Enlarge the distance of water molecules to incise microorganism cell----the development and application of nano-grade microorganism cell crushing machine

Yao Hongwen* and Guo Suge**

*College of Bioengineering , Hebei University of Science and Technology, Shijiazhuang, 050018, China, yaohw163@sina.com
**Weisheng Pharmaceutical (Shijiazhuang) Co., Ltd., Shijiazhuang, 050035, China, gsg1027@sohu.com

ABSSTRACT

This article elaborates the principle and method which microorganism cell is broken by nano-grade microorganism cell crushing machine. The machine has tailor-made nozzles which send out mightiness sector jet flow enlarged space between of molecules of water to 1~100nm within target distance of jet flow, and incise microorganism cell to nanometer microorganism granule between 10nm and 100nm.

Key words: space between of molecules of water, microorganism cell, nanometer microorganism granule, jet flow of water molecule

1 ENLARGE THE DISTANCE OF WATER MOLECULES TO INCISE MICROORGANISM CELL

Nano-grade microorganism cell crushing machine(patent number: 03143321.9)can break the microbial cell to nanometer level. It established the machine rationale to study out the enlargement water intermolecular distance formula from the design special-purpose spray nozzle, the enlargement water intermolecular distance, jetting flow of water molecule, cutting the microorganism cell. The birth of nano-grade microorganism cell crushing machine ended the disintegrator family cannot crush microscopic material the history.

1.1 Sending jet flow of water molecule and the structure of spray nozzle[1] [2] [3] [4] [5]

Microorganism cell is equably distributed in water and its density is between 10%~12%. The superhigh pressure jet flow carries secretly microorganism cell that sending by the jet flow generator comes into two pipelines which their diameters are between 0.8nm and 1.2mm, then into special-purpose spray nozzles, and enlarges the space between of molecules of water to 4-100 times. Two jet flows collide each other in collided room and jet to microorganism cell, then cut it into nano-grade biology granule. The pressure of the jet flow by generator send is different with microorganism cell. The structre of the spray nozzle see fig 1. Its broken pressure and effect can be seen in the table 1.

From fig1 we can see that the superhigh pressure jet flow carries secretly microorganism cell that sending by the jet flow generator comes into 5 left spray pipe and 6 right spray pipe, then into 3 left nozzle and 4 right nozzle, and collides each other in jet flow correlation and incision room, then cutting microorganism cell later. Its collided each other power is between 500kg/cm^2 and 1400 kg/cm^2. Its particular process is as following fig 2.

Table 1 Various industry microorganism broken pressure and effect:

Name	Crushing pressure(Mpa)	Crushing rate(%)	Microognizism cell original size(μ)	Nanometer microorganism granule size(nm)
Penicillium	75	>90	3x50	10-80
Pseudomonas	75	>90	0.5x0.5	25-50
Streptomyces rimosus	85	>90	1x30	10-100
Bacillus cereus	70	>90	3x10	25-50
Streptomyces griseus	85	>90	1.2x1.2	----
Acremonium chrysogenum	85	>90	1.5x1.5	----
Yeast	110	>90	3x6	20-60

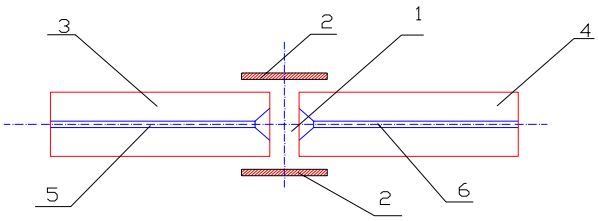

Fig 1 The structure of spray nozzle of nano-grade microorganism cell crushing machine

In fig 1, 1. jet flow ccorrelation and incision room; 2. shaken slice; 3. left spray nozzle; 4. right spray nozzle; 5. left pipe; 6. right pipe.

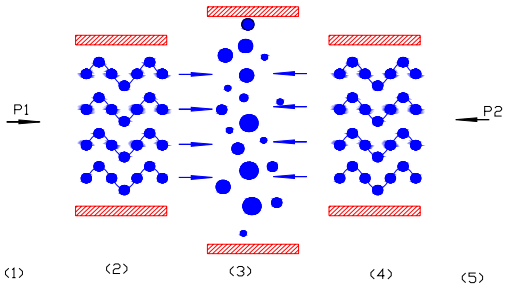

Fig 2 a schematic diagram of supervoltage flow of molecule of water to cut microorganism cell to nanometer biology grain

In fig2, (1)P1 is the directional left stock superhigh pressure jet flow by generator sending out; (2)left stock superhigh pressure jet flow schematic drawing, namely the generator sends out the high-pressured water jet flow which enlarging the molecules spacing between 1nm and 100nm and directional motion to incise the microorganism cell in collided room to the nanometer level granule; (3) Microorganism cell which is crushed is made the biology granule between 1nm and 100nm; (4)The right stock superhigh pressure jet flow; (5)P2 is the directional right stock superhigh pressure jet flow by generator sending out.

1.2 Water intermolecular distance enlargement and example[3] [4] [7] [8] [9]

It is well known that the liquid water has the certain volume not to be compressed easily. The very strong action is being in the water intermolecular because of the water intermolecular distance is very small. Only molecule who has enough kinetic energy can overcome other molecular action and enters the free space forms the gas hydrone however the general member is not easy to be separated from the water liquid into free gas.

The water has fluidity not solid form because affects between the liquid molecule does not strong like the solid, the water molecule time of day changes its position of equilibrium, each of them does not fixed position, arrangement rule between them is the temporary combination again as necessary decomposes. Bestowed the formidable pressure, the water forced into the high-pressured nozzle and enlarged in the nozzle place according to its characteristics. We can see figure 3:

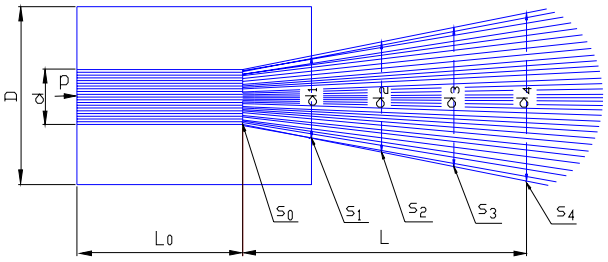

Figure 3 a schematic diagram of water intermolecular distance enlargement

(1)D---spray pipe outer diameter, unit: mm; (2)P---jet flow pressure, unit: Mpa; (3)d---spray pipe inside diameter, unit: mm; (4)S_0---spray pipe inside cross-sectional area, unit: mm^2; (5)S_1, S_2, S_3, S_4---the cross-sectional area of the place where the jet flow is in the target distance, unit: mm^2; (6)d_1, d_2, d_3, d_4---the diameter of place where the taper jet flow pass through,passes through the place diameter, unit: mm; (7)L_0---pipe length, unit: mm; (8)L---the jet flow length in target distance, unit: mm.

It is known that the space between molecules of water was enlarged in the d tube in the fig 3. The space between molecules of water is very small in the normal, only 0.4nm, r_0 = 0.4nm, and was enlarged in the place where d_1, d_2, d_3, d_4 is when the liquid water sprayed out after added high-pressured P. The calculation formulae of enlargement factor η is as follows:

In the place d_n, enlargement factor η_n :

$$\eta_n = \frac{Sn}{S_0} = \frac{\pi\left(\frac{d_n}{2}\right)^2}{\pi\left(\frac{d}{2}\right)^2} = \frac{d_n^{\,2}}{d^{\,2}} \qquad n=1,2,3\ldots$$

It shows spray nozzle structure in chart 1, the thickness is between 10%and 12%, microorganism cell is equably distributed in the water in the left nozzle 3 and right nozzle 4, in the place r_0 = 0.4nm. We can give enove strong pressure P to jet flow in the left and right pipe to crush the microorganism cell inside target distance. The enlarged

distance of water molecules calculation formulae is as follows:

$r_F=\eta x\ r_0$

In nature ,d is measured:
d=1.2mm, d_1=2.4mm, d_2=4.8mm, d_3=9.6mm, d_4=19.2mm.
In the place d distance of water molecules r can be calculated, for example, r_3,

$$r_3=\eta_3 \text{ x } r_0=\frac{d_3^{\,2}}{d^2} \text{ x } r_0=\frac{9.6^2}{1.2^2} \text{ x } 0.4=10.24\text{nm}$$

After crushed by nano-grade microorganism cell crusher, the size of microorganism granule is seen in table 2 from the Beijing physics and chemistry center examination result.

Serial number	Name	S.
1	The fresh yeast	20 nm - 60nm
2	The bacterium original fluid	25 nm - 50nm
3	The penicillin fungus	10 nm - 80nm
4	The streptomyces rimosus	40 nm - 100nm
5	The corn flour	50 nm - 100nm

Table 2 the size of microorganism granule examination result

S* After crushed by nano-grade microorganismcell crusher examination result
The machine crushing effect is as follows fig 4 and fig 5.

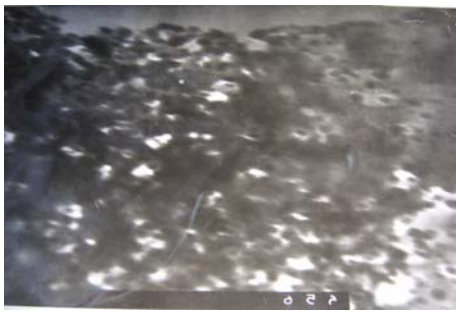

Fig4 the phototelegraph that pseudomonas and bacillus cereus was broken and then enlarged 48000 times

Fig5 the phototelegraph that the yeast was broken and then enlarged 100000 times

2 DEVELOPMENT AND CONCLUSION OF NANO-GRADE MICROORGANISM CELL CRUSHING MACHINE[7] [8] [9] [10]

2.1 Nano-grade microorganism cell breaker machine sculpt

Nano-grade microorganism cell breaker machine can be seen in fig 6.

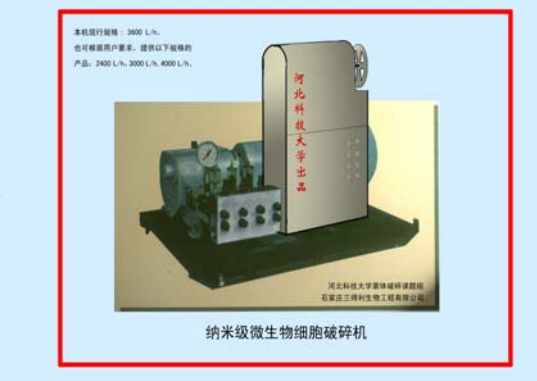

fig 6 nano-grade microorganism cell breaker machine sculpt

2.2 Nano-grade microorganism cell crusher can be developped and manufactured according to model machine

Nano-grade microorganism cell crusher that is used in production is taken to research and produce on the basis of model machine. The mathematics model of systematic is educed on the basis of doniel bermoulli equation and relevant mathematics. See it as follows:

$$D=1.233\sqrt{\frac{Q}{\sqrt{P}\times n}}\times\omega \text{ x}\psi \qquad (1)$$

D---spray nozzle diameter, unit: mm; p---jet pressure, unit: MPa; Q---spraying flux, unit: L/min; n---spray nozzle number, unit: quantity; ω ---water flux quotiety, ω=0.85~1; ψ ---spray nozzle efficiency quotiety.

Velocity of jet flow V calculation formulae of nano-grade microorganism cell crushing machine is as follows

$$V=\frac{Q}{\pi\gamma^2} \quad (2)$$

V---velocity of jet flow, unit: m/s; Q---jet flow flux, unit: m^3/s; r---spray nozzle semidiameter, unit: m.

Jet flow impulsive force F calculation formulae effecting 1g particle of Nano-grade microorganism cell crusher is as follows

$$F=\frac{m(v-v_0)}{t} \quad (3)$$

F---impulsive force of 1g particle received, unit: kgm/s^2; m----1g particle weight, unit: g; v---the velocity of jet flow striking 1g particle, unit: m/s; v_0---muzzle velocity of jet flow, unit: m/s, v_0=0; t---time of jet flow striking 1g particle, unit: s, $t=6.0 \times 10^{-3}$s.

Spray pipe sectional area S calculation formulae of nano-grade microorganism cell crushing machine is as follows

$$S=\pi r^2 \quad (4)$$

S---spray pipe sectional area, unit: m^2; π---3.14; r---spray pipe semidiameter, unit: m.

Jet flow flux Q calculation formulae of nano-grade microorganism cell crushing machine is as follows

$$Q=S \times V \quad (5)$$

Q---jet flow flux, unit: m^3/s; S---spray pipe sectional area, unit; m^2; V---velocity of jet flow, unit: m/s.

Electromotor power N calculation formulae of nano-grade microorganism cell crushing machine is as follows

$$N=\frac{\psi P_N Q_N}{600\eta_P} \quad (6)$$

N---engine power, unit: Kw; Ψ---transform quotiety $\frac{p_{max}}{P_N}$, $\frac{p_{max}}{P_N}$=0.52~0.54; P_N---rating working pressure, unit: MPa; Q_N---rating working flux, unit: L/min; η_p ---engine efficiency , 80%~90%.

2.3 Conclusion

1. The special-purpose spray nozzle in this disquisition enlarge triumphantly the distance of water molecules, calculation formulae is as follows: $r_F=\eta x r_0$. Nano-grade microorganism cell crusher based on this theory.
2. Nano-grade biology granule by this machine produced can be used in the beer, the soy sauce, the antibiotic and the microorganism drugs manufacture industry as the nitrogen raw material, and realizes the waste mycelium circulation economy in fermentation industry.
3. Nano-grade microorganism cell crusher end the disintegrator family cannot crush microscopic material the history at present and realizes nano-grade biology crushing. This machine become one of the disintegrator family.

REFERENCES

[1]Dong Zhiyong, etc..Jet flow mechanics, Beijing: Science publishing house, 2005,3.
[2]Wang Huimin, etc..Project hydromechanics, Nanjing: The river and sea university publishing house, 2005,1.
[3]Wang Huajiu, etc..Technical mathematics, Beijing: Engineering industry publishing house, 2003,8.
[4]Huang Weimin,etc..Technical physics foundation (volume one),2002,9.
[5]Yao Hongwen, etc..Study on the Technique of yeast cell Disruption , Beijing: China brews, 2005, (4).32-34.
[6]Yao Hongwen, etc..Nanometer grade of microorganism cell crushing machine and applies in the beer industry, Beijing: Beer science and technology, 2004 (7), 48-50.
[7]Liu Guoquan. The bio-engineering downriver technology, Beijing: the chemical industry publishing house, 2003. 65-69.
[8]Mao Zhonggui. Bio-engineering downriver technology, Beijing, Chinese light industry publishing house, 2000, 61-79.
[9]H.Schlichting, K.Gersten. Boundary Layer Theoey (8thRevisedandEnlaerged Edition), Springer, 2000.
[10]A.J.Smits.A. Physical Introduction To Fluid Mechanics. John Wiley & Sons. Inc.,2000.