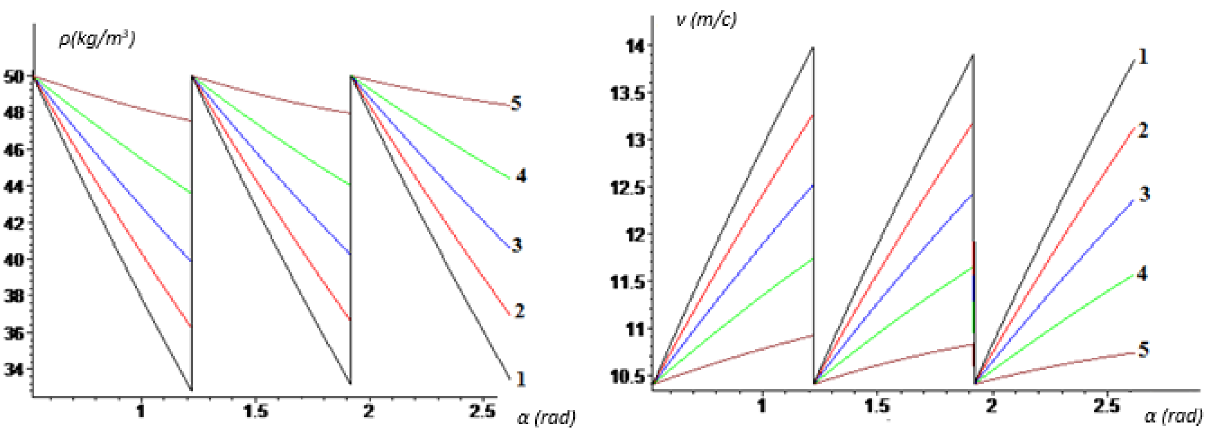


Figure-3. Graphs of distribution by raw clearance of raw materials density (a- curves) and velocity (b- curves) $\rho_{00} = 70\,kg/m^3$ at different values of parameter β $1-\beta = 0.1$, $2-\beta = 0.3$, $3-\beta = 0.5$, $4-\beta = 0.7$, $5-\beta = 0.9$

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Initial density of purging can reduce the maximum valves in the graphs diminution. The use of the density and frequency distribution in the treatment zone is β highly effective. In its small valves there is a high level of intensity changes in the sectoral boundaries and frequencies. The increase in this coefficient reduces the coefficient of friction and as a result may lead to the discrepancy between the sector's distances.

In order to investigate the process of separating the dirt particles from the raw material, we use the formula $\varepsilon = (m_0 - m)/m_0$ in formula (10) which evaluates the efficacy of the effluent and the proportionality coefficients. Are considered to the same as the following parameter β $\lambda = \lambda_0(1-\beta)\beta$.

In figures 4 and 5 there are 4 graphs for cleaning outcomes in different values of ρ_{00} and β at 4 where the cleaning efficiency is 4. The results show a sharp reduction in the efficacy of the analysis of each of the sexes and the sharp reduction of the raw material density due to the impact of the piles and the decreasing effectiveness of the number of sections.

Taking into account the rule of thorough coefficient of parameter λ, given the law the effectiveness of the chosen principle corresponds to the maximum in accordance with the maximum values of coefficient β

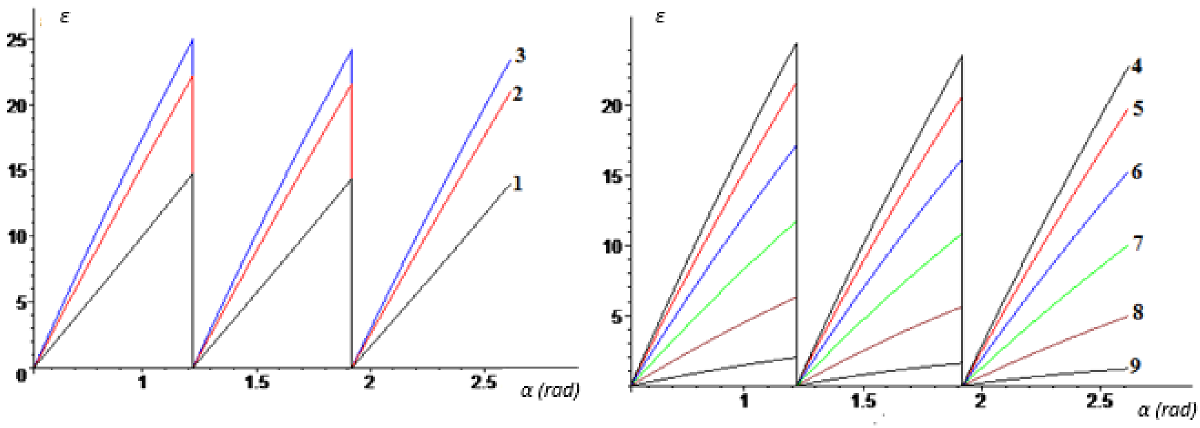

Figure-4. Graphs of cleavage distribution by different values $\varepsilon = (m_0 - m)/m_0$ of the parameter $\rho_{00} = 55\, kg/\text{m}^3$ when the parameter β when the efficiency of cleaning of the dewaterant from composition of cotton raw material $1-\beta = 0.1$, $2-\beta = 0.2$, $3-\beta = 0.3$, $4-\beta = 0.4$, $5-\beta = 0.5$, $6-\beta = 0.6$, $7-\beta = 0.7$, $8-\beta = 0.8$, $9-\beta = 0.9$

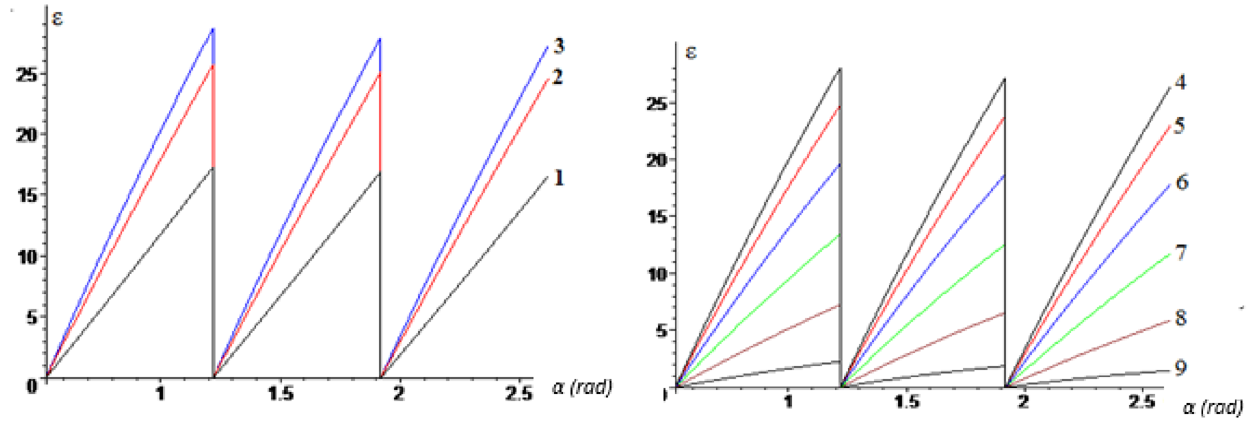

Figure-5. Drip irrigation effectiveness in the raw cotton raw materials in the values of parameters $\varepsilon = (m_0 - m)/m_0$ for distribution parameters at $\rho_{00} = 70\, kg/\text{m}^3$ different values of parameters β . $1-\beta = 0.1$,

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$2-\beta=0.2$, $3-\beta=0.3$, $4-\beta=0.4$, $5-\beta=0.5$, $6-\beta=0.6$, $7-\beta=0.7$, $8-\beta=0.8$, ε
$9-\beta=0.9$

In figure 6 the coefficient of the efficiency λ cannot be changed and its value is $\lambda_1=\int_0^1 \lambda(x)dx$ and the graphs of change of the clearance arrey at its various values ρ_{00} and β are given. As the coefficient of the graphs analysis increases the above mentioned laws can also be mentioned laws can also be observed in the change of efficiency.

$\rho_{00}=55\,kg/\mathrm{m}^3$ $\qquad$ $\rho_{00}=70\,kg/\mathrm{m}^3$

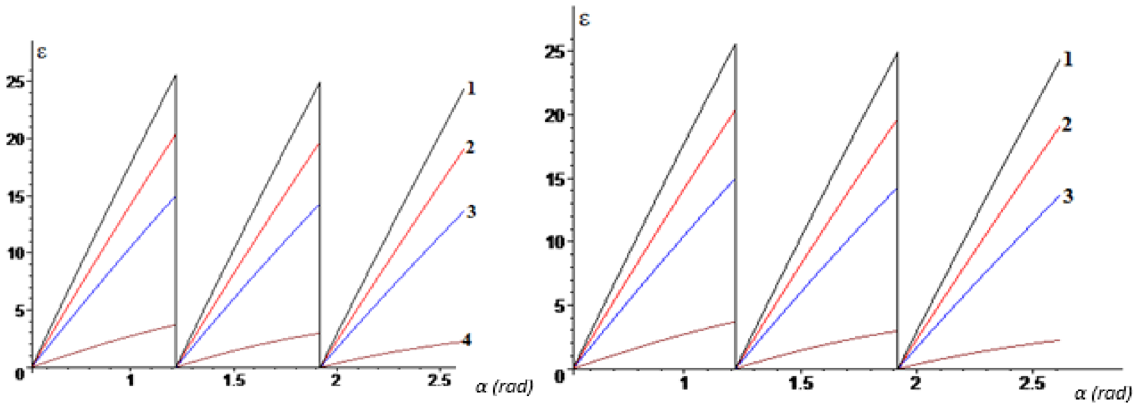

Figure-6. Drip irrigation effectiveness in the raw cotton raw materials in the values of parameters $\varepsilon=(m_0-m)/m_0$ for distribution parameters at $\rho_{00}=70\,kg/\mathrm{m}^3$ different values of parameters.

The full effectiveness of the cleaning zone can be determined by this integral:

$$\alpha_{n-1}-\alpha_0-\sum_{j=1}^{n-1}\frac{\rho_j(\alpha)}{\rho_0}d\alpha$$

The efficiency of the cleaning zone the numeral values of the variations in the density and useful coefficients of the raw material ε_c in the table are given in the table. The results of the analysis of the results show that the efficacy of the treatment zone is dependent on the high level of parameter β and the initial density. The table breaks zone changes in the initial density and the beneficial coefficient β in different values.

$\rho_{00}=55\,kg/\mathrm{m}^3$

$\lambda=4(1-\beta)\beta$									
β	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
ε_c %	14.96	22.95	26.05	25.56	22.46	17.59	11.84	6.20	1.85
$\lambda=\lambda_1=0.6666$									
β	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
ε_c %	26.56	23.83	21.05	18.22	15.35	12.44	9.47	6.46	3.40

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$$\rho_{00} = 70\, kg/\text{m}^3$$

$\lambda = 4(1-\beta)\beta$									
β	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
ε_c %	17.58	26.75	30.20	29.53	25.94	20.30	13.66	7.15	2.11
$\lambda = \lambda_1 = 0.6666$									
β	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
ε_c %	31.00	27.76	24.49	21.17	17.80	14.39	10.94	7.44	3.89

CONCLUSION

It has been established that the pressure, densities and flow rates along the cleaning arc as a result of hammer spikes vary in steps, with a decrease in pressure and density and an increase in the flow velocity along this arc. This indicates the process of significant loosening of the flow during the transition from the cleaning section to the second one and there is a slight change in their values in other cleaning sections. It is proposed to use the model of A.G.Sevostyanov to describe the process of cleaning raw cotton from weed impurities. Left equations for determining the amount of selected impurities in the areas between the pegs, and honey sections of the cleaning zones. It has been established that the greatest amount of impurities released is released in the areas between the first and third pegs, then there is a slight drop in the areas between the next pegs. This circumstance should be considered when choosing the length of the zones of contact of the raw material with a mesh surface.

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