Calculation task № 2.

Determine the mass and volume of bentonitic clay and the volume of waste water which are needed for preparing 1 m^3 of drilling mud. Moisture content of bentonitic clay is 7.5 %, the density of waste water is 1060 kg/m^3, the density of drilling mud is 1250 kg/m^3. Instruction: the magnitude of the density of bentonitic clay should be taken within the range 2200 − 2700 kg/m^3.

Data:

$n_{b.c.} = 0.075$

$\rho_{b.c.} = 2450\ kg/m^3$

$\rho_{w.w.} = 1060\ kg/m^3$

$\rho_{d.m.} = 1250\ kg/m^3$

Determine : $G_{b.c.}$ - ? $V_{b.c.}$ - ? $V_{w.w.}$ - ?

Solution

The mass of bentonitic clay which is needed for preparing 1 m^3 of drilling mud is determined by formula:

$$G_{b.c.} = \frac{\rho_{b.c.} \cdot (\rho_{d.m.} - \rho_{w.w.})}{\rho_{b.c.} - \rho_{w.w.} \cdot (1 - n_{b.c.} + 10^{-3} \cdot n_{b.c.} \cdot \rho_{b.c.})} \qquad (1)$$

where $G_{b.c.}$ is the mass of bentonitic clay which is needed for preparing 1 m^3 of drilling mud, kg/m^3; $\rho_{b.c.}$ is the density of bentonitic clay, kg/m^3; $n_{b.c.}$ is moisture content of bentonitic clay, fractions; $\rho_{d.m.}$ is the density of drilling mud, kg/m^3; $\rho_{w.w.}$ is the density of waste water, kg/m^3.

According to the instruction for the solution of problem take the magnitude of the density of bentonitic clay: $\rho_{b.c.} = 2450\ kg/m^3$.

So $G_{b.c.} = \frac{2450 \cdot (1250 - 1060)}{2450 - 1060 \cdot (1 - 0.075 + 10^{-3} \cdot 0.075 \cdot 2450)} = 365.2$ kg/m^3.

2. The volume of bentonitic clay which is needed for preparing 1 m^3 of drilling mud (m^3/m^3):

$$V_{b.c.} = \frac{G_{b.c.}}{\rho_{b.c.}} \qquad (2)$$

$$V_{b.c.} = \frac{365.2}{2450} = 0.149 \text{ m}^3/\text{m}^3.$$

3. The volume of waste water which is needed for preparing 1 m^3 of drilling mud:

$$V_{w.w} = 1 - V_{b.c.} . \qquad (3)$$

$$V_{w.w} = 1 - V_{b.c.} = 1 - 0.149 = 0.851 \text{ m}^3/\text{m}^3.$$

Answer : $G_{b.c.}$ = 365.2 kg/m^3; $V_{b.c.}$ = 0.149 m^3/m^3; $V_{w.w.}$ = 0.851 m^3/m^3.