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183 « _____ »

« _____ »



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« _____ » 2

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_____ 20 _____ .,

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183 « _____ »

« _____ »

« _____ » _____ .

1. _____
« _____ 27.01.23 _____ 21-03 _____ »
2. _____ 13 _____ 2023 _____
3. _____ , _____ , _____ , _____

4. _____ , _____ , _____ , _____

_____ 12, _____ .

5. _____ (_____ , _____) _____ 12, _____

6.

1.	.	10.09.	13.11.
2.	.	10.09.	13.11.
3.	.	10.09.	13.11.
4.	.	10.09.	13.11.

7.

01.09.23

1.		01.09.23	
2.		1.09-20.09.23	
3.		20.09-25.10.23	
4.	,	26.10-05.11.23	
5.		26.10-5.11.23	
6.		26.10-12.11.23	
7.		13.11.23	
8.			
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39

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12.

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1.	6
1.1. ,	6
1.2.	17
1.3.	25
1.4. 12.....	35
1.5. 12.....	36
2. , , '	40
2.1.	40
2.2. '	40
2.3.	40
3.	50
3.1.	50
3.2.	50
3.3.	52
3.4. 12	54
4.	57
4.1.	57
4.2. ...	58
4.3. -	61
4.4.	63
5	72
.....	75
.....	76

，

6,8

2%.

3

3

. [26].

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. [23].

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10%

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. [27].

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1. 21-03.4.4

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. [28].

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1.1. 1.

80

3

,5 50

- 1,5...4,5 .

() - 30

9,5...11,5

70%,

- 14,5%,

- 7,5

- 8%.

. 1.1

[15].

1.1.

	, %
	0,2
	0,9
	4,8
	0,6
	6,5

1. 21-03.4.4

, S - r -
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 (6), (2) 1,5...2
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 -
 , .1.2 [5].

7.2. -

, °	13...75
()	6,5...4,5
, / ³	1022...1027
, (10 ⁻³)	1,55...1,65
, / (10 ⁻³)	50...52

1

1,7

! [5].

20%.

[5,15].

95°

1. 21-03.4.4

Candida pseudotropicalis

Kluyveromyces fragilis

1,5...1,7 . 1 [5].

1. 21-03.4.4

90°

()

.7.1.

().

[1,2].

10 1000³

1. 21-03.4.4

2...2,5

1/3

0,7

0,5...2

[17].

1. 21-03.4.4

, ,) ().

, - . , .

. [35].

, 10-20%

, 80-90%

50%

250

(. . , - , , ,).

. [32].

, (, ,) , (, ,) , () , ()

. (/ , , . .) ,

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(- , ,) ,

, , ,

.1.3

1.1

(%)

	6,5	6	6,8
	4,5	4,2	4,5
	0,7	0,8	1
	0,5	0,6	0,7

1.2.

.1.4

	<i>100</i> .	%
	4,66	71,7
	0,91	14
	0,50	7,7
	0,37	5,7
	0,06	0,9
	6,5	100

1. 21-03.4.4

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. [41].

1.5.

.1.5

	/
-	2805
-	1440
	1599
	1013

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. [42].

1.2.

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0,05%,

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1. 21-03.4.4

(93 ± 2 °)

60-65 ° C,

() - 63 - 65 ° C
15-20 .

30 , - 72 ° C

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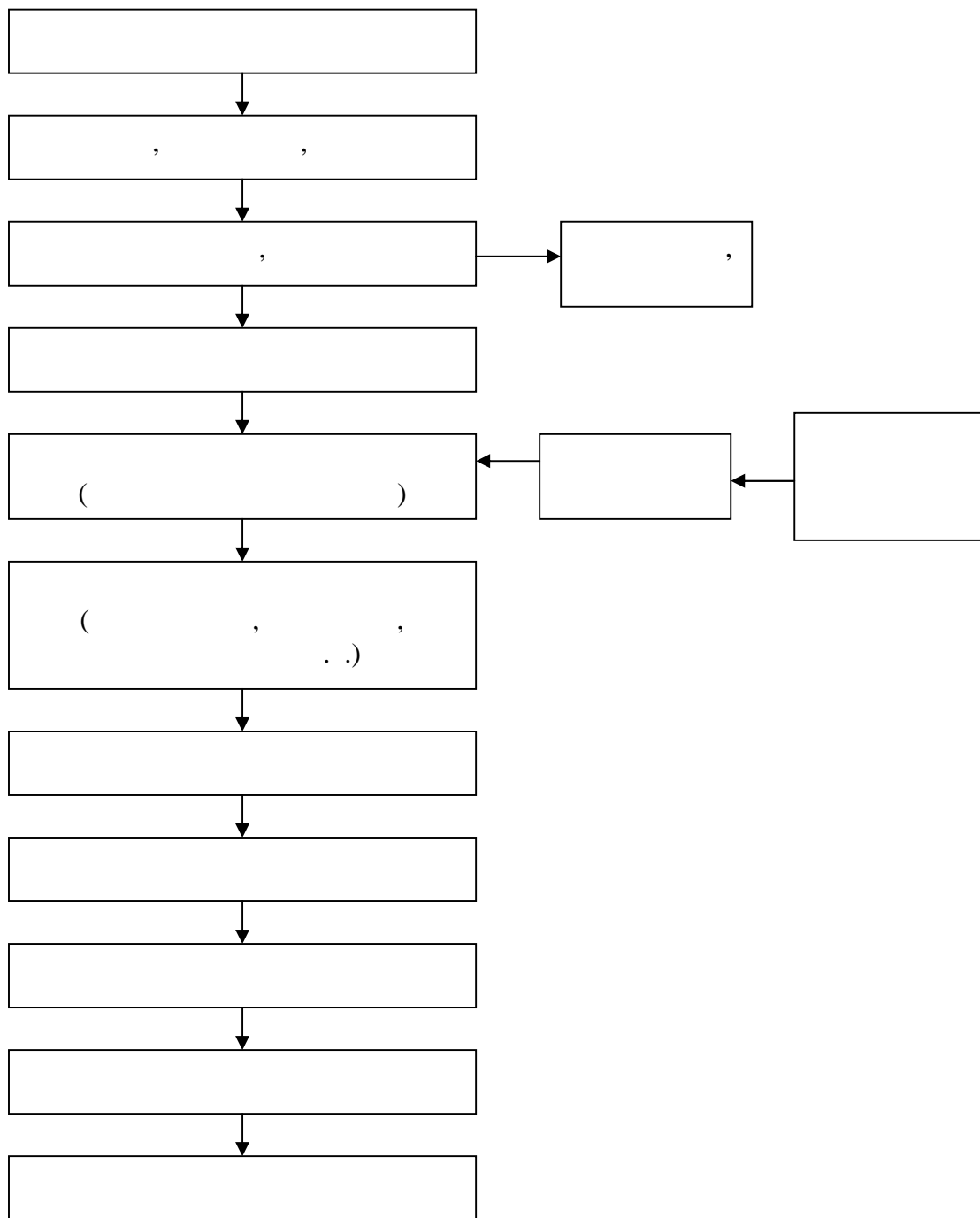
+

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 ; , ;
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 . [22].
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 (), , , .
 .
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 .
 90%
 -
 15...18% .
 ,
 Kluyveromyces lactis, Kluyveromyces fragilis,
 Zygosacharomyces lactis, Candida pseudotropicalis.
 28...30° , 4,5.
 ,
 Clostridium acetobutylicum.



. 1.1.

Propionibacterium

shermanii,

5%

1%

30° ,

– 7,0.

1

24

10

12

5,6 –

5,6 –

12

P. shermanii.

30° ,

48

6,5.

4%.

12

60 / .

12

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: L. acidophilus,

L. helveticus, P. shermanii,

Torula, Candida utilis, K. fragilis

40...44° ,

5-6,2.

- 17,1%,

- 7,4%,

- 0,5%,

- 0,5%,

9579 / ,

- 2143,7 / .

4%

47...52%

,

1. 21-03.4.4

pseudotropicalis,

S -

Tr. lignorum.

Candida
Scl. sclerotiorum,

Aspergillus Niger,

4,2

25...28°

32,4 /

1.3.

1. 21-03.4.4

[38].

[16].

(70...80%),

(IV) (30%)

, , . (

). , ,

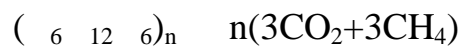
,

4.

().

(IV).

(IV).



4(-CH₂)

(IV).

30...40°

(6,5...8,0).

1776

1. 21-03.4.4

60...70%.

10%

10...13

[11]

r_2 .

r_2

$$r_2 = -\lg \dots$$

$$r_2 = \frac{\dots}{0,03} + 2$$

, 1

(0,1), $r_2=0$.

$r_2=41,2$.

r_2 .

r_2 3...20.

-330

:

;

- (2, N₂, 2)
);

- (,
, ,);

- ;
-

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, ,

75%

, 20% - , 4% - . -

, (IV) .

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10⁶

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2...3 .

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1. 21-03.4.4

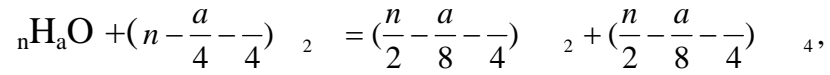
1985 .

30 14 6 .

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n, , - ,

30° .

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540 , 1 - 823 , 1

- 1055 , - 1224 .

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: N: 700:5:1, : N 20:1.

1500:2000 / , ,

- 3000 - 8000 / . ,

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30...32° 1 0,91...0,93

³. 1 , (

) 0,35 ³ . ()

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(8...10%)

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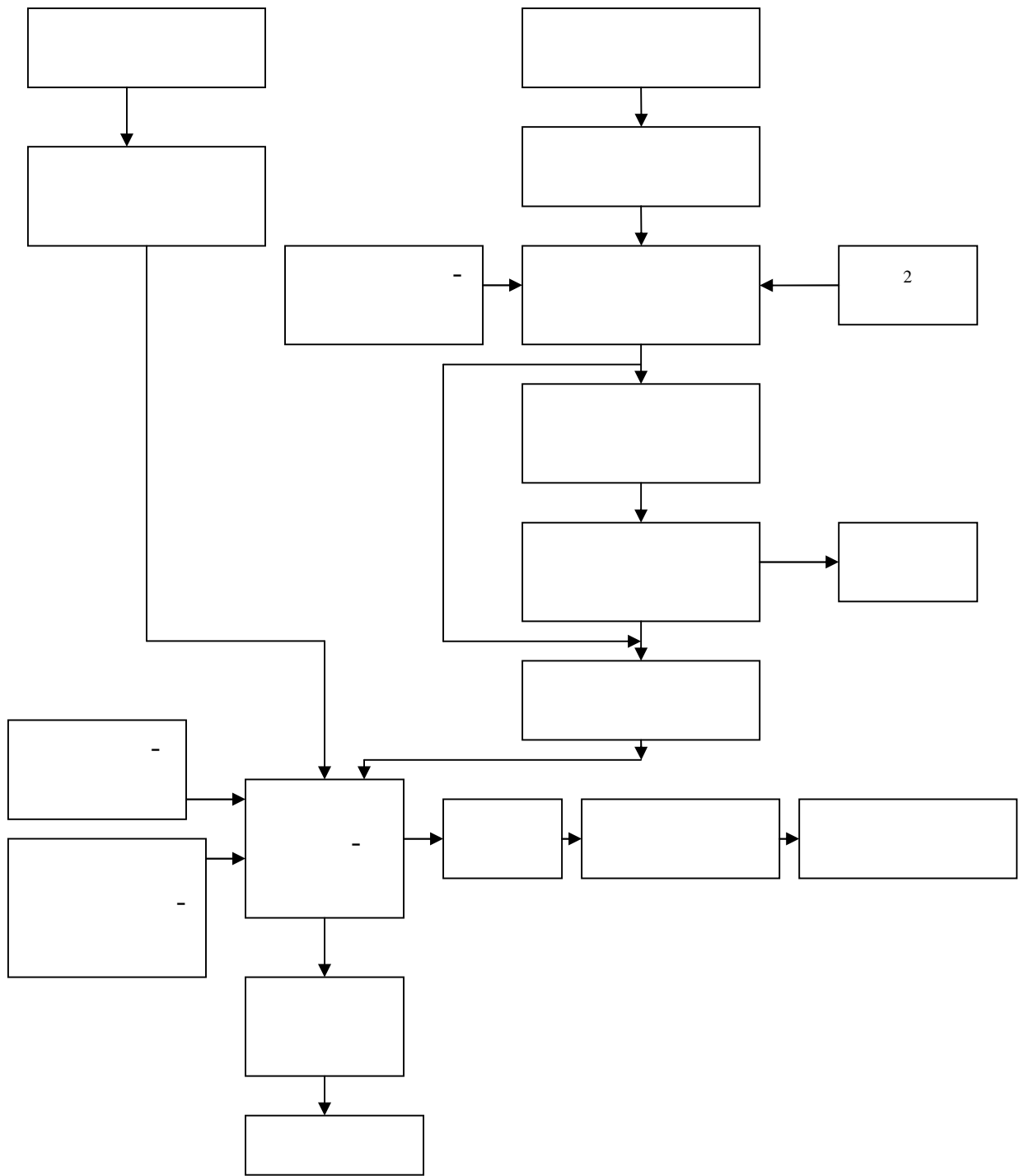
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· ，

1. 21-03.4.4



.7.2.

2/3.

,

1. 21-03.4.4

10%

()

0,45³ 1

70%.

1...5%

0,25...0,4%

0,7%

1%

6,5...8,5.

1.4.

12

12 ()

12

- 5-

1. 21-03.4.4

, ,
 ,
 . [30].

12 ,
 , ,
 .[33]. ,

, (),
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 (, ,),
 , . [31].

1.5. 12

12

12

Prop, freudenreichii ATCC6207, Prop, shermanii ATCC13673,
Prop, shermanii BKM-103 .

, 5,6 . [39].

5,6 ,

,
 . 1-
 . 2- ,
 5,6

5,6 . 2-
 (,) ,

(10—100 /),

Fe, Mn Mg,

(10—100

/),

[(Ni- UhSCU)].

(30—70 /),

. [37].

- ,

30°,

6,5—7,0

-

(NH 4)OH.

500 ,

340

,

7

80

N 2

(),

88

(2 3 /)

12

:

1)

;

2)

(80%), -

;

3)

91-98% ().

80°—120°

10-30

6,1—8,5.

CN-

,

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NaNO2

: IRC-50, 12 3,

B12

-25—40 / . [18].

B12

1. 21-03.4.4

12 4,1 /

Methanosarcina barkeri 0,65 /

Metanobacterium formicum. (.

barkei) .

Mtb. thermoautotrophicum , [36].

, H2

+ CO2, , .

Mis. barkeri

- , . [21].

, (3—

12 /), , , NH4, Co, 5,6 .

35° 1000 3

10% .

1000 /

, -3000 / B12

45-50% , III-10-15%

- 40-50%.

Methanobacillus Methanobacterium 2 /

8 / . [19].

1

1. : - 71,7%, - 14%, -
7,7%
2. ,
, , .
3. .
4. , , .
12 .
5. , 12 .

2 , , *

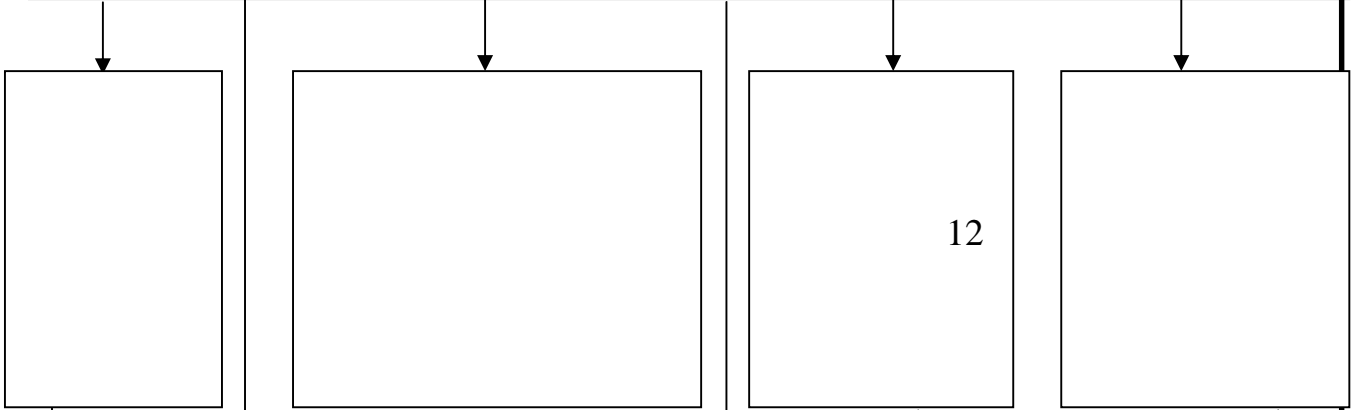
2.1.

, , -
, 2.1.

2.2. ,
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2.3. -
2.1.

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12

2.1.

2.1. ,

/				
1.			26754-2007	1
2.			23327-2007	2
3.			3626 -2005	3
4.			9225-2008	4
5.		,	- , 13685-2009	5
6.	' ,		13372- 2003	6
7.			29248-2009	13
8.	12		12083-2007	14
9.		12- ,	13476- 2008	15

_____ .
, 150 ,

3

_____ .
,
, 2-

1. 10 , 0,5 ('10-12) 1%-
0,1 . N

_____ , 1. 21-03.4.4

2. 2 40% ()

0,1 .

3. 0,1 . ,
1,94.
(1,51 -).

15 - 20

(0,05 0,1)

(, 0,1, 0,5 1,0

)
48 - 50 °

1. 21-03.4.4

2 - 15

100 - 150

30 - 50

10,

10

3

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10

4

1

5,0

15

1

6

10

$(20 \pm 2)^\circ$

20-30

1. 21-03.4.4

25-

30

250

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0,5

, 25

37,5

0,1

/

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20 °

20

8

0,5

/ ,

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12.

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(

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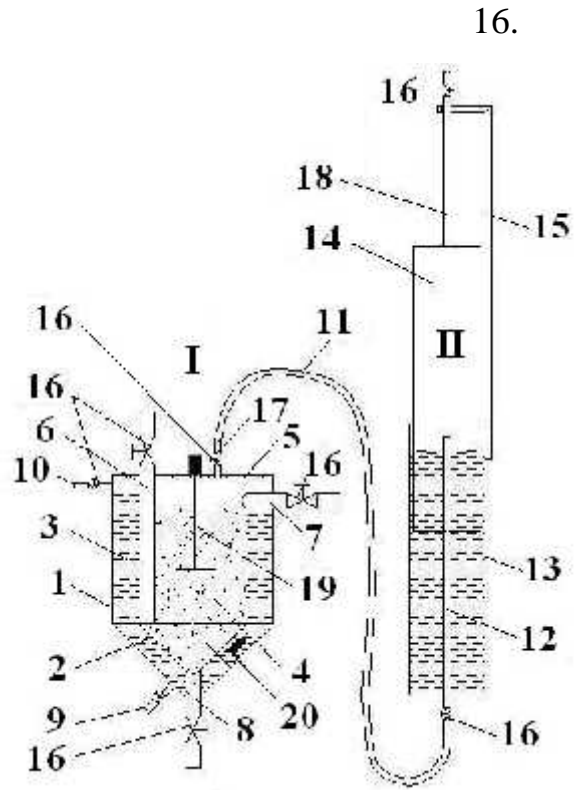
12 1

0,02; 0,025; 0,03; 0,035; 0,04;

0,045; 0,05; 0,055; 0,065 0,07 1

B12,

1. 21-03.4.4



- 2.1. : -
 ; - ; 1 - ; 2 -
 ; 3 - ; 4 -
 ; 5 - ; 6 - ; 7 -
 ; 8 - ; 9 -
 ; 10 -
 ; 11 - ; 12 - ; 13 -
 ; 14 - ; 15 - ; 16 - ; 17 -
 ; 18 -
 ; 19 - ; 20 -

19,

17

11

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" " , .
 : 13 - 14, 15.
 13 ,
 - 14. 12
 - 14,
 15 ,
 , .
 18 16
 - 14.

2.2.

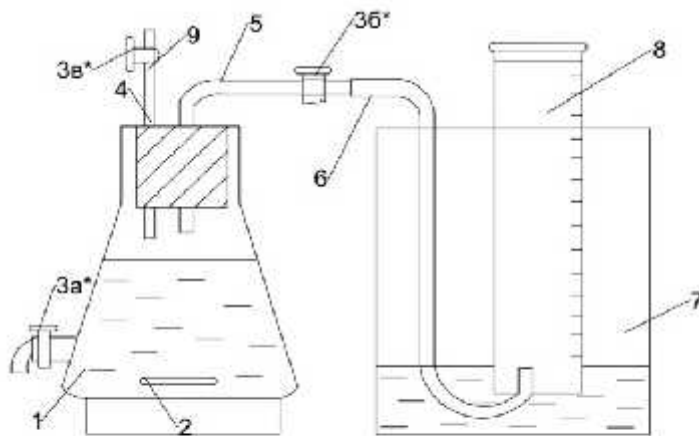


Рис.1 Схема лабораторної установки

2.2

1. ; 2. ; 3 , , - ; 4. ; 5.
 ; 6. 7. ; 8. ; 9.

1 2. 4
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1. 21-03.4.4

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3.1.

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2).

3.1. , -
3.1. , -

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	-
	;
, %	7,0
, %	0,2
, %	0,86
, / ³	1023
, ° ,	50
, .	4,7
, %	4,7
, ³ /	1,55

3.2.

	1. 21-03.4.4	
--	--------------	--

« » (.). 1
 : 74-75⁰ , 15

15%.

1:3

(t=38-40⁰).

45 ,

6,5 - 7,0.

(. 3.2)

3.2.

	, %	, %	, -
1	2	3	4
16.10.2012	4,5	6,3	1,5*10 ²
23.10.2012	3,7	6,0	5,6*10 ³
1.11.2012	2,9	5,6	9,4*10 ⁴

.3.2.

1	2	3	4
6.11.2012	1,5	5,4	-
13.11.2012	0,43	4,8	$1 \cdot 10^7$
27.11.2012	0,4	4,2	$1 \cdot 10^8$
4.12.2012	0,39	3,8	$1,2 \cdot 10^8$

40-45

45

$1,2 \cdot 10^8$. .

3.3.

.3.3

3.3.

1	2 , %	3 , %	4 , -
21.01.2013	4,8	6,3	$3 \cdot 10^2$
25.01.2013	4.6	6,0	-
29.01.2013	4.5	5,9	$3,2 \cdot 10^4$
4.02.2013	4.33	5,9	-
7.02.2013	4.0	5.7	$5,1 \cdot 10^4$
11.02.2013	3.8	5.8	-
14.02.2013	3,39	5.5	$7,2 \cdot 10^4$
18.02.2013	3.2	5.4	-
26.02.2013	3.16	5.3	$9,7 \cdot 10^4$

1. 21-03.4.4

. 3.3

1	2	3	4
1.03.2013	2.8	5.2	-
4.03.2013	2.56	5.2	5,4*10 ⁶
11.03.2013	2.32	5.1	-
14.03.2013	2.1	5.0	8,6*10 ⁶
18.03.2013	1.8	4.9	-
26.03.2013	1.6	4.7	1*10 ⁷
29.03.2012	1.42	4.7	-
3.04.2013	1.28	4.6	1,2*10 ⁷
5.04.2013	0.9	4.4	-
10.04.2013	0.8	4.3	1,3*10 ⁸
15.04.2013	0.76	4.2	-
18.04.2013	0.7	4.2	1,4*10 ⁸
22.04.2013	0.64	4.1	-
25.04.2013	0.6	4.0	1,4*10 ⁸

1,4*10⁸

10%

12

5-7 / .

3.4.

3.4

	, %	, %	, %
%		-	
4,0	0,6	1,4*10 ⁸	

1. 21-03.4.4

« »

44,5 -52,5 % .

. ,
,

3.5

3.5-

	1	2	3	4	5	6	7	8	9	10
‘ , /	15,2	14,9	15,0	15,5	17,0	15,8	15,5	16	16,5	17,0
2 : 4, % : %	16:84	15:85	15:85	10:90	12:88	10:90	16:84	15:85	12:88	12:88
, /	12,8	12,7	12,8	14,0	15,0	13,5	13,0	13,6	14,5	14,0

« »,

.3.1

. ,

1. 21-03.4.4



. 3.1

« »(.)

3.4.

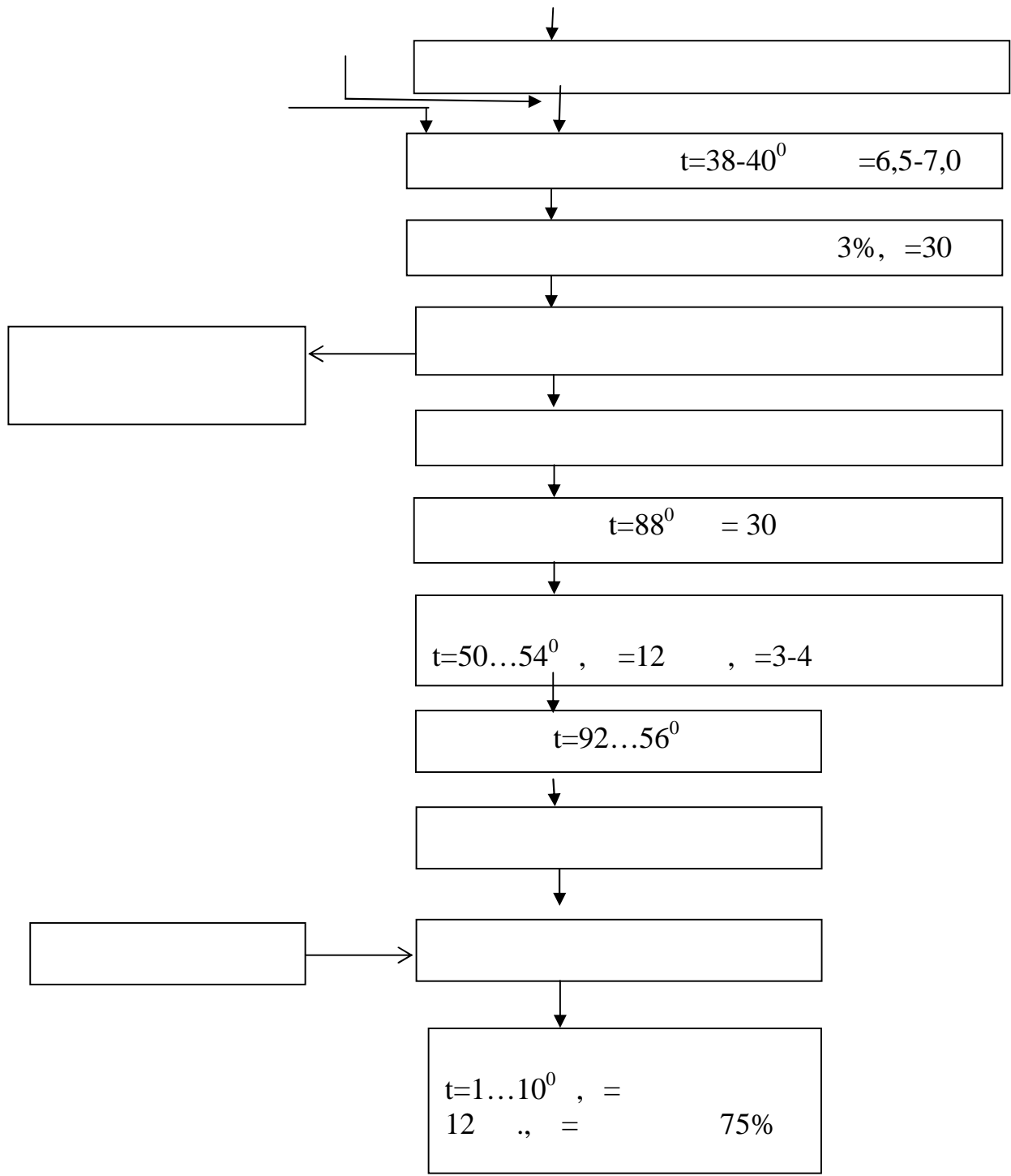
12

12

3.2

.,

1. 21-03.4.4



. 3.2

12.

12.

10%

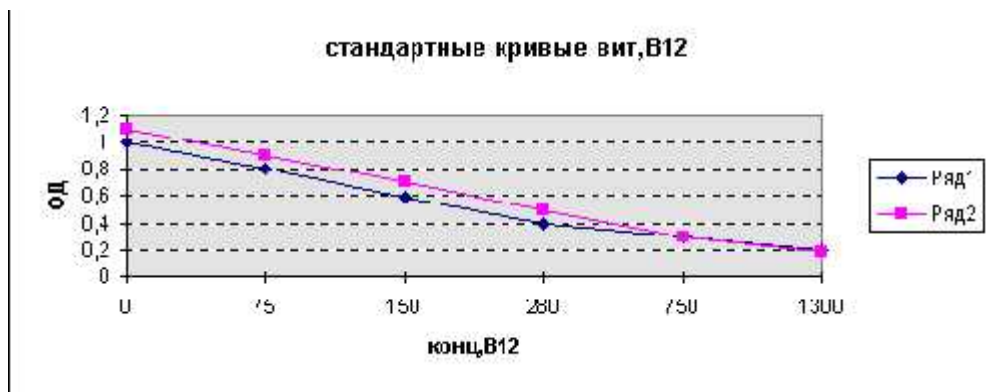
30

3-5%

60-84 / 13-15%

12

3.1.



3.1

12

: Clostridium botulinum.

12

5-7%,

93-95%,

370-375 / 12.

10-14 .

$t=1...10^0$, = 12 .

= 75%

1.

2.

3.

4.

5.

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8.

9.

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. ,

10%

12 5-7 /

6,8-7,0, 38-40⁰ .

15%.

t=50...54⁰ , =3-4 .

12 12

« »

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:

4.1.

4.2.

4.3.

4.4.

4.1.

.4.1.

1	2	3	4	5	6
1.	: - ; - ; - ;	- . 40- 60% 75% 24°	12.0.003- 2004		, , , , ,

. 4.1.

	. ,	1. 21-03.4.4
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1	2	3	4	5	6
1.	- ; - ; -	65% 26° 220 – 380 100 -150	12.1.038-2005 3.3.6.037-99		- , ,
2.	- : - ; - ; - ;	-		,	,
3.	- .	-		-	,
4.	(, , , ,) .	-	12.0.003-2004		
	- ; - .				

4.2.

24-86,

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.4.2.1.

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1. 2.	55	III II	C A

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.4.2.2.

.4.2.2.

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1. 2.	-27			- -

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10 , 2 2(3)

4.3.

4.3.1.

8.1.00-1.01-88 (15.0-1.01-88) .

4.3.2.

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4.4.

4.4.1.

5/41

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2.1.

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2.2.

2.2.1.

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2.5.

2.6.

2.7.

2.8.

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3.1.

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3.2.

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3.3. :

3.3.1. , ' , ,

3.3.2. :

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3.3.3. , , .

3.3.4. , ,

3.3.5. : , - ,

3.3.6. .

3.3.7.

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1.

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4.1.

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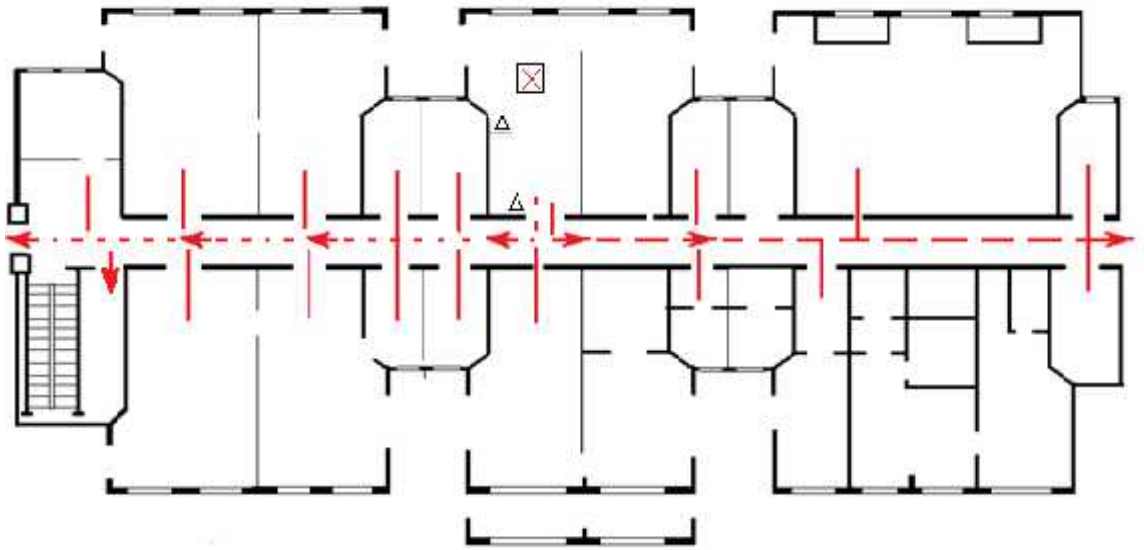
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27

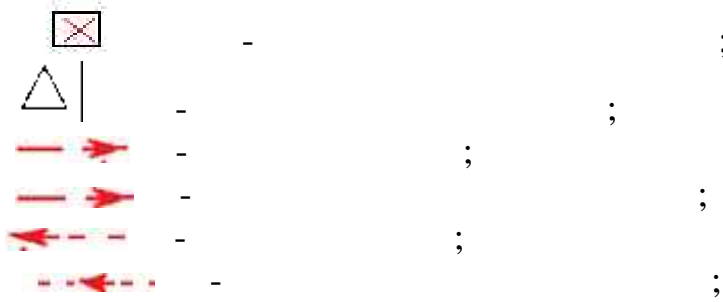
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.4.1.

1. « » :

$$Q_{.1} = n \cdot Q_{.}, \quad ^3/ .$$

$$Q_{.1} = 3 \cdot 1200 = 3600, \quad ^3/ .$$

-72-2

$$Q_{.2} = n \cdot Q_{.}, \quad ^3/ .$$

$$Q_{.2} = 1 \cdot 1000 = 1000, \quad ^3/ .$$

$$Q_{.} = Q_{.1} + Q_{.2}$$

$$Q_{.} = Q_{.1} + Q_{.2} = 3600 + 1000 = 4600, \quad ^3/ .$$

3. :

$$Q_{.} = N \cdot Q_{N.},$$

$$Q_{.} = N \cdot Q_{N.}, \quad ^3/ .$$

$$Q_{.} = N \cdot Q_{N.} = 425 \cdot 10 + 5 \cdot 5 = 4275 \quad ^3/ .$$

$$425 \quad .$$

« » :

$$N_{.} = \frac{Q_{.}}{Q_{.}},$$

N -

« » « ^3/ . », ;

Q -

$$N_{.} = \frac{900}{2} = 450, \quad ;$$

« » N_{.} = \frac{4600}{10} = 460, \quad .

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: t=50...54⁰ , =3-4 .

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