

**O‘ZBEKISTON RESPUBLIKASI OLIIY VA O‘RTA  
MAXSUS TA‘LIM VAZIRLIGI**

**ISLOM KARIMOV NOMIDAGI TOSHKENT DAVLAT  
TEXNIKA UNIVERSITETI**

# **MUHANDISLIK EKOLOGIYASI**

**fanidan**

**amaliy mashg‘ulotlar bo‘yicha**

**USLUBIY QO‘LLANMA**

**(1qism)**

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Uslubiy qo'llanma 5630100-Ekologiya va atrof-muhit muhofazasi ta'lim yo'nalishi tatalabalari uchun "Muhandislik ekologiyasi" fanining o'quv dasturiga muvofiq tuzilgan. Uslubiy qo'llanmada bajariladigan amaliy mashg'ulotlarning bayoni, yechilishi, variantlar va ilovalar keltirilgan

*Toshkent davlat texnika universitetining Ilmiy-uslubiy kengashi qaroriga asosan nashr etishga ruxsat berilgan.*

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## MUNDARIJA

|                                                                                                                       |    |
|-----------------------------------------------------------------------------------------------------------------------|----|
| Kirish.....                                                                                                           | 4  |
| 1-amaliy mashg‘ulotlar                                                                                                |    |
| Apparatning «kichik nafas olishidagi» zaharli chiqindilarning atmosfera havosiga tashlanishi miqdorini hisoblash..... | 5  |
| 2-amaliy mashg‘ulotlar                                                                                                |    |
| Apparatning «katta nafas olishidagi» zaharli chiqindilarning Atmosfera havosiga tashlanishi miqdorinihisoblash.....   | 12 |
| 3-amaliy mashg‘ulotlar                                                                                                |    |
| Suyuqlik yuzasidan bug‘lanayotgan zararli birikmalarning miqdorini hisoblash.....                                     | 16 |
| 4-amaliymashg‘ulotlar                                                                                                 |    |
| Nisbiyko‘rsatkichlarbo‘yichazararlimoddalarningmiqdorinihisoblash.....                                                | 22 |
| 5-amaliymashg‘ulotlar                                                                                                 |    |
| Yog‘och-qipiqliplitalarniolishdaatmosferagaajralibchiqayotganformaldegi dningmiqdorinihisoblash.....                  | 25 |
| 6-amaliymashg‘ulotlar                                                                                                 |    |
| Yog‘ochgaishlovberishjarayonidaatmosferagatashlanayotganbut anolvaksilolmiqdorinihisoblash.....                       | 27 |
| 7-amaliymashg‘ulotlar                                                                                                 |    |
| Turlixilyoqilg‘ilarniyonishidahosilbo‘layotganzaharlibirik-malarnihisoblash.....                                      | 28 |
| 8-amaliy mashg‘ulotlar                                                                                                | 32 |
| Oltingugurt oksidining tashlanishini hisoblash.....                                                                   |    |
| 9-amaliy mashg‘ulotlar                                                                                                |    |
| Uglerod oksidining tashlanmalarini hisoblash.....                                                                     | 34 |
| Ilovalar .....                                                                                                        | 36 |
| Adabiyotlar.....                                                                                                      | 50 |

## **Kirish**

Mazkur uslubiy qo'llanmalar "Muhandislik ekologiyasi" fani asoslari, biosfera va atmosferada borayotgan jarayon, mavjud kimyoviy moddalarni tabiiy va antropogen jarayonlarini talabalarga o'rganishdan iboratdir. Uslubiy qo'llanmalarda zararli chiqindi gazlarning atmosferahavosiga tashlanish miqdorini, turli xil yoqilg'ilarni yonishida hosil bo'ladigan zararli birikmalarni aniqlashi, suyuqlik yuzasidan bug'lanayotgan zararli birikmalarning miqdorini hisoblashi masalalar bilan o'rganiladi.

Ishbu uslubiy qo'llanmalar Ekologiya va atrof-muhit muhofazasi ta'lim yo'nalishi bakalavriat talabalari uchun "Muhandislik ekologiyasi" fani bo'yicha bilimlarini, amaliy mashg'ulot darslarini mustahkamlash uchun mo'ljallangan.

# 1-AMALIY MASHG‘ULOT

## APPARATNING «KICHIK NAFAS OLISHIDAGI» ZAHARLI CHIQINDILARNING ATMOSFERA HAVOSIGA TASHLANISHI MIQDORINI HISOBLASH.

**Ishni bajarish vaqti: 2 soat**

Kichik nafas olish deb – tashqi muhit ta’sirida gaz yoki bug’ning haroratini o‘zgarishi bilan apparatdan bug’ yoki gazning chiqishi yoki havoning apparat ichiga tortilishiga aytiladi. Kichik nafas olishda suyuqlikning sathi kam o‘zgaradi, gazning hajmi esa o‘zgarmaydi.

Misol. Apparat ichidagi suyuqlik yoki gaz haroratini 1 soat mobaynida  $40^{\circ}\text{C}$  dan  $42^{\circ}\text{C}$  gacha o‘zgarishida apparat tirqishlaridan atmosfera havosiga tashlanadigan zaharli chiqindilarning miqdorini aniqlang.

Berilgan: Apparatdagi suyuqlikning tarkibi –  $\text{H}_2\text{O}$ -40%, Benzol –30%, Dixeloretan –30%. Apparatdagi gaz muhiti – havoning ammiak bilan aralashmasi, namlik  $\psi=50\%$ . Ammiakning havodagi konsentratsiyasi  $S_{\text{NH}_3}=10\text{mg}/\text{m}^3$ , tashqi muhit bosimi  $V=101325\text{ Pa}$ , apparat 5 iametric-1,4m, balandligi –2,5m. Suyuqlik bilan to‘ldirilganligi  $K_{\text{tul}}=0,7$ .

Yechish.

**2.** Gaz muhiti tarkibiga kiruvchi gazlarning nisbiy massalari  $M_{\text{H}_2\text{O}} = 18$ ,  $M_d = 99$ ,  $M_b = 78$ ,  $M_{\text{NH}_3} = 17$ .

Suyuqlikni tashkil etuvchilarning molyar miqdori:

$$n_i = \frac{a_i}{M_i \sum \frac{a_j}{M_j}}$$

$$\text{a) } n_{\text{H}_2\text{O}} = \frac{0.4}{18 \left( \frac{0.4}{18} + \frac{0.3}{78} + \frac{0.3}{99} \right)} = 0.7637$$

$$\text{b) } n_b = \frac{0.3}{78 \left( \frac{0.4}{18} + \frac{0.3}{78} + \frac{0.3}{99} \right)} = 0.1321$$

$$v) n_d = \frac{0,3}{99(\frac{0,4}{18} + \frac{0,3}{78} + \frac{0,3}{99})} = 0.1042$$

2. Suyuq aralashma komponentlarining jadvaldagi koeffitsiyentlari:

$$\text{Suv} \quad A = 7.9608 \quad V = 1678 \quad S = 230$$

$$\text{Benzol} \quad A = 6.912 \quad V = 1214.6 \quad S = 221.2$$

$$\text{Dixloretan} \quad A = 7.184 \quad V = 1358.5 \quad S = 232$$

3. Toza suyuq birikmalar ustidagi to'yingan bug'ning parsial bosimi:

$$\lg P^H = A - V / (S + t)$$

$t = 40^\circ\text{C}$  bo'lganda

$$\text{a) } \lg P_{H_2O}^H = 7.9608 - 1678 / (230 + 40) = 1.7460, P_{H_2O}^H = 56.7 \text{ mm.rt.st} = 7541.1 \text{ Pa}$$

$$\text{b) } \lg P_{\phi}^H = 6.912 - 1214.6 / (221.2 + 40) = 2.262, P_{\phi}^H = 182.5 \text{ mm.rt.st} = 24272.5 \text{ Pa}$$

$$\text{v) } \lg P_{\phi}^H = 7.184 - 1358.5 / (232 + 40) = 2.190, P_{\phi}^H = 155 \text{ mm.rt.st} = 20615 \text{ Pa}$$

$t = 42^\circ\text{C}$  bo'lganda

$$\text{a) } \lg P_{H_2O}^H = 7.9608 - 1678 / (230 + 42) = 1.7917, P_{H_2O}^H = 61.8 \text{ mm.rt.st} = 8233 \text{ Pa}$$

$$\text{b) } \lg P_{\phi}^H = 6.912 - 1214.6 / (221.2 + 42) = 2.2973, P_{\phi}^H = 198 \text{ mm.rt.st} = 26397 \text{ Pa}$$

$$v) \lg P_o^H = 7.184 - 1358.5 / (232 + 42) = 2.2619, P_o^H = 182.5 \text{ mm.rt.st} = 24331 \text{ Pa}$$

4. Komponentlarning suyuq aralashmasi ustidagi bug`ning parsial bosimi:

$$P_i' = n_i \cdot P_i^H$$

t = 40°C bo'lganda

t = 42°C bo'lganda

$$P_{H_2O}' = 7541.1 \cdot 0.7637 = 5759$$

$$P_{H_2O}' = 8233 \cdot 0.7637 = 292$$

$$P_o' = 24272.5 \cdot 0.321 = 320$$

$$P_o' = 26397 \cdot 0.321 =$$

$$P_o' = 20615 \cdot 0.142 = 2148$$

$$3487$$

$$P_o' = 24331 \cdot 0.142 = 2535$$

5. Gaz muhitidagi to'yingan suv bug`ining parsial bosimi:

$$\lg P_{H_2O}^{H'} = 0.622 + 7.5 t / (238 + t)$$

t = 40°C bo'lganda

$$\lg P_{H_2O}^{H'} = 0.622 + 7.5 \cdot 40 / (238 + 40) = 1.7011; P_{H_2O}^{H'} = 50.2 \text{ mm. rt. St} = 6676.6 \text{ Pa}$$

t = 42°C bo'lganda

$$\lg P_{H_2O}^{H/} = 0.622 + 7.5 \cdot 42 / (238 + 42) = 1.747; \quad P_{H_2O}^{H/} = 55.8 \text{ mm. rt.st} \\ = 7439 \text{ Pa}$$

6. Berilgan namlikdagi parsial bosim:

$$P_i = P_{H_2O}^{H/} \cdot \varphi$$

$$t = 40^0\text{C bo'lganda } P_{H_2O} = 6676.6 \cdot 0.5 = 3338 \text{ Pa}$$

$$t = 42^0\text{C bo'lganda } P_{H_2O} = 7439 \cdot 0.5 = 3719.5 \text{ Pa}$$

7. Gaz muhitidagi qo'shimchalarning (ammiakning) parsial bosimi:

$$P_i = \frac{C_i(273+t) \cdot 133.3}{16M_i \cdot 1000}$$

$$t = 40^0\text{C bo'lganda } P_{NH_3} = \frac{10(273+40) \cdot 133.3}{16 \cdot 17.31 \cdot 1000} = 1.503 \text{ Pa}$$

$$t = 42^0\text{C bo'lganda } P_{NH_3} = \frac{10(273+42) \cdot 133.3}{16 \cdot 17.31 \cdot 1000} = 1.52 \text{ Pa}$$

8. Havodagi asosiy komponentning parsial bosimi:

$$P_v = P - (P_{H_2O}^{H/} + P_B^{H/} + P_A^{H/} + P_{NH_3})$$

$$\text{bu yerda } t = 40^0\text{C } R_v = 101325 - (5759 + 3206.4 + 2148 + 1.503) \text{ Pa}$$

$$\text{bu yerda } t = 42^0\text{C } R_v = 101325 - (6292 + 3487 + 2535 + 1.52) \text{ Pa}$$

9. Gaz aralashmasini tashkil etuvchilarning konsentratsiyasi, mg/m<sup>3</sup>:

$$C_i = \frac{16P_i' M_i 1000}{(273+t)133.3}$$

$t = 40^0\text{C}$  bo'lganda

$$C_{H_2O} = \frac{16 \cdot 5759 \cdot 18 \cdot 1000}{(273+40)133.3} = 39876$$

$$C_B = \frac{16 \cdot 3206,4 \cdot 78 \cdot 1000}{(273+40)133.3} = 96258$$

$$C_{\text{д}} = \frac{16 \cdot 2148 \cdot 99 \cdot 1000}{(273+40)133.3} = 81710$$

$$C_{NH_3} = 10$$

$$C_B = \frac{16 \cdot 90210 \cdot 29 \cdot 1000}{(273+40)133.3} = 1001690$$

$t = 42^0\text{C}$  bo'lganda

$$C_{H_2O} = \frac{16 \cdot 6292 \cdot 18 \cdot 1000}{(273+42)133.3} = 43186$$

$$C_B = \frac{16 \cdot 3487 \cdot 78 \cdot 1000}{(273+42)133.3} = 103770$$

$$C_{\text{д}} = \frac{16 \cdot 89010 \cdot 99 \cdot 1000}{(273+42)133.3} = 95588$$

$$C_{NH_3} = 10$$

$$C_B = \frac{16 \cdot 89010 \cdot 29 \cdot 1000}{(273+42)133.3} = 982115$$

10. Gaz aralashmasining o'rtacha konsentratsiyasi,  $\text{mg/m}^3$ :

$$C_i = \frac{C_{i1} + C_{i2}}{2}$$

$$C_{cp.H_2O} = \frac{39876 + 43186}{2} = 41531$$

$$C_{cp.B} = \frac{96258 + 103770}{2} = 100014$$

$$C_{cp.D} = \frac{81710 + 95588}{2} = 88634$$

$$C_{cp.NH_3} = 10$$

$$C_{cp.B} = \frac{1001690 + 982115}{2} = 991902$$

11. Apparatdagi gaz aralashmasining hajmi:

$$V = \pi DH (1 - k_{zap}) = 3.14 \cdot 1.4 \cdot 2.5 (1 - 0.7) = 3.3 m^3$$

12. Apparatdagi gaz aralashmasining harorati o'zgarishi:

$$\Delta t = t_2 - t_1 = 42 - 40 = 2^\circ C$$

13. Haroratning o'zgarishi bilan gaz aralashma hajmini o'zgarishi:

$$V_z = V \frac{\Delta t}{273} = 3.3 \frac{2}{273} = 0.024 m^3$$

14. Apparatning kichik nafas olishidagi gaz aralashmasini tashkil etuvchilarning miqdori, g/s:

$$C_i = V_z \cdot C_{cp.i}$$

$$C_{H_2O} = 0.024 \cdot 41531 \cdot 10^{-3} = 0.984$$

$$C_B = 0.024 \cdot 100014 \cdot 10^{-3} = 2.400$$

$$C_D = 0.024 \cdot 88634 \cdot 10^{-3} = 2.127$$

$$C_{NH_3} = 0.024 \cdot 10 \cdot 10^{-3} = 0.00024$$

$$C_B = 0.024 \cdot 991902 \cdot 10^{-3} = 23.806$$

***Variantlar:***

| <b>1</b>                                                                                                          | <b>2</b>                                                                                                          | <b>3</b>                                                                                                          | <b>4</b>                                                                                                         |
|-------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
| Benzol – 45<br>Dixlorethan – 25<br>Suv – 30<br>$C_{NH_3} = 15$<br>mg/m <sup>3</sup><br>t = 40 – 42 <sup>0</sup> C | Benzol – 50<br>Dixlorethan – 20<br>Suv – 30<br>$C_{NH_3} = 10$<br>mg/m <sup>3</sup><br>t = 45 – 48 <sup>0</sup> C | Benzol – 30<br>Dixlorethan – 30<br>Suv – 40<br>$C_{NH_3} = 10$<br>mg/m <sup>3</sup><br>t = 30 – 44 <sup>0</sup> C | Benzol – 20<br>Dixlorethan – 40<br>Suv – 30<br>$C_{NH_3} = 5$<br>mg/m <sup>3</sup><br>t = 40 – 46 <sup>0</sup> C |
| <b>5</b>                                                                                                          | <b>6</b>                                                                                                          | <b>7</b>                                                                                                          | <b>8</b>                                                                                                         |
| Benzol – 40<br>Dixlorethan – 30<br>Suv – 30<br>$C_{NH_3} = 15$<br>mg/m <sup>3</sup><br>t = 35 – 40 <sup>0</sup> C | Benzol – 10<br>Dixlorethan – 30<br>Suv – 60<br>$C_{NH_3} = 5$<br>mg/m <sup>3</sup><br>t = 25 – 30 <sup>0</sup> C  | Benzol – 35<br>Dixlorethan – 25<br>Suv – 40<br>$C_{NH_3} = 15$<br>mg/m <sup>3</sup><br>t = 35 – 40 <sup>0</sup> C | Benzol – 25<br>Dixlorethan – 20<br>Suv – 55<br>$C_{NH_3} = 5$<br>mg/m <sup>3</sup><br>t = 30 – 45 <sup>0</sup> C |

**2-AMALIY MASHG‘ULOT**  
**APPARATNING «KATTA NAFAS OLISHIDAGI» ZAHARLI**  
**CHIQUINDILARNING ATMOSFERA HAVOSIGA TASHLANISHI**  
**MIQDORINI HISOBLASH.**

**Ishni bajarish vaqti: 2 soat**

Katta nafas olish deb –apparatning ichidagi suyuqlikning sathini o‘zgarishi bilan bug‘ning tashqariga chiqishi yoki havoning ichkariga tortilishiga aytiladi.

Katta nafas olish - neft mahsulotlarini quyishda rezervuarning havo bo‘shligidan tashqi muhitga bug‘larning chiqishida ko‘proq yuz beradi

Apparatdan siqilib tashlanayotgan gazning hajmi:

$$V_g = V_1 - V_2$$

$P_{rab}$  – sig‘imdagi ishchi bosim (const)

$t$  – harorat (const)

$V_1$  i  $V_2$  – apparatdagi to‘ldirishgacha va to‘ldirilgandan so‘ngi gazlarning hajmi.

1 siklda nafas olishdagi yo‘qotilayotgan gazlarning massasi, kg/ sikl.

$$G_{sm} = V_g \cdot \rho_{g.sm} = (V_1 - V_2) \rho_{g.sm} = V_g \cdot S_i$$

$\rho_{g.sm}$  –gazlarning zichligi, kg/m<sup>3</sup>.

**Misol.**Apparatning katta nafas olishidagi tashlanayotgan zararli birikmalarning miqdorini aniqlash. $G_i$  - ?

**Berilgan**

Apparatdagi suyuqlikning tarkibi % (mass):

$H_2O = 40$ , Benzol = 30, dixloretan = 30

Apparatdagi gaz muhiti havo -  $NH_3$ , aralashmasi, havoning namligi  $\varphi = 50 \%$ .

Havodagi ammiakning konsentratsiyasi  $NH_3$ ,  $C_{NH_3} = 10 \text{ mg/m}^3$ .

Apparatdagi suyuqlik va gaz muhitining harorati  $t = 40^\circ S$ .

Tashqi muhitning bosimi  $P = 101325 \text{ Pa}$ .

Apparatning diametri  $D = 1.4 \text{ m}$ .

Apparatning balandligi  $H_{ap} = 2.5 \text{ m}$ .

To'ldirishdan avvalgi suyuqlik sathining balandligi -  $h_{zap}$ .

Sathi darajasi  $k_3 = 0.7$  da to'ldirish vaqti 40 min..

### **Yechish:**

1. Suyuqlik ustidagi gaz aralashmasining parsial bosimi (Pa), berilgan

$$P_{H_2O} = 5759$$

$$P_b = 3206$$

$$P_d = 2148 \quad P_{NH_3} = 1.503$$

2. Havo asosiy komponentining parsial bosimi

$$P_v = P - (P_{H_2O} + P_b + P_d + P_{NH_3}) = 90210.5 \text{ Pa}$$

3. Gazni tashkil etuvchilarning konsentratsiyasi  $\text{mg/m}^3$ :

$$C_i = \frac{16 \cdot P_i \cdot M_i \cdot 1000}{(273 + 40) \cdot 133.3}$$

$$a) C_{H_2O} = \frac{16 \cdot 5759 \cdot 18.015 \cdot 1000}{(273 + 40) \cdot 133.3} = 39876$$

$$b) C_B = \frac{16 \cdot 3206 \cdot 78 \cdot 1000}{(273 + 40) \cdot 133.3} = 96258$$

$$d) C_{\text{д}} = \frac{16 \cdot 2148 \cdot 99 \cdot 1000}{(273 + 40) \cdot 133.3} = 81710$$

$$c) C_{NH_3} = 10$$

$$g) C_B = \frac{16 \cdot 90210 \cdot 29 \cdot 1000}{(273 + 40) \cdot 133.3} = 1001690$$

4. Apparatni to'ldirishdan avvalgi gaz aralashmasining hajmi

$$V_1 = \pi D (N_{ap} - h_{zap}) = 3.14 \cdot 1.4 \cdot (2.5 - 0.2) = 10.1 \text{ m}^3$$

5. Apparatni to'ldirgandan keyingi gaz aralashmasining hajmi:

$$V_2 = \pi D N_{ap} (1 - k_l) = 3.14 \cdot 1.4 \cdot 2.5 \cdot (1 - 0.7) = 3.3 \text{ m}^3$$

6. 40 minut mobaynida apparatdan siqib chiqarilgan gaz aralashmasining hajmi

$$V_g = V_1 - V_2 = 10.1 - 3.3 = 6.8 \text{ m}^3$$

7. 40 minut mobaynida gaz aralashmasini tashkil etuvchi birikmalarning miqdori, gr:  $G_i = V_g \cdot C_i$

$$a) G_{H_2O} = 6.8 \cdot 39876 \cdot 10^{-3} = 271$$

$$b) G_B = 6.8 \cdot 96258 \cdot 10^{-3} = 655$$

$$d) G_D = 6.8 \cdot 81710 \cdot 10^{-3} = 556$$

$$c) G_{NH_3} = 6.8 \cdot 10 \cdot 10^{-3} = 0.068$$

$$g) G_V = 6,8 \cdot 999800 \cdot 10^{-3} = 6800$$

***Variantlar:***

| <b>1</b>                                                                                                     | <b>2</b>                                                                                                     | <b>3</b>                                                                                                     | <b>4</b>                                                                                                    |
|--------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| Benzol – 45<br>Dixlorethan – 25<br>Suv – 30<br>$C_{NH_3} = 15$<br>mg/m <sup>3</sup><br>t = 40 <sup>0</sup> C | Benzol – 50<br>Dixlorethan – 20<br>Suv – 30<br>$C_{NH_3} = 10$<br>mg/m <sup>3</sup><br>t = 45 <sup>0</sup> C | Benzol – 30<br>Dixlorethan – 30<br>Suv – 40<br>$C_{NH_3} = 10$<br>mg/m <sup>3</sup><br>t = 30 <sup>0</sup> C | Benzol – 20<br>Dixlorethan – 40<br>Suv – 30<br>$C_{NH_3} = 5$<br>mg/m <sup>3</sup><br>t = 40 <sup>0</sup> C |
| <b>5</b>                                                                                                     | <b>6</b>                                                                                                     | <b>7</b>                                                                                                     | <b>8</b>                                                                                                    |
| Benzol – 40<br>Dixlorethan – 30<br>Suv – 30<br>$C_{NH_3} = 15$<br>mg/m <sup>3</sup><br>t = 35 <sup>0</sup> C | Benzol – 10<br>Dixlorethan – 30<br>Suv – 60<br>$C_{NH_3} = 5$<br>mg/m <sup>3</sup><br>t = 25 <sup>0</sup> C  | Benzol – 35<br>Dixlorethan – 25<br>Suv – 40<br>$C_{NH_3} = 15$<br>mg/m <sup>3</sup><br>t = 35 <sup>0</sup> C | Benzol – 25<br>Dixlorethan – 20<br>Suv – 55<br>$C_{NH_3} = 5$<br>mg/m <sup>3</sup><br>t = 30 <sup>0</sup> C |

### **3-AMALIY MASHG‘ULOT**

#### **SUYUQLIK YUZASIDAN BUG‘LANAYOTGAN ZARARLI BIRIKMALARNING MIQDORINI HISOBLASH**

**Ishni bajarish vaqti: 2 soat**

Suyuqlik yuzasidan bug‘lanayotgan zararli birikmalarning miqdori, ularning kimyoviy xususiyatlariga, harorat, bug‘lanish yuzasiga, jarayonning davomiyligiga va suyuqlikning harakatlanishiga bog‘liq. Bug‘lanish jarayoni diffuzion, tabiiy yoki majbur etilgan konveksion xarakterga ega bo‘ladi

#### **Suyuqlik yuzasidan plyenka rejimida bug‘lanayotgan zararli birikmalarning miqdorini hisoblash**

Bunday rejimda suyuqlik sirtida qo‘zg‘almas havoning qalin plyenkasi hosil bo‘ladi.

Moddaning bunday plyenkadan o‘tishi asosan diffuziya qonuniyatlari asosida amalga oshadi. Diffuziya jarayoni Graskof va Prandtl kriteriylarining hosilalari bilan xarakterlanadi.

$$Gr \times Pr < 1$$

Bu yerda  $Gr$ – Graskofkriteriysi,  $Pr$  – Prandtl kriteriysi.

Chuqur hajmli rezervuardan suyuqlikning bug‘lanishida atmosfera havzasiga tashlanayotgan zararli moddalarning miqdori quyidagi formula yordamida hisoblanadi:

$$G_i = \frac{k_2}{k_1} \times 10^{-3} \frac{D_i \times F \times C_i}{h} \times \ln \frac{B - P_{oi}}{B - P_{\text{жс}i}}$$

bu yerda

$D_i$  – suyuqlik parlarining bug‘lanish koeffitsiyenti,  $\text{sm}^2 / \text{ch}$

$F$  – idish yuzasi,  $\text{m}^2$

$C_i$  – gaz aralashmasidagi komponentlarning konsentratsiyasi,  $\text{mg} / \text{m}^3$

$h$  – idish yuzasidan suv sathigacha bo‘lgan balandlik,  $\text{m}$

$B$  – barometrik bosim,  $\text{Pa}$

$P_{oi}$  – manbadagi bug‘larning parsial bosimi,  $\text{Pa}$

$P_{ji}$  – bug‘lanish haroratidagi suyuqlik ustidagi parsial bosim,  $\text{Pa}$

$k_1$  – bug‘lanish yuzasidagi harorati pasayishini hisobga oluvchi koeffitsiyent (jadvaldan)

| Suyuqlikning<br>qaynash<br>temperaturasi, $^{\circ}\text{C}$ | $\leq 80$ | 100 | 150 | $> 150$ |
|--------------------------------------------------------------|-----------|-----|-----|---------|
| $k_1$                                                        | 1.5       | 1.3 | 1.1 | 1.0     |

$k_2$  – Bug‘lanish yuzasini yopiqlik darajasining koeffitsiyenti (jadvaldan)

|           |            |           |          |     |     |     |         |
|-----------|------------|-----------|----------|-----|-----|-----|---------|
| $F_1/F_2$ | 0.00<br>01 | 0.00<br>1 | 0.0<br>1 | 0.1 | 0.5 | 0.8 | $> 0.8$ |
|-----------|------------|-----------|----------|-----|-----|-----|---------|

|       |   |      |     |     |     |     |     |
|-------|---|------|-----|-----|-----|-----|-----|
| $k_2$ | 0 | 0.01 | 0.1 | 0.2 | 0.3 | 0.6 | 1.0 |
|-------|---|------|-----|-----|-----|-----|-----|

**Misol.** Lyukdan bugʻlanayotgan zararli moddalarning miqdorini aniqlash.

**Berilgan:**

Atmosfera bosimi  $B = 101325 \text{ Pa}$ .

Lyuk diametri  $d = 0.5 \text{ m}$ .

Apparat diametri  $d_{ap} = 1.4 \text{ m}$ .

Apparatning balandligi  $H_{ap} = 2.5 \text{ m}$ .

Suyuqlik bilan toʻldirilganlik darajasi  $k_{zap} = 0.7$ .

Apparatdagi suyuqlikning tarkibi:

Suv – 40%ob., Benzol – 30%ob., Dixeloretan – 30% ob.

Apparat tashqarisidagi gaz muhiti – ammiak aralashmali havo.

Namlik  $\varphi = 50\%$ .

Ammiakning konsentratsiyasi  $= 10 \text{ mg/m}^3$ .

Apparatdagi suyuqlik va gaz muhitining harorati  $= 40^\circ\text{S}$ .

**Yechish:**

1. Komponent parlarining suyuqlik ustidagi parsial bosimi, Pa

$$P'_{H_2O} = 5759, P'_B = 3206.4, P'_A = 2148$$

2. Komponent parlarining  $t = 0^\circ\text{C}$ ,  $P_0 = 101308 \text{ Pa}$  dagi diffuziya koeffitsiynti:

$$D_{0H_2O} = 18.8 \times 10^{-6} \text{ m}^2/\text{s}, D_{0B} = 9.05 \times 10^{-6} \text{ m}^2/\text{s}, D_{0A} = 8.02 \times 10^{-6} \text{ m}^2/\text{s}$$

3. Komponent parlarining  $t = 40^{\circ}\text{C}$ ,  $P = 101325 \text{ Pa}$  dagi diffuziya koeffitsiynti:

$$D_t = \frac{P_0}{P} \left( \frac{T}{T_0} \right)^2 \times D_0$$

a)  $D_{t,H_2O} = 18.8 \times 10^{-6} \frac{101308}{101325} \left( \frac{273+40}{273+0} \right)^2 = 24.69 \times 10^{-6} \text{ m}^2/\text{s}$

b)  $D_{t,E} = 9.05 \times 10^{-6} \frac{101308}{101325} \left( \frac{273+40}{273+0} \right)^2 = 11.89 \times 10^{-6} \text{ m}^2/\text{s}$

d)  $D_{t,D} = 8.02 \times 10^{-6} \frac{101308}{101325} \left( \frac{273+40}{273+0} \right)^2 = 10.54 \times 10^{-6} \text{ m}^2/\text{s}$

4. Apparatdagi bug‘lanish yuzasi

$$F_{ap} = 0.785 \times d_{an}^2 = 0.785 \times 1.4^2 = 1.5386 \text{ m}^2$$

5. Lyuk yuzasi

$$F_l = 0.785 \times d_{\lambda}^2 = 0.785 \times 0.5^2 = 0.1962 \text{ m}^2$$

6. Nisbat  $\frac{F_{\lambda}}{F_{an}} = \frac{0.1962}{1.5386} = 0.127$

7. Bug‘lanish yuzasini yopiqlik‘ini hisobga oluvchi koeffitsiyent

$$\frac{F_{\lambda}}{F_{an}} = 0.127, k_l = 0.2$$

8. Suyuqlik komponentlarining qaynash temperaturasi:

9. Suv –  $100^{\circ}\text{C}$ , Benzol –  $80.1^{\circ}\text{C}$ , Dixloretn –  $83.5^{\circ}\text{C}$

10. Bug‘lanish yuzasini harorati pasayishini hisobga oluvchi koeffitsiyntlar  $k_l$ :

Suv – 1.3

Benzol - 1.5

Dixloretn - 1.3

11. Yuqori burchakdan suv yuzasigacha bo‘lgan balandlik,

$$h = H_{ap}(1 - k_{zap}) = 2.5(1 - 0.7) = 0.75 \text{ m}$$

12. Suyuqlik yuzasidagi gaz aralashmasining komponentlarining konsentratsiyasi (punkt 9,1-hisobdan)

$$C_i = \frac{16P_i' M_i 1000}{(273+t)133.3}$$

$$C_{H_2O} = 39876$$

$$C_B = 96258$$

$$C_D = 81710$$

13. Tashqi muhit gaz komponentlarining parsial bosimi, Pa (punkt 6, 1 hisobdan)

$$R_i = P_{H_2O}^{H'} \cdot \varphi$$

$$\text{Bu yerda } t = 40^\circ\text{C } P_{H_2O} = 6676.6 \cdot 0.5 = 3338 \text{ Pa, } P_B = 0, P_D = 0$$

14. Lyuk orqali bug'lanib tashqi muhitga tashlanmayotgan gaz aralashmasi komponentlarining konsentratsiyasi, g/ch

$$G_i = \frac{k_2}{k_1} \times 10^{-3} \frac{D_i \times F \times C_i}{h} \times \ln \frac{B - P_{0i}}{B - P_{\text{sci}}}$$

$$\text{a) } G_{H_2O} = \frac{0.2}{1.3} \times 10^{-3} \frac{24.69 \times 10^{-6} \times 3600 \times 1.5386 \times 39876 C_i}{0.75} \times \ln \frac{101325 - 3328}{101325 - 5759} = 0.0364$$

$$\text{b) } G_B = \frac{0.2}{1.5} \times 10^{-3} \frac{11.83 \times 10^{-6} \times 3600 \times 1.5386 \times 96258}{0.75} \times \ln \frac{101325 - 0}{101325 - 3206.4} = 0.0419$$

$$\text{d) } G_D = \frac{0.2}{1.3} \times 10^{-3} \frac{10.54 \times 10^{-6} \times 3600 \times 1.5386 \times 81710}{0.75} \times \ln \frac{101325 - 0}{101325 - 2148} = 0.038$$

***Variantlar:***

| <b>1</b>                                                                                                                                                    | <b>2</b>                                                                                                                                                                          | <b>3</b>                                                                                                                                                                            | <b>4</b>                                                                                                                                                                            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Benzol – 45 %<br>Dixloretan – 25 %<br>Suv – 30 %<br>$C_{NH_3} = 15 \text{ mg/m}^3$<br>$t = 42^0\text{C}$<br>$d = 0.7 \text{ m}$<br>$d_{ap} = 1.6 \text{ m}$ | Benzol – 50 %.<br>Dixloretan – 20 %<br>Suv – 30 %<br>$C_{NH_3} = 10 \text{ mg/m}^3$<br>$t = 48^0\text{C}$<br>$d = 0.2 \text{ m}$<br>$d_{ap} = 1.5 \text{ m}$<br>$N = 3 \text{ m}$ | Benzol – 30 %<br>Dixloretan – 30 %<br>Suv – 40 %<br>$C_{NH_3} = 10 \text{ mg/m}^3$<br>$t = 44^0\text{C}$<br>$d = 1 \text{ m}$<br>$d_{ap} = 1.4 \text{ m}$<br>$N_{ap} = 2.5\text{m}$ | Benzol – 20 %<br>Dixloretan – 40 %<br>Suv – 30 %<br>$C_{NH_3} = 5 \text{ mg/m}^3$<br>$t = 46^0\text{C}$<br>$d = 0.35 \text{ m}$<br>$d_{ap} = 2 \text{ m}$<br>$N_{ap} = 4 \text{ m}$ |
| <b>5</b>                                                                                                                                                    | <b>6</b>                                                                                                                                                                          | <b>7</b>                                                                                                                                                                            | <b>8</b>                                                                                                                                                                            |
| Benzol – 40 %<br>Dixloretan – 30 %<br>Suv – 30 %<br>$C_{NH_3} = 15 \text{ mg/m}^3$<br>$t = 40^0\text{C}$                                                    | Benzol – 10 %<br>Dixloretan – 30 %<br>Suv – 60 %<br>$C_{NH_3} = 5 \text{ mg/m}^3$<br>$t = 30^0\text{C}$                                                                           | Benzol – 35 %<br>Dixloretan – 25 %<br>Suv – 40 %<br>$C_{NH_3} = 15 \text{ mg/m}^3$<br>$t = 40^0\text{C}$                                                                            | Benzol – 25 %<br>Dixloretan – 20 %<br>Suv – 55 %<br>$C_{NH_3} = 5 \text{ mg/m}^3$<br>$t = 45^0\text{C}$                                                                             |

|                          |                          |                        |                          |
|--------------------------|--------------------------|------------------------|--------------------------|
| $d = 0.5 \text{ m}$      | $d = 1 \text{ m}$        | $d = 1.5 \text{ m}$    | $d = 0.5 \text{ m}$      |
| $d_{ap} = 2.5 \text{ m}$ | $d_{ap} = 1.8 \text{ m}$ | $d_{ap} = 2 \text{ m}$ | $d_{ap} = 1.8 \text{ m}$ |
| $N_{ap} = 2.5\text{m}$   | $N_{ap} = 2.5\text{m}$   | $N_{ap} = 3.5\text{m}$ | $N_{ap} = 3$             |

#### 4-AMALIY MASHG‘ULOT

#### NISBIY KO‘RSATKICHLAR BO‘YICHA ZARARLI

#### MODDALARNING MIQDORINI ANIQLASH

**Ishni bajarish vaqti: 2 soat**

1. Yog‘ochni qayta ishlashda atmosfera havosiga tashlanadigan zararli moddalar

Yog‘ochni qayta ishlashda atmosfera havosiga quyidagi zararli moddalar tashlanadi:

- a) yog‘ochga mexanik ishlov berganda -qirindi, qipiq, shliflash changi
- b) yuqori haroratda presslaganda, quritishda, yelimiashda - formaldegid, fenol, ammiak bug‘lari
- d) mahsulotga ishlov berishda - aromatik uglevodorodlar bug‘lari, efirlar, spirtlar.

I. yog‘ochga mexanik ishlov berganda -qirindi, qipiq, shliflash changning miqdori qo‘llanilayotgan dastgohga va undan foydalanish mashina vaqtining koeffitsiyntiga bog‘liq. Chang ko‘rinishidagi chiqindilarning miqdorini (zarrachaning kattaligi  $< 200\text{mkm}$ ) quyidagi tenglama orqali hisoblanadi, kg/s:

$$G = G_0 \times k_p$$

$G_0$  – qurilayotgan dastgoxdan o‘rtacha vaqt mobaynida ajralib chiqayotgan chiqindi miqdori, kg/s

$k_p$  – Chang chiqindilarni ushlaganlik koeffitsienti.  $G_0$  i  $k_p$  ko‘rsatkichlarjadvalidan olinadi (Ilova 1.).

1. Pnevмотransportda yoki aspiratsiya orqali sistemaga tashlanadigan changli chiqindilarning miqdori, kg/s

$$G = G_0 \times k_p \times k_{e.m.o}$$

Bu yerda -  $k_{e.m.o}$  – joydagi tortish tizimining samaradorlik koeffitsiynti, tortish tizimining ko‘ndalang kesimi va tortilayotgan havo hajmi orqali aniqlanadi.

2. Changni tozalash inshootidan keyingi atmosferaga tashlanadigan changsimon chiqindilarning miqdori, kg/s

$$G = G_0 \times k_p \times k_{e.m.o}(1 - k_{e.o})$$

Bu yerda  $k_{e.o}$  – changni tozalash inshootining samaradorligi.

**Misol.**Yog‘ochni kesuvchi S-6 stanogidan atmosfera havosining aspiratsion sistemasiga tashlanayotgan changli chiqindilarining miqdorini aniqlash.

**Berilgan:**

Joylardagi tortish tizimining samaradorligi  $k_{e.m.o} = 0.9$  (90%).

Changni tozalovchi inshoot (siklon) ning samaradorlik darajasi  $k_{e.o} = 0.95$  (95%).

**Yechish:**

1. Gadvaldan (Ilova 1) chiqindining o‘rtacha 1 soatdagi miqdori 30 kg/s ga, a umumiy miqdori

$$G_0 = 2 \times 30 = 60 \text{ kg/s ga teng}$$

2. Changsimon chiqindilarning miqdori (kattaligi < 200 mkm)

$$G = G_0 \times k_p = 60 \times 0.3 = 18 \text{ kg/s}$$

3. Aspiratsiya orqali sistemaga kirayotgan changsimon chiqindilarning miqdori:

$$G = G_0 \times k_p \times k_{e.m.o} = 60 \times 0.3 \times 0.9 = 16.2 \text{ kg/s}$$

4. Changni tozalash inshootidan keyingi atmosferaga tashlanadigan changsimon chiqindilarning miqdori:

$$G = G_0 \times k_p \times k_{e.m.o} (1 - k_{e.o}) = 60 \times 0.3 \times 0.9 \times 0.05 = 0.81 \text{ kg/s ga teng.}$$

### Variantlar:

|                    | <b>1</b> | <b>2</b>        | <b>3</b>             | <b>4</b>                   |
|--------------------|----------|-----------------|----------------------|----------------------------|
| Stanokning markasi | SF - 3   | 2 frezer FA – 1 | 2 teshuvchi SHO – 10 | 4 lentali-kesuvchi LO – 80 |
| $k_{e.o}$ , %      | 50       | 65              | 80                   | 35                         |
| $k_{e.m.o}$ , %    | 70       | 80              | 95                   | 85                         |
|                    | <b>5</b> | <b>6</b>        | <b>7</b>             | <b>8</b>                   |
| Stanok markasi     | 4 SF - 4 | 3 LD – 140      | 3 SA – 2             | 2 SVPA                     |
| $k_{e.o}$ , %      | 70       | 65              | 88                   | 75                         |
| $k_{e.m.o}$ , %    | 98       | 98              | 95                   | 95                         |

## **5-AMALIY MASHG‘ULOT**

### **YOG‘OCH-QIPIQLI PLITALARNI OLISHDA ATMOSFERAGA**

### **AJRALIB CHIQUYOTGAN FORMALDEGIDNING MIQDORINI**

### **ANIQLASH.**

**Ishni bajarish vaqti: 2 soat**

**II.** Texnologik operatsiyalarni amalga oshirishda –yelimlash, bo‘yash va boshqalarda texnologik jarayonlarda qo‘llaniladigan smolasimon, lak-buyq materiallaridan zaharli birikmalar tashlanadi. Jarayonlarda kabamidoformaldegid, fenol – formaldegid smolalar va ularning chiqindilarining miqdori quyidagicha aniqlanadi, kg/s:

$$G = G_{sm} \times k_1 \times (1 - k_2) \times k_3 \times 0.01$$

Bu yerda  $G_{sm}$  – smolaning sarfi (kg/s)

$k_1$  – bog‘lanmagan formaldegidning miqdori, smola tarkibidagi fenol, qo‘llanilayotgan smolaning markasiga qarab jadvaldan (ilova 2) (%).

$k_2$  – tayyor mahsulotda qoladigan bog‘lanmagan fenol va u formaldegidning miqdorini hisobga oluvchi koeffitsiynt, uni texnologik jarayonga qarab jadvaldan tanlanadi (ilova 3).

$k_3$  – uchastkalar bo‘yicha zaharli birikmalarning taqsimlanishini hisobga oluvchi koeffitsiynt (ilova 3).

Formaldegid va ammiakning miqdorini nisbiy ko‘rsatkichlar bo‘yicha hisoblash.

**Misol.**

Yogʻoch-qipikli plitalarni olishda pressdan va bosh konveyrdan ajralib chiqayotgan formaldegidning miqdorini aniqlash.

**Berilgan:**

Smolaning sarfi – 500kg/s.

$$k_1 = 0.3\% = 0.003$$

$$k_2 = 0.6$$

$$k_3 = 0.9$$

**Yechish:**

$$G = G_{sm} \times k_1 \times (1 - k_2) \times k_3 \times 0.01 = 500 \times 0.003 \times (1 - 0.6) \times 0.9 = 0.54 \text{ kg/ch}$$

***Variantlar:***

|                          |                        |                                        |                           |                      |
|--------------------------|------------------------|----------------------------------------|---------------------------|----------------------|
| Smolanin<br>g<br>markasi | <b>1</b>               | <b>2</b>                               | <b>3</b>                  | <b>4</b>             |
|                          | MFP                    | SFJ – 3011                             | M - 60                    | M - 70               |
| Jarayon                  | Qogʻozni<br>shimdirish | Surkash va<br>fanerlash                | Qipiqni<br>shimdirish     | Surkash,<br>quritish |
| Uchastka                 | Shimdirish             | Fanerlangan<br>mahsulotni<br>presslash | Bogʻlovchini<br>tayerlash | Sovutish<br>kamerasi |
| Smolanin<br>g<br>markasi | <b>5</b>               | <b>6</b>                               | <b>7</b>                  | <b>8</b>             |
|                          | SFJ -3013              | KF – B                                 | KF - MT                   | M - 70               |
| Jarayon                  | Qipiqni<br>shimdirish  | Surkash va<br>fanerlash                | Qipiqni<br>shimdirish     | Surkash,<br>quritish |

|          |                                            |                                               |                              |                     |
|----------|--------------------------------------------|-----------------------------------------------|------------------------------|---------------------|
|          | h                                          |                                               |                              |                     |
| Uchastka | Bosh<br>konveyrn<br>i<br>joylashtir<br>ish | Elim surkovchi<br>va shlakni<br>joylashtirish | Tayyor<br>mahsulot<br>ombori | Shponni<br>quritish |

## 6-AMALIY MASHG‘ULOT

### YOG‘OCHGA ISHLOV BERISH JARAYONIDA ATMOSFERAGA TASHLANAYOTGAN BUTANOL VA KSILOL MIQDORINI ANIQLANG.

**Ishni bajarish vaqti: 2 soat**

**III.** Mahsulotlarga ishlov berishda tarkibida turli xil erituvchi bo‘lgan lok-buyoq materiallari qo‘llaniladi.

Maxsulotlarga ishlov berishda atmosfera havosiga tashlanadigan zaharli birikmalarning miqdorini quyidagicha aniqlanadi (kg/s):

$$G = G_m \times k_k \times 0.8$$

Bu yerda

$G_m$  – ishlov beruvchi materiallning sarfi, kg/s

$k_k$  – ishlov beruvchi materiallning tarkibidagi uchuvchan komponentlarning miqdori %, gadvaldan (4Ilova.)

**Misol.**

Yog‘ochga to‘xtovsiz ishlov berish jarayonida atmosferaga tashlanayotgan butanol va ksilol miqdorini aniqlang.

**Berilgan:**

Erituvchi RKB – 1 ning sarfi 20kg/s ga teng.

## Yechish:

Erituvchi RKB-1ning tarkibini aniqlaymiz, ogir qism – 100%:

50% - Butanol, 50% - Ksilol.

$$G_B = G_m \times k_k \times 0.8 = 20 \times 0.5 \times 0.8 = 0.8 \text{ kg/s}$$

$$G_K = G_m \times k_k \times 0.8 = 20 \times 0.5 \times 0.8 = 0.8 \text{ kg/s}$$

### Variantlar:

|                      |          |           |          |          |
|----------------------|----------|-----------|----------|----------|
| Erituvchi<br>markasi | <b>1</b> | <b>2</b>  | <b>3</b> | <b>4</b> |
|                      | R – 4    | RML – 315 | RKB - 1  | R - 198  |
|                      |          |           |          |          |
| Erituvchi<br>markasi | <b>5</b> | <b>6</b>  | <b>7</b> | <b>8</b> |
|                      | R – 12   | R – 6     | RL - 278 | RDV      |

## 7-AMALIY MASHG‘ULOT TURLI XIL YOQILG‘ILARNI YONISHIDA HOSIL BO‘LAYOTGAN ZAHARLI BIRIKMALARNI ANIQLASH.

**Ishni bajarish vaqti: 2 soat**

Ushbu metodika turli xil yoqilg‘ilarni – qattiq yoqilg‘i, mazut, gaz va boshqalarni sanoat va maishiy qozonxonalardagi samaradorligi 30t/s bo‘lgan pechlarda, agregat va generatorlarda yonishida hosil bo‘layotgan zaharli birikmalarni aniqlashga bag‘ishlangan.

### Tashlanadigan qattiq zarrachalarni hisoblash

Qozonxona agregatidan atmosferaga tutun gazlari bilan birga tashlanadigan yonishga ulgurmagan yoqilg‘i va kullarning miqdorini quyidagi tenglama yordamida aniqlanadi:

$$M_{iv} = VA'f(1-\eta_3),$$

Bu yerda  $V$  – tabiiy yoqilg‘i sarfi, t/yil, g/s

$A'$  – ishchi sharoitidagi yoqilg‘ining kulga aylanish, %

$\eta_3$  – kulni ushlab qoluvchida qattiq zarrachalarning qismi

$$f = \alpha_{un} / (100 - G_{un}),$$

bu yerda  $\alpha_{un}$  – tutun-gaz bilan olib ketiladigan kul

$G_{un}$  – gaz bilan olib ketiladigan yoqilg‘ining miqdori, %

$A'$ ,  $f$  – kattaliklar (Ilova 5 va 6 dan), a  $\eta_3$  – kul ushlovchining texnik ko‘rsatkichlariga qarab tanlanadi.

**Misol.** Quvvati 2.5 tonna bo‘lgan qozon agregatda Kuznetsk xavzasidan olingan OS markali toshko‘mirni yoqqanda tutun-gazlar bilan tashlanadigan kulning miqdorini aniqlash.

### **Berilgan:**

Yoqilg‘ining sarfi  $G = 210$  kg/soat, yiliga 847 tonna (28 kundan 6 oy).

Qo‘zg‘almas panjarali va yoqilg‘ini qo‘lda uzatiladi.

### **Yechish:**

Yoqilg‘ining ishchi massasiga kulga aylanishi  $A' = 27.9$  % ga teng

Qo‘zg‘almas panjarali va yoqilg‘ini qo‘lda uzatiladigan sharoitdagi toshko‘mir uchun koeffitsiynt  $f = 0.0023$

$$1 \text{ soniyadagi yoqilg‘ining sarfi } V_s = 210/3600 = 0.058 \text{ kg/s}$$

Siklon tipidagi kul ushlagichning samaradorligi  $\eta_3 = 70$  % (0.7) ga teng

Tutunli gazlar bilan atmosferaga tashlanadigan kulning miqdori:

$$1 \text{ soniyada } M_{tv} = 0.0023 \cdot 0.058 \cdot 27.9 (1 - 0.7) = 0.001 \text{ gr.}$$

1yilda  $M_{iv} = 847 \cdot 0.0023 \cdot 27.9 (1-0.7) = 16.3$  tonna

***Variantlar:***

| <b>№</b>              | <b>1</b>           | <b>2</b>      | <b>3</b>                   | <b>4</b>      |
|-----------------------|--------------------|---------------|----------------------------|---------------|
| G, kg/soat            | 150<br>(3 oy)      | 120<br>(4 oy) | 280<br>(7 oy)              | 350<br>(3 oy) |
| Ko‘mirning<br>markasi | KR                 | SSSSH         | DSSH<br>(Ko‘k –<br>Yongoq) | BSSH          |
| $\eta_3$              | 85                 | 78            | 90                         | 60            |
| <b>№</b>              | <b>5</b>           | <b>6</b>      | <b>7</b>                   | <b>8</b>      |
| G, kg/soat            | 250<br>(4 oy)      | 300<br>(6 oy) | 280<br>( 5 oy)             | 200<br>(8 oy) |
| $\eta_3$              | 98                 | 55            | 80                         | 75            |
| Ko‘mirning<br>markasi | DSSH<br>(Jergalan) | B20MSSH       | BR                         | B3            |
| <b>№</b>              | <b>9</b>           | <b>10</b>     | <b>11</b>                  | <b>12</b>     |
| G, kg/soat            | 350<br>(3 oy)      | 400<br>(5 oy) | 380<br>( 4 oy)             | 200<br>(7 oy) |
| $\eta_3$              | 88                 | 65            | 85                         | 70            |
| Ko‘mirning            | DSSH               | B20MSSH       | BR                         | B3            |

|         |            |  |  |  |
|---------|------------|--|--|--|
| markasi | (Jergalan) |  |  |  |
|---------|------------|--|--|--|

## 8-AMALIY MASHG‘ULOT

### OLTINGUGURT OKSIDINING TASHLANISHINI HISOBLASH

**Ish bajarish vaqti: 2 soat**

Qozon agregatlarida suyuq yoki qattiq yoqilg‘ilarni yoqishda atmosfera havosiga tutunli gazlar bilan tashlanadigan oltingugurt oksidlarining miqdorini  $SO_2$  va  $SO_3$  ni  $SO_2$  ga o‘tkazib quyidagi tenglama orqali hisoblanadi:

$$G_{SO_2} = 0.02 \cdot BS^p (1 - \eta'_{SO_2}) (1 - \eta''_{SO_2}),$$

Bu yerda  $V$ - tabiiy yoqilg‘ining sarfi, t/yil, g/s

$S^p$ – oltingugurt oksidining yoqilg‘ini ishchi massasidagi miqdori, %

$\eta'_{SO_2}$  – yoqilg‘ining uchadigan qismida tarkibidagi oltingugurt oksidining va kulining tarkibiy miqdorini quyidagicha deb qabul qilamiz:

slanes–  $0.5 \div 0.8$

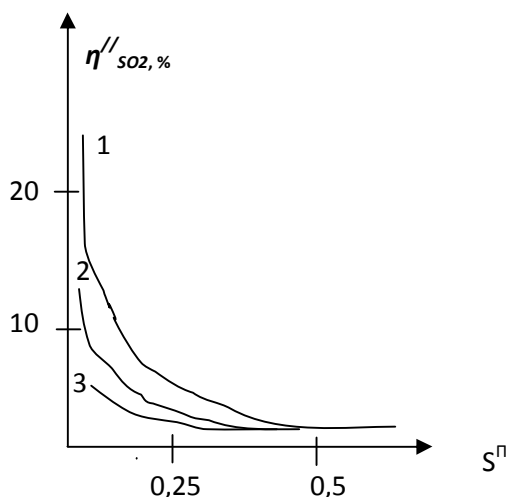
ko‘mir uchun –  $0.1 \div 0.2$

torf uchun –  $0.15$

mazut uchun –  $0.02$

gaz –  $0.0$

$\eta''_{SO_2}$  – oltingugurt oksidining kulini ushlab qolish inshootidagi miqdorini quruq changushlagichlar uchun nolga teng deb qabul qilamiz, ho‘l changushlagichlar uchun esa suyuqlikning ishqoriyligiga va yoqilg‘ining tarkibidagi oltingugurt birikmalarining miqdoriga bog‘liq bo‘lib, u grafik usulda aniqlanadi.



Oltingugurtning oksidlarini ho‘l changushlagichlarda yoqilg‘ining tarkibidagi oltingugurt birikmalariga va suyuqlikning ishqoriyligiga bog‘liqligi:

1- 10 mg-ekv / l

2- 5 mg-ekv / l

3 - 0 mg-ekv / l

**Misol.** Yonish issiqligi  $Q_n^p = 4200 \text{ kDj/kg}$  ( $1000 \text{ kkal/kg}$ ) va tarkibidagi oltingugurtning miqdori  $S^p = 1,5 \%$  ga teng bo‘lgan yoqilg‘i yondirilganda tutunli gaz bilan atmosfera havosiga tashlanadigan oltingugurt oksidining miqdorini aniqlang.

**Berilgan:**

Yoqilg‘ining sarfi  $700 \text{ kg/soat}$  (5oyda),  $2352 \text{ t/yil}$ . Qozon-agregatdan tashlanadigan chiqindi tutunli gazlarni ishqoriyligi  $5 \text{ mg/(mol}\cdot\text{l)}$  bo‘lgan suv bilan yuviladi.

**Yechish:**

1. Yoqilg‘ining tarkibidagi oltingugurt birikmalarining miqdori:

$$S^p = (1000 \times 1.5) / 4200 = 0.36 \text{ kg/ mdj}$$

2. Qozon-agregatdan tashlanadigan kulning tarkibidagi oltingugurt oksidining miqdori  $\eta_{SO_2} = 0.02$

3. Ho'l kul ushlagichda 5 mg/(mol l) ishqoriylikka ega bo'lgan suv bilan tozalaganda oltingugurt oksidini ushlab qolish darajasi 5 mg/(mol·l), grafikdan,  $\eta_{SO_2} = 0.02$

4. Tutun-gazlari bilan olib ketiladigan oltingugurt oksidining miqdori

$$1 \text{ soniyada: } G_{SO_2} = \frac{0.02 \times 700 \times 1.5 \times (1 - 0.02) \times 1 - 0.02}{3600} = 0.0056 \text{ kg} = 5.6 \text{ g}$$

$$1 \text{ yilda: } G_{SO_2} = \frac{0.02 \times 2352 \times 1.5 \times (1 - 0.02) \times (1 - 0.02)}{1000} = 95 \text{ tonn}$$

### Variantlar

| №                    | 1                       | 2                   | 3                          | 4                       |
|----------------------|-------------------------|---------------------|----------------------------|-------------------------|
| Yoqilg'i turi        | Kam oltingugurtli mazut | Oltingugurtli mazut | Yuqori oltingugurtli mazut | Stabillashtirilgan neft |
| Yoqilg'i sarfi       | 850 kg/s (4 oy)         | 600 kg/s (6 oy)     | 500 kg/soat (3 oy)         | 750 kg/soat (7 oy)      |
| Suvning ishqoriyligi | 5mg/ (mol×litr)         | 10mg/ (mol×litr)    | 0mg/ (mol×litr)            | 5mg/ (mol×litr)         |
|                      | 5                       | 6                   | 7                          | 8                       |
| Yoqilg'i turi        | Tyumen torfi            | Ko'mir BR           | Ko'mir BZ                  | Solyarka moyi           |
| Yoqilg'i sarfi       | 400 kg/s                | 500 kg/s            | 650 kg/s                   | 800 kg/s                |
| Suvning ishqoriyligi | 10mg/ (mol×litr)        | 5mg/ (mol×litr)     | 10mg/ (mol×litr)           | 5mg/ (mol×litr)         |
| №                    | 9                       | 10                  | 11                         | 12                      |
| Yoqilg'i             | Tyumen                  | Ko'mir BR           | Ko'mir BZ                  | Solyarka                |

| turi                 | torfi              |                    |                    | moyi               |
|----------------------|--------------------|--------------------|--------------------|--------------------|
| Yoqilg'i sarfi       | 3400 kg/s          | 400 kg/s           | 550 kg/s           | 870 kg/s           |
| Suvning ishqoriyligi | 6mg/<br>(mol×litr) | 4mg/<br>(mol×litr) | 9mg/<br>(mol×litr) | 7mg/<br>(mol×litr) |

## 9-AMALIY MASHG'ULOT

### UGLEROD OKSIDINING TASHLANMALARINI HISOBLASH

**Ish bajarish vaqti: 2 soat**

I. Quvvati 30 t/soat bo'lgan qozon-agregatidan vaqt birligi ichida (t/yil, g/s) yoqilg'ini yonishida tashlanadigan uglerod oksidining miqdori quyidagi tenglama yordamida aniqlanadi:

$$G_{CO} = 0.001 \cdot k_{CO} \cdot B (1 - q_4 / 100),$$

Bu yerda  $V$  – yoqilg'ining sarfi, t / yil, ming. m<sup>3</sup> / yil, g/s, l/s

$k_{SO}$  – yoqilg'ining yonishida issiqlik birligida tashlanayotgan uglerod oksidining miqdori

$Q_N^R$  – yoqilg'i yonganda ajralib chiqadigan past harorat, MDj / kg, MDj/m<sup>3</sup>

$q_4$  – yoqilg'ining mexanik to'liq yonmasligi natijasidagi issiqlikning yo'qotilishi, %;

$k_{SO}$ ,  $Q_N^R$ ,  $q_4$  – jadvalda keltirilgan kattaliklar (Ilova 5, 6, 7.).

**Misol.** Quvvati 2tonna/soat bo'lgan qozon-agregatda tabiiy gazning yonishi natijasida tutunli gaz bilan birga tashlanadigan uglerod oksidining miqdorini aniqlang.

**Berilgan:** Tyumen tabiiy gazining yonish issiqligi  $Q_N^R = 35.7$  kDj/m<sup>3</sup> (8550 kkal/ m<sup>3</sup>). Yoqilg'ining sarfi 180 m<sup>3</sup> / soat, 483840 m<sup>3</sup> / yil (4oy).

**Yechish:**

1. Jadvaldan par va suvni isitish agregatlarida tabiiy gazni yoqqanda  $k_{SO} = 0.25 \text{ kg/kDj}$ ,  $q_4 = 0.0 \%$  bo'lishini aniqlaymiz.
2.  $1 \text{ m}^3$  tabiiy gazning yonishida hosil bo'lgan uglerod oksidining miqdorini hisoblaymiz:

$$G_{CO} = k_{CO} \cdot Q_N^R (1 - q_4/100) = 0.25 \cdot 35.7 \cdot (1 - 0.0/100) = 8.88 \text{ g/m}^3$$

3. Tutunli gaz bilan birga tashlanayotgan uglerod oksidining miqdori:

$$1 \text{ soniyada } G_{CO} = 8.88(180/3600) = 0.444 \text{ g}$$

$$1 \text{ yilda } G_{CO} = 0.001 \cdot 483.840 \cdot 35.7 \cdot 0.25(1 - 0.0/100) = 4.318 \text{ tonna}$$

### *Variantlar*

| <b>№</b>       | <b>1</b>               | <b>2</b>               | <b>3</b>                      | <b>4</b>                                |
|----------------|------------------------|------------------------|-------------------------------|-----------------------------------------|
| Yoqish turi    | Shaxta usulida         | Issiqlik generatorida  | Par va suvni isitish qozonida | Qo'zg'almas panjara va qo'lda uzatishli |
| Yoqilg'i turi  | Torf (Tyumen)          | Toshko'mir (B3)        | Mazut (kam oltingugurtli)     | Toshko'mir (B20MSSH)                    |
| Yoqilg'i sarfi | 750 kg/s (5 oy)        | 800 kg/s (6 oy)        | 600 kg/s (4 oy)               | 450 kg/s (7 oy)                         |
| <b>№</b>       | <b>5</b>               | <b>6</b>               | <b>7</b>                      | <b>8</b>                                |
| Yoqish turi    | Pnevmatik usulda       | Og'ma-uzatishli usulda | Par va suvni isitish kozonida | Issiqlik generatorida                   |
| Yoqilg'i turi  | Ko'mir (BSSH)          | Slanes (Estoslanets)   | Mazut (yuqori oltingugurtli)  | Slanes (Kashir shaxtasidan)             |
| Yoqilg'i sarfi | 850 kg/s (4 oy)        | 750 kg/s (5 oy)        | 650 kg/s (6 oy)               | 500 kg/s (7 oy)                         |
| <b>№</b>       | <b>9</b>               | <b>10</b>              | <b>11</b>                     | <b>12</b>                               |
| Yoqish turi    | Og'ma-uzatishli usulda | Issiqlik generatorida  | Pnevmatik usulda              | Par va suvni isitish qozonida           |

|                 |                      |                             |                 |                              |
|-----------------|----------------------|-----------------------------|-----------------|------------------------------|
| Yoqilg' i turi  | Slanes (Estoslanets) | Slanes (Kashir shaxtasidan) | Ko'mir (BSSH)   | Mazut (yuqori oltingugurtli) |
| Yoqilg' i sarfi | 650 kg/s (4 oy)      | 600 kg/s (6 oy)             | 750 kg/s (5 oy) | 950 kg/s (8 oy)              |

## ILOVALAR

### 1-ilova.Yog'ochlarga turli xil stanokrlarda ishlov berishda hosil bo'lganchiqindilarning o'rtachasoatlik miqdori

| Mashina asboblari                           | Mashinadanf oydalanishva qti koeffitsiynti | Minimal assimilyatsi ya havo miqdori, ming m <sup>3</sup> /soat | Chiqindilarn i oʻrtacha miqdori kg/soat | Zarrachalar hajmi 200 mikrondan kichik boʻlgan changning oʻrtacha miqdori % kg/soat |      |
|---------------------------------------------|--------------------------------------------|-----------------------------------------------------------------|-----------------------------------------|-------------------------------------------------------------------------------------|------|
| aylana arra:                                |                                            |                                                                 | Chang, qirindi                          |                                                                                     |      |
| S6-2                                        | -                                          | 0,84                                                            | 29,7                                    | 36                                                                                  | 10,7 |
| STEF                                        | -                                          | 2,52                                                            | 46,3                                    | 34                                                                                  | 15,7 |
| SKB-4, SME-2                                | 0,5-0,6                                    | 0,86                                                            | 44,0                                    | 36                                                                                  | 15,8 |
| SPA-40                                      | 0,6                                        | 0,84                                                            | 44,0                                    | 35                                                                                  | 15,3 |
| S2K12                                       | 0,6                                        | -                                                               | 35                                      | 34                                                                                  | 11,8 |
| SD-2A                                       | 0,9                                        | 1,50                                                            | 61,0                                    | 35                                                                                  | 21,5 |
| SDK-4                                       | 0,9                                        | -                                                               | 78,0                                    | 36                                                                                  | 28,1 |
| SA-2                                        | 0,9                                        | -                                                               | 110,0                                   | 36                                                                                  | 39,7 |
| SMR-1                                       | 0,95                                       | 1,90                                                            | 170,0                                   | 36                                                                                  | 61,2 |
| Universal aylana arra S6                    | 0,7                                        | -                                                               | 28,0                                    | 30                                                                                  | 8,4  |
| Universal aylana arra UP                    | 0,7                                        | -                                                               | 21,0                                    | 30                                                                                  | 6,3  |
| Rejalashtirish:                             |                                            |                                                                 | Qirindi, chang:                         |                                                                                     |      |
| Qoʻlda uzatiladigan burgʻilash mashinalari: |                                            |                                                                 |                                         |                                                                                     |      |
| SF-3                                        | 0,7                                        | -                                                               | 33,0                                    | 25                                                                                  | 8,2  |
| SF-6                                        | 0,6                                        | -                                                               | 73,0                                    | 25                                                                                  | 18,2 |
| Mexanik                                     |                                            |                                                                 |                                         |                                                                                     |      |

|                                        |      |      |       |    |       |
|----------------------------------------|------|------|-------|----|-------|
| uzatmali<br>burg'ilash<br>mashinalari: |      |      |       |    |       |
| SF-4                                   | 0,9  | -    | 97,0  | 25 | 24,3  |
| SF-6                                   | 0,9  | -    | 190,0 | 25 | 47,5  |
| SFA-4                                  | 0,9  | -    | 97,0  | 25 | 24,2  |
| SFA-6                                  | 0,9  | -    | 190,0 | 25 | 47,6  |
| SR-3                                   | 0,9  | -    | 97,0  | 25 | 24,2  |
| SK-15, S16-4, S16-5                    | 0,9  | -    | 310,0 | 25 | 77,7  |
| S2R6, S2R8                             | 0,9  | 2,50 | 445,0 | 25 | 112,0 |
| S2R12                                  | 0,9  | 3,10 | 490,0 | 25 | 122,5 |
| S2R16                                  | 0,9  | -    | 555,0 | 25 | 139,0 |
| Frez mashinalari: Qirindi, chang:      |      |      |       |    |       |
| FL, FLA, FSSh-1                        | -    | 0,9  | 24,0  | 20 | 4,8   |
| F-4, F-6                               | 0,7  | 1,35 | 26,1  | 20 | 5,2   |
| F-5                                    | 0,7  | 1,50 | 26,1  | 20 | 5,2   |
| FA-1                                   | 0,8  | -    | 44,0  | 20 | 8,8   |
| F                                      | 0,8  | -    | 22,0  | 20 | 4,4   |
| FS-1                                   | -    | 1,35 | 47,5  | 20 | 9,5   |
| VFK-2                                  | -    | 0,40 | 27,0  | 20 | 5,4   |
| SR-6                                   | 0,9  | -    | 245,0 | 25 | 61,2  |
| SR-12                                  | 0,9  | -    | 335,0 | 25 | 83,7  |
| SR-18                                  | 0,9  | -    | 500,0 | 25 | 125,  |
| SP-30, S-26                            | 0,9  | -    | 600,0 | 25 | 150,  |
| O'yuvchi:                              |      |      |       |    |       |
| O'yuvchi aylana arra                   | -    | 1,51 | 73,0  | 16 | 11,6  |
| ShO-10 (chang)                         | -    | 0,72 | 4,6   | 16 | 0,7   |
| Quloqli arra                           | -    | 0,83 | 24,0  | 16 | 3,8   |
| ShO-6 (chang)                          | -    | 0,72 | 3,7   | 16 | 0,6   |
| O'yuvchi bosh                          | -    | 1,22 | 54,0  | 16 | 8,6   |
| Quloqli disk                           | -    | 0,79 | 15,3  | 16 | 2,4   |
| Arra                                   | 0,96 | -    | 74,0  | 34 | 25,2  |
| Aylana arraning boshi                  | 0,95 | -    | 68,0  | 20 | 13,6  |
| O'yuvchi arraning ramasi ShD-10        | -    | -    | 9,2   | 16 | 1,5   |
| O'yuvchiaylana                         | -    | -    | 145,0 | 16 | 23,2  |

|                                                                               |      |      |       |     |      |
|-------------------------------------------------------------------------------|------|------|-------|-----|------|
| arra                                                                          |      |      |       |     |      |
| Quloqli aylanaarra                                                            | -    | -    | 48,0  | 16  | 7,7  |
| O'yuvchiarraqutisi                                                            | -    | 1,0  | 8,5   | 24  | 2,0  |
| ShPA-40, Sh2PA                                                                | -    | 1,98 | 62,3  | 16  | 10,0 |
| ShLX-3                                                                        |      |      |       |     |      |
| Lentali arralash: <span style="float: right;">Qirindi, chang</span>           |      |      |       |     |      |
| LO-80                                                                         | 0,8  | 1,15 | 29,0  | 34  | 9,8  |
| LD-140                                                                        | 0,8  | 2,5  | 245,0 | 34  | 83,5 |
| LS-80-1, LS-40-1                                                              | -    | 1,2  | 36,0  | 33  | 12,0 |
| Frezer boshlari bilan shakllangan to'rtta arra                                | 0,9  | -    | 245,0 | 25  | 61,3 |
| Burg'alash va kanal ochish: <span style="float: right;">Qirindi, chang</span> |      |      |       |     |      |
| SPVA                                                                          | 0,6  | -    | 22,0  | 18  | 1,5  |
| SVA-2                                                                         | 0,5  | 0,15 | 14,0  | 18  | 2,5  |
| SVA-2M                                                                        | -    | 0,15 | 25,9  | -   | 1,6  |
| SVP-2                                                                         | -    | 0,15 | 25,9  | -   | 1,6  |
| SGVP-1                                                                        | -    | 1,0  | 23,1  | -   | 1,5  |
| burg'alovchi 2N,125L                                                          | -    | 0,8  | 26,0  | 21  | 6,0  |
| DSA-2                                                                         | 0,4  | -    | 27,0  | 18  | 4,8  |
| Tokarlik-E61M, 1A61V                                                          | -    | 1,8  | 26,0  | 21  | 60   |
| Yo'nuvchi moslama: <span style="float: right;">chang</span>                   |      |      |       |     |      |
| ShlPS-5P                                                                      | -    | 3,0  | 2,8   | 100 | 2,8  |
| ShlPS-7                                                                       | -    | 3,0  | 5,6   | 100 | 5,6  |
| ShlINSV                                                                       | -    | 2,4  | 1,2   | 100 | 1,2  |
| ShlDB                                                                         | 0,78 | -    | 3,2   | 95  | 3,1  |
| ShlNS                                                                         | 0,85 | -    | 2,8   | 95  | 2,7  |
| ShlSL                                                                         | 0,85 | -    | 1,8   | 95  | 1,7  |
| Shl2D                                                                         | 0,7  | -    | 4,0   | 95  | 3,8  |
| Shl3S-2                                                                       | 0,85 | -    | 27,0  | 95  | 26,5 |
| Shl3SV-3                                                                      | 0,85 | -    | 48,0  | 95  | 45,0 |
| Yo'nuvchi -aylanuvchi-yo'nuvchi: <span style="float: right;">chang</span>     |      |      |       |     |      |
| ShlDB-4                                                                       | -    | 1,4  | 12,0  | 67  | 8    |

## 2-ilova.Smola tarkibidagi erkin formaldegid va fenolning ulushi %

| Smola turi | Erkin formaldegid | Erkin fenol | Smola turi | Erkin formaldegid | Erkin fenol |
|------------|-------------------|-------------|------------|-------------------|-------------|
| MF         | 3-4               | -           | MFP        | 0,5-1,0           | -           |

|         |         |   |          |      |      |
|---------|---------|---|----------|------|------|
| M-60    | 1-1,5   | - | SPMF-4   | 0,5  | -    |
| M-70    | 1,5-3,0 | - | KF-MT    | 0,3  | -    |
| M-19-62 | 1,0-1,2 | - | KF-B     | 0,9  | -    |
| MFPS-1  | 2       | - | KF-J     | 1,0  | -    |
| MFPS-2  | 1       | - | SFJ-3014 | 0,1  | 0,1  |
| PMF-1,  | 1       | - | SFJ-3013 | 0,18 | 0,18 |
| PMF-2   |         |   | SFJ-3011 | 1,0  | 2,5  |
| MMPK-25 | 1,4     | - |          |      |      |
| MMPK-50 | 1,1     | - |          |      |      |

### 3-ilova. Erkin formaldegid va fenolning taqsimlanishi

| Jarayon                                                                             | Qolgan tayyor mahsulot dagierkin Formaldegid vafenol miq-dorini Xarakterlovchi ko-effitsiyent k | Jarayon bo'limi                                                                                                  | Moddalar bo'yicha taqsimlanishini tavsiflovchi ko-effitsiyent k <sub>j</sub> |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|
| Mebelishlabchiqarishdatabiiy vasintetikqoplamni bo'yashvaqoplash                    | 0.7                                                                                             | Yelimyoyuvchirulonlarniva issiqpresslarnijoylashtirish<br>2. Faner mahsulotlarning ushlash maydoni               | 0,83<br><br>0,17                                                             |
| Qog'ozni shimdirish (laminatsiya)                                                   | 0.5                                                                                             | shimdirish                                                                                                       | 1,0                                                                          |
| Issiq presslash rezina bilan chiplarni shimdirish;<br>Zarralar taxtalarini sovutish | 0.6                                                                                             | 1. Asosiy konveyerni va peslashni joylashtirish<br>2. Qatlamlarni tayyorlash<br>3. Tayyor mahsulotlarning ombori | 0,9<br><br>0,09<br><br>0,01                                                  |

|                                                                                          |     |                                                                                                                |                             |
|------------------------------------------------------------------------------------------|-----|----------------------------------------------------------------------------------------------------------------|-----------------------------|
| Moylash, quritish:<br>preslashdan so'ng shponlarni<br>elimlash va fanerlarni<br>sovitish | 0.5 | 1. Yopishuvchi silindrlar<br>2. Moylangan shponlarni<br>quritish;<br>issiq presslash<br>3. Sovutgich kameralar | 0,1<br><br>0,75<br><br>0,15 |
|------------------------------------------------------------------------------------------|-----|----------------------------------------------------------------------------------------------------------------|-----------------------------|

#### 4-ilova.Erituvchilar tarkibi , %

| Komponentlar      | R - 4   | R - 5    | R - 6    | R - 7    | R - 12   | R - 14   |
|-------------------|---------|----------|----------|----------|----------|----------|
| Atseton           | 26      | 30       | -        | -        | -        | -        |
| Benzol            | -       | -        | 40       | -        | -        | -        |
| Butilatsetat      | 12      | 30       | 15       | -        | 30       | -        |
| Butil spirti      | -       | -        | 15       | -        | -        | -        |
| Ksilol            | -       | 40       | -        | -        | 10       | -        |
| Toluol            | 62      | -        | -        | -        | 60       | 50       |
| Siklogeksanon     | -       | -        | -        | 50       | -        | 50       |
| Etilspirti        | -       | -        | 30       | 50       | -        | -        |
|                   |         |          |          |          |          |          |
| Komponentlar      | R - 24  | R - 40   | R - 60   | R- 189   | R - 198  | R - 219  |
| Atseton           | 15      | -        | -        | -        | -        | 30       |
| Butilatsetat      | -       | -        | -        | 13       | -        | -        |
| Ksilol            | 35      | -        | -        | 13       | 27       | -        |
| Metiletilketon    | -       | -        | -        | 37       | -        | -        |
| Solvent-nafta     | 50      | -        | -        | -        | -        | -        |
| Toluol            | -       | 50       | -        | -        | -        | 33       |
| Siklogeksanon     | -       | -        | -        | -        | 50       | 34       |
| Etilglikolatsetat | -       | -        | -        | 37       | -        | -        |
| Etil spirti       | -       | -        | 70       | -        | -        | -        |
| Etilsellozolv     | -       | 50       | 30       | -        | 50       | -        |
|                   |         |          |          |          |          |          |
| Komponentlar      | R - 548 | R - 1101 | R - 1166 | R - 2106 | R - 3160 | RL - 176 |

|                     |                      |                      |                     |                   |                   |                   |
|---------------------|----------------------|----------------------|---------------------|-------------------|-------------------|-------------------|
| Butilspirti         | -                    | -                    | -                   | -                 | 60                | -                 |
| Ksilol              | -                    | -                    | 50                  | -                 | -                 | -                 |
| Propilenkarbonat    | 30                   | -                    | -                   | -                 | -                 | -                 |
| Solvent-nafta       | -                    | 55                   | -                   | 70                | -                 | 50                |
| Toluol              | -                    | 25                   | -                   | -                 | -                 | -                 |
| Siklogeksanon       | -                    | -                    | 15                  | 30                | -                 | 50                |
| Etilatsetat         | -                    | -                    | 20                  | -                 | -                 | -                 |
| Etilglikolatsetat   | -                    | 20                   | -                   | -                 | -                 | -                 |
| Etilspirti          | -                    | -                    | -                   | -                 | 40                | -                 |
| Etilsellozolv       | 70                   | -                    | 15                  | -                 | -                 | -                 |
|                     |                      |                      |                     |                   |                   |                   |
| <b>Komponentlar</b> | <b>RL-<br/>277</b>   | <b>RL -<br/>278</b>  | <b>RL -<br/>298</b> | <b>RVL</b>        | <b>RFG</b>        | <b>RS -<br/>2</b> |
| Butil spirti        | -                    | 20                   | -                   | -                 | 75                | -                 |
| Ksilol              | -                    | 30                   | 70                  | -                 | -                 | 30                |
| Metiletilketon      | 50                   | -                    | -                   | -                 | -                 | -                 |
| Toluol              | -                    | 25                   | -                   | -                 | -                 | -                 |
| Uayt-spirt          | -                    | -                    | -                   | -                 | -                 | 70                |
| Xlorbenzol          | -                    | -                    | -                   | 50                | -                 | -                 |
| Siklogeksanon       | 50                   | -                    | -                   | -                 | -                 | -                 |
| Etil spiriti        | -                    | 15                   | -                   | -                 | 25                | -                 |
| Etilsellozolv       | -                    | 10                   | 30                  | 50                | -                 | -                 |
|                     |                      |                      |                     |                   |                   |                   |
| <b>Komponentlar</b> | <b>№<br/>645</b>     | <b>№<br/>646</b>     | <b>№<br/>647</b>    | <b>№<br/>648</b>  | <b>№<br/>649</b>  | <b>№<br/>650</b>  |
| Atseton             | 3                    | 7                    | -                   | -                 | -                 | -                 |
| Butilatsetat        | 18                   | 10                   | 29,8                | 50                | -                 | -                 |
| Butil spirt         | 10                   | 15                   | 7,7                 | 20                | 20                | 30                |
| Ksilol              | -                    | -                    | -                   | -                 | 50                | 50                |
| Toluol              | 50                   | 50                   | 41,3                | 20                | -                 | -                 |
| Etilatsetat         | 9                    | -                    | 21,2                | -                 | -                 | -                 |
| Etil spirti         | 10                   | 10                   | -                   | 10                | -                 | -                 |
| Etilsellozolv       | -                    | 8                    | -                   | -                 | 30                | 20                |
|                     |                      |                      |                     |                   |                   |                   |
| <b>Komponentlar</b> | <b>RML<br/>- 218</b> | <b>RML<br/>- 315</b> | <b>RDV</b>          | <b>RKB-<br/>1</b> | <b>RKB-<br/>2</b> | <b>M</b>          |
| Atseton             | -                    | -                    | 3                   | -                 | -                 | -                 |
| Butilatsetat        | 9                    | 18                   | 18                  | -                 | -                 | 30                |
| Butil spirti        | 9                    | 15                   | 10                  | 50                | 95                | 5                 |
| Ksilol              | 23,5                 | 25                   | -                   | 50                | 5                 | -                 |
| Toluol              | 23,5                 | 25                   | 50                  | -                 | -                 | -                 |
| Etilatsetat         | 16                   | -                    | 9                   | -                 | -                 | 5                 |
| Etil spirti         | 16                   | -                    | 10                  | -                 | -                 | 60                |

|               |   |    |   |   |   |   |
|---------------|---|----|---|---|---|---|
| Etilsellozolv | 3 | 17 | - | - | - | - |
|---------------|---|----|---|---|---|---|

### 5-ilova.Qattiq yoqil‘ining xususiyatlari

| Shaxtalar,<br>konlar,<br>manzillari     | Ko‘mirdarajasi | W <sub>p</sub> ,% | A <sub>p</sub> ,% | S <sub>p</sub> ,% | Q <sub>pN</sub> .<br>mdj/kg |
|-----------------------------------------|----------------|-------------------|-------------------|-------------------|-----------------------------|
| Qirg‘iziston                            |                |                   |                   |                   |                             |
| Konlar :                                |                |                   |                   |                   |                             |
| Jergalan                                | DSSh           | 11,5              | 14,0              | 1,0               | 22,77                       |
| Ko‘k-<br>yong‘oq                        | DSSh           | 10,5              | 21,0              | 1,8               | 21,31                       |
| Tosh-<br>ko‘mir                         | DSSh           | 14,5              | 25,0              | 1,5               | 17,87                       |
| Sulyktin<br>konini<br>boshqarmasi       | BZSSh          | 32,0              | 21,0              | 0,7               | 17,0                        |
| Qizil javhari,<br>konlar<br>boshqarmasi | BZSSh          | 28,0              | 18,0              | 1,6               | 16,16                       |
| № 4                                     | BZSSh          | 25,0              | 18,0              | 1,8               | 17,0                        |
| Markaziy                                | BZSSh          | 19,5              | 15,0              | 0,7               | 19,0                        |
| Kara-<br>Kiche                          | BZ             | 19,0              | 10,0              | 1,0               | 19,80                       |
| Tojikiston                              |                |                   |                   |                   |                             |
| Konlar:                                 |                |                   |                   |                   |                             |
| № 1/2,<br>Sho‘rob                       | BR             | 21,5              | 20,0              | 1,0               | 16,83                       |
| № 8,<br>Sho‘rob                         | BSSh           | 29,5              | 18,0              | 1,0               | 15,24                       |
| Uzoqsharq                               |                |                   |                   |                   |                             |
| Artemov                                 | BZOMSSh        | 24,0              | 32,0              | 0,4               | 13,31                       |

|                                  |                               |      |      |     |       |
|----------------------------------|-------------------------------|------|------|-----|-------|
| koni                             |                               |      |      |     |       |
|                                  | BZKOM                         | 24,5 | 26,0 | 0,4 | 14,82 |
|                                  | BZSShA                        | 23,0 | 35,5 | 0,4 | 12,68 |
| Partizan(Suc<br>han)             | J6R                           | 5,5  | 34,0 | 0,5 | 20,51 |
| Hovuzlar                         | J,<br>Tsanoatmahsulotl<br>ari | 9,0  | 40,0 | 0,5 | 17,25 |
| Razdolen<br>hovuzi:              |                               |      |      |     |       |
| Paydobo‘lga<br>n<br>joyi         |                               |      |      |     |       |
| Lipoves                          | DKO                           | 6,0  | 32,0 | 0,4 | 19,64 |
|                                  | DMSSh                         | 6,0  | 35,0 | 0,4 | 18,63 |
|                                  | DR, DSSh                      | 6,0  | 36,0 | 0,4 | 18,13 |
| Ogodjin                          | DR                            | 13,0 | 40,0 | 0,3 | 15,83 |
| Qozog‘iston                      |                               |      |      |     |       |
| Qarag‘anda<br>hovuzi             | KR, K2R                       | 8,0  | 27,6 | 0,8 | 21,12 |
|                                  | KSSh, K2SSh                   | 8,0  | 29,4 | 0,8 | 20,24 |
| Kuchkin<br>koni                  | K, K2                         | 10,0 | 20,7 | 0,8 | 22,97 |
|                                  | K2R                           | 7,0  | 40,9 | 0,7 | 16,63 |
| Ekibastuz<br>havzasi             | SSR                           | 7,0  | 32,6 | 0,7 | 18,94 |
| Lengerkoni                       | BZR, BESSh                    | 29,0 | 14,2 | 1,8 | 15,33 |
| To‘rg‘yhavz<br>asi:              |                               |      |      |     |       |
| Qushmurunk<br>oni                | B2                            | 37,0 | 11,3 | 1,6 | 13,18 |
| Ko'l oldi<br>koni                | B2                            | 36,0 | 11,5 | 0,5 | 13,23 |
| O‘zbekiston                      |                               |      |      |     |       |
| Angrenbo‘li<br>mi                | B20MSSh                       | 34,5 | 22,0 | 2,0 | 13,44 |
| Shargun<br>konini<br>boshqarmasi | SSSSh                         | 6,0  | 18,5 | 0,8 | 25,95 |
| Neftslanesi                      |                               |      |      |     |       |
| Estoslanes                       | 0 -100 mm                     | 12,0 | 50,5 | 1,6 | 11,34 |
| Leningrad<br>slanes:             | -                             |      |      |     |       |
| Kon № 3                          | -                             | 11,0 | 54,2 | 1,5 | 9,50  |

|                            |                     |      |      |     |       |
|----------------------------|---------------------|------|------|-----|-------|
| Kashir koni                | -                   | 14,0 | 68,5 | 3,6 | 6,40  |
| Boltish koni               | -                   | 32,0 | 67,0 | 1,4 | 10,47 |
| MelintliKarpata slaneslari | -                   | 5,0  | 75,0 | 3,0 | 7,12  |
| Torf                       |                     |      |      |     |       |
| Kon joyi:                  |                     |      |      |     |       |
| Leningrad                  | -                   | 48,0 | 11,3 | 0,2 | 8,92  |
| Shatur                     | -                   | 48,0 | 11,0 | 0,3 | 8,83  |
| Tuymen                     | -                   | 48,0 | 10,9 | 0,3 | 8,29  |
| Smolen                     | -                   | 47,9 | 12,0 | 0,3 | 8,29  |
| Boshqa yoqilg'i turlari    |                     |      |      |     |       |
|                            | Yog'och             |      | 0,6  | —   | 10,24 |
|                            | Masut:              |      |      |     |       |
|                            | Kam oltingugurtli   |      | 0,1  | 0,5 | 40,30 |
|                            | Oltingugurt ko'proq |      | 0,1  | 1,9 | 39,85 |
|                            | Ko'p oltingugurtli  |      | 0,1  | 4,1 | 38,89 |
|                            | Stabil bo'lgan neft |      | 0,1  | 2,9 | 39,90 |
|                            | Dizel yoqilg'isi    |      | 0,02 | 0,3 | 42,75 |
|                            | Salyarka moyi       |      | 0,02 | 0,3 | 42,46 |
|                            | Motor yonilg'i      |      | 0,05 | 0,4 | 41,49 |

**6-ilova. f vak<sub>co</sub>koefitsiyentlarinio'choq va yoqilg'i turlariga bogliqligi.**

| O'choqturi                                           | Yoqilg'ituri                          | f                | K <sub>co</sub> , kg/kJ |
|------------------------------------------------------|---------------------------------------|------------------|-------------------------|
| Ruxsat etilgan panjara va qo'lda quyma bilanyonilg'i | Kulrang va toshli ko'mirvaantrasitlar | 0,0023           | 1,9                     |
|                                                      | ASvaAM                                | 0,0030           | 0,9                     |
|                                                      | ARSh                                  | 0,0078           | 0,8                     |
| Pnevmatiktartatuvchilarva xarakatsizpanjara          | Kulrang va toshli ko'mir AntrasitARSh | 0,0026<br>0,0088 | 0,7<br>0,6              |
| To'g'riyonaltilirilgan zanjirli panjaralar           | Antrasit AS va AM                     | 0,0020           | 0,4                     |
| Panjaralizanzjirtashuvchilar                         | Kulrangvatoshko'mir                   | 0,0035           | 0,7                     |
| Shaxtalar                                            | Qattiqyonilg'i                        | 0,0019           | 2,0                     |
| Zanjirlishaxta                                       | Torftuproqli                          | 0,0019           | 1,0                     |
| Qiyama itaruvchi                                     | Estoniya slanesi                      | 0,0025           | 2,9                     |
| Qavatli o'choq maishiyissiqlikgeneratorlari          | Yog'och                               | 0,0050           | 14,0                    |
|                                                      | Kulrang ko'mir                        | 0,0011           | 16,0                    |
|                                                      | Toshko'mir                            | 0,0011           | 7,0                     |
|                                                      | Antrasit, maydako'mir                 | 0,0011           | 3,0                     |
| Bug' vaissiqsuvqozonlari                             | Mazut                                 | 0,02             | 0,32                    |

|                                                      |                      |   |      |
|------------------------------------------------------|----------------------|---|------|
|                                                      | Tabiiygaz, gazvakoks | — | 0,25 |
| Xona o'choqlari va maishiy<br>issiqlik generatorlari | Tabiiygaz            | — | 0,08 |

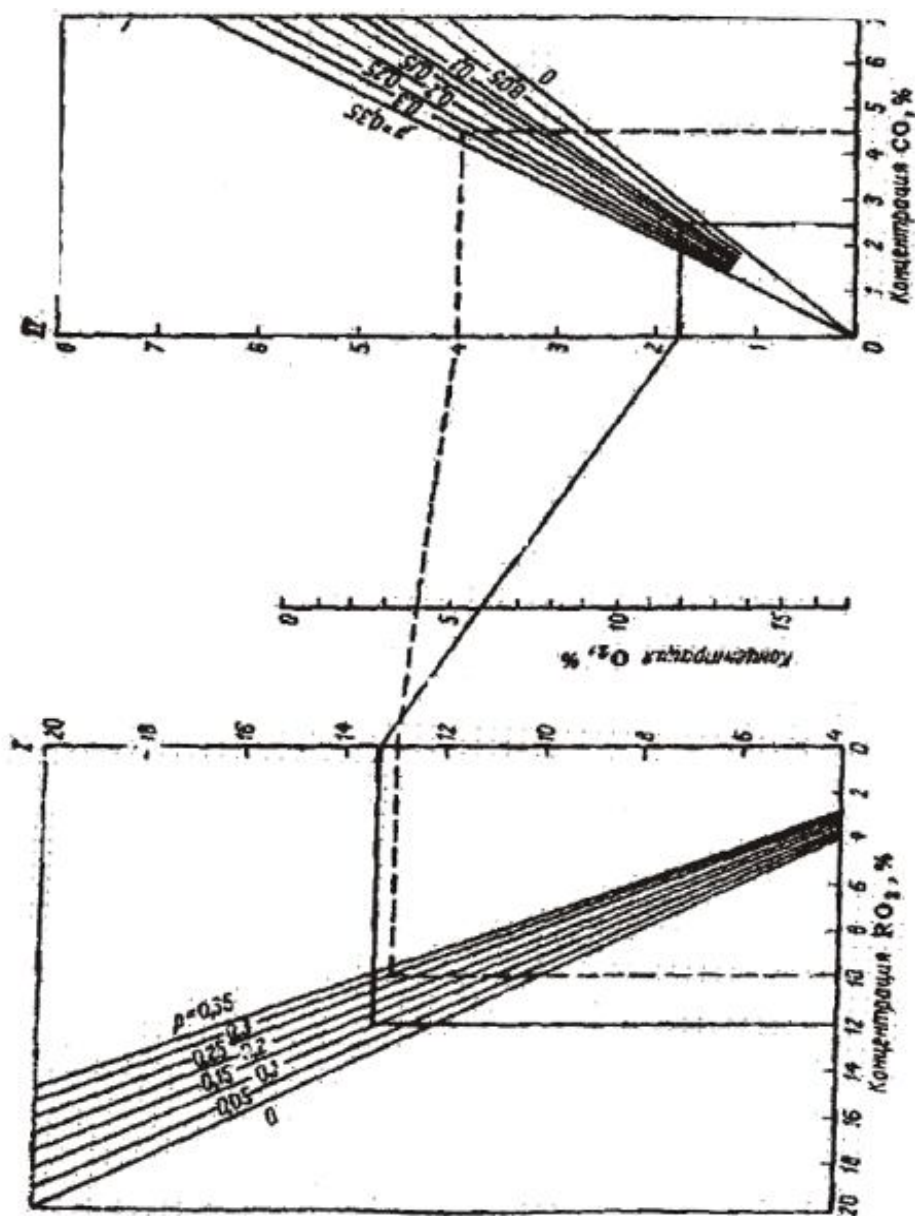
**7-ilova. Yonilg'ining to'liq yonimasligi sababli  
kimyoviy q<sub>3</sub> va mexanik q<sub>4</sub> issiqliklarni yo'qotish**

| O'choq turi                                                                | Yoqilg'i                                                   | a <sub>T</sub> | q <sub>3</sub> , % | q <sub>4</sub> , % |
|----------------------------------------------------------------------------|------------------------------------------------------------|----------------|--------------------|--------------------|
| Zanjirli panjara                                                           | Donesk antrasit                                            | 1,5-1,6        | 0,5                | 13,5-10            |
| Zanjirli shaxta                                                            | Tuproqlit orf                                              | 1,3            | 1,0                | 2,0                |
| Pnevmexanikli<br>tashlovchi va to'g'ri<br>yo'nalishli<br>zanjirli panjara  | Kuzntsk tipidagi ko'mir                                    | 1,3-1,4        | 0,5-1              | 5,5-3              |
|                                                                            | Donesk tipidagi ko'mir                                     | 1,3-1,4        | 0,5-1              | 6-3,5              |
|                                                                            | kulrang ko'mir                                             | 1,3-1,4        | 0,5-1              | 5,5-4              |
| Zanjirli qaytaruvchi<br>panjara                                            | Ko'mir                                                     | 1,3-1,4        | 0,5-1              | 5,5-3              |
|                                                                            | Kulrang ko'mir                                             | 1,3-1,4        | 0,5-1              | 5,5-4,5            |
| Xuddi shu va qat'iy<br>panjara                                             | Dones antrasit Moskva                                      | 1,6-1,7        | 0,5-1              | 13,5-10            |
|                                                                            | yaqinidagi kulrang<br>ko'mirturi                           | 1,4-1,5        | 0,5-1              | 9-7,5              |
|                                                                            | Borodino Kuznesk                                           | 1,4-1,5        | 0,5-1              | 6-3                |
|                                                                            | tipidagi ko'mir                                            | 1,4-1,5        | 0,5-1              | 5,5-3              |
| Egiluvchan panjarali<br>shaxta                                             | Yog'och, ezilgan<br>chiqindilar, qirindi, torf<br>tuproq'i | 1,4            | 2                  | 2                  |
| Tezyonuvchan                                                               | Yog'och, qirindi                                           | 1,3            | 1                  | 4-2                |
| Soatiga 2 tonnadan<br>ortiq bug'chiqish<br>quvvatiga ega qozon<br>pechlari | Estoniyaslanesi                                            | 1,4            | 3                  | 3                  |
| Qattiqshlag'ni<br>ushlovchi kamerali                                       | Ko'mir                                                     | 1,2            | 0,5                | 5-3                |
|                                                                            | Kulrang ko'mir                                             | 1,2            | 0,5                | 3-1,5              |
|                                                                            | Frezerli torf                                              | 1,2            | 0,5                | 3-1,5              |
| kamerali                                                                   | Mazut                                                      | 1,1            | 0,5                | 0,0                |
|                                                                            | Gaz (tabiiy)                                               | 1,1            | 0,5                | 0,0                |
|                                                                            | Domengazi                                                  | 1,1            | 1,5                | 0,0                |
| Ruxsat etilgan<br>panjara va qo'lda<br>yonilg'i quyish<br>tizimlari        | kulrang ko'mir                                             | 1,6            | 2,0                | 8,0                |
|                                                                            | Tosh ko'mir                                                | 1,5            | 2,0                | 7,0                |
|                                                                            | Antrasitlar AS va AM                                       | 1,7            | 1,0                | 10,0               |

Eslatma. 1<sub>at</sub> – ortiqchahavokoeffitsiyenti; bug'chiqishi D > 10 t / s bo'lgan  
bug'generatorlari uchun past qiymatlar.

2.  $Q_4$  qiymatlarining katta miqdori yoqilg'ini kamaytirish uchun vositalar yo'q bo'lganda qabul qilinadi; Kichkina miqdori esa ilshlab chiqarish quvvati 25-35 t/s ga teng bo'lgan qozonlar uchun ham xarakterlidir.

**8- Ilova. Turli xildagi yoqilg'lar uchun toliq yonmaganda tutunli gazlar  $RO_2$  ( $CO_2 + SO_2$ ) konsentrasiyasining  $O_2$  va  $CO$  konsentrasiyasigabog'liqlik diagrammasi**



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