

ES200 Assignment

19D170027

Sanidhya Anand

$$\begin{aligned} H_u (\text{kJ/kg}) &= 53.5 (F + 3.6 CP) + 372 PLR \\ &= 53.5 (0.15 + 3.6 \times 0.55) + 372 (0.10) \\ &= \frac{15115.5}{151.155} \text{ kJ/kg} = E_w \end{aligned}$$

Total moisture content: Let us assume 1kg waste

$$\begin{aligned} \therefore \text{Food wastes} &= 0.15 \text{ kg} \quad \therefore (\text{Moisture})_{\text{Food}} = 70\% \text{ of } 0.15 \text{ kg} \\ &= 0.105 \text{ kg} \end{aligned}$$

$$\begin{aligned} \text{Paper wastes} &= 0.45 \text{ kg} \quad \therefore (\text{Moisture})_{\text{Paper}} = 6\% \text{ of } 0.45 \\ &= 0.027 \text{ kg} \end{aligned}$$

$$\begin{aligned} \text{Cardboard wastes} &= 0.10 \text{ kg} \quad \therefore (\text{Moisture})_{\text{Cardboard}} = 5\% \text{ of } 0.10 \\ &= 0.005 \text{ kg} \end{aligned}$$

$$\begin{aligned} \text{Plastic} &= 0.10 \text{ kg} \quad \therefore (\text{Moisture})_{\text{Plastics}} = 2\% \text{ of } 0.1 \\ &= 0.002 \text{ kg} \end{aligned}$$

$$\begin{aligned} \text{Garden trimmings} &= 0.10 \text{ kg} \quad \therefore (\text{Moisture})_{\text{GT}} = 60\% \text{ of } 0.1 \\ &= 0.06 \text{ kg} \end{aligned}$$

$$\begin{aligned} \text{Wood} &= 0.05 \text{ kg} \quad \therefore (\text{Moisture})_{\text{Wood}} = 20\% \text{ of } 0.05 \\ &= 0.01 \text{ kg} \end{aligned}$$

$$\begin{aligned} \text{Tin cans} &= 0.05 \text{ kg} \quad \therefore (\text{Moisture})_{\text{TC}} = 3\% \text{ of } 0.05 \\ &= 0.0015 \text{ kg} \end{aligned}$$

$$\therefore \text{Total moisture content} = 0.105 + 0.027 + 0.005 + 0.002 + 0.006 + 0.01 + 0.0015$$

$$= 0.2105 \text{ kg (in 1 kg MS)}_{(a)}$$

$$\therefore \text{Moisture content} = 21.05 \%$$

$$\therefore E_w (\text{dry basis}) = 1511.545 \times \frac{100}{100 - 21.05}$$

$$= \frac{191415.66}{191.4566} \text{ kJ/kg}$$

E_w (ash free dry basis):

$$\% \text{ ash} = 6\% \text{ of MS}$$

$$\therefore E_w (\text{ash free dry basis}) = \frac{1511.545}{151.155} \times \frac{100}{100 - 6 - 21.05}$$

$$= \frac{20720.36}{207.2036} \text{ kJ/kg}$$

ES200 Assignment
Sanidhya Anand
19D170027

Lec 3

1] $t_1 = 20 \text{ min}$
 $t_2 = 25 \text{ min}$
 $d_1 = 8 \text{ min}$
 $H = 8 \text{ hrs}$
 $W = 0.15$

$$t_{\text{net}} = m + u + d_2 + s + h$$

$$\begin{aligned} &= \frac{60 \text{ km}}{90 \text{ km/hr}} \\ &= \frac{2}{3} \text{ hr/trip} \end{aligned}$$

$$m + u = 0.4 \text{ hr/trip}$$

$$s = 0.133 \text{ hr/trip}$$

$$N_t = \frac{(1 - W)H - t_1 - t_2}{t_{\text{net}}}$$

$$= \frac{0.85 \times 8 - \frac{45}{60}}{0.4 + 0.133 + \frac{8}{60} + 0.67}$$

$$= 4.53$$

\therefore 4 trips are possible.

$$2] (a) A_2 = A_0 - A_1$$

$$= \underline{9 \text{ tons/hour}}$$

$$B_2 = \underline{5 \text{ tons/hour}} \cdot (B_0 - B_1)$$

$$(b) A_3 = A_2 - A_4$$

$$= 9 - 1 = \underline{8 \text{ tons/hour}}$$

$$B_3 = B_2 - B_4$$

$$= 5 - 3$$

$$= \underline{2 \text{ tons/hour}}$$

$$(c) \text{ Purity of RDF} = \frac{A_3}{A_3 + B_3}$$

$$= \frac{8}{2 + 8} = 80\% \text{ pure}$$

$$\text{Recovery of A} = \frac{A_3}{A_0} = \frac{8}{10} = 80\%$$

ES200 Assignment rec4

Sanidhya Anand

19D170027.

→ At break-even point (t)

Hauling cost using a transfer st = cost of direct hauling to destination point from collection system

$$K_d = K_t$$

$$\therefore K_d = K_{ft} + K_{ht}(t)$$

oper. and amort. costs

$$\therefore K_{hd}(t) = K_{ft} + K_{ht}(t)$$

Direct Hauling cost rate / unit mass

Transfer hauling cost rate / unit mass

$$K_{hd} = \frac{\$20/\text{hr}}{325 \text{ kg} / 18 \text{ m}^3} = 1.11 / 325$$

$$K_{hd} = \frac{\$20/\text{hr}}{325 \times 18 \text{ kg}} = 0.0034 \text{ \$ / hr - kg}$$

$$K_{ht} = \frac{\$25/\text{hr}}{150 \times 120} = 0.00139 \text{ \$ / hr - kg}$$

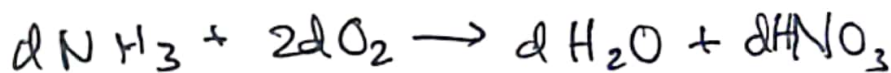
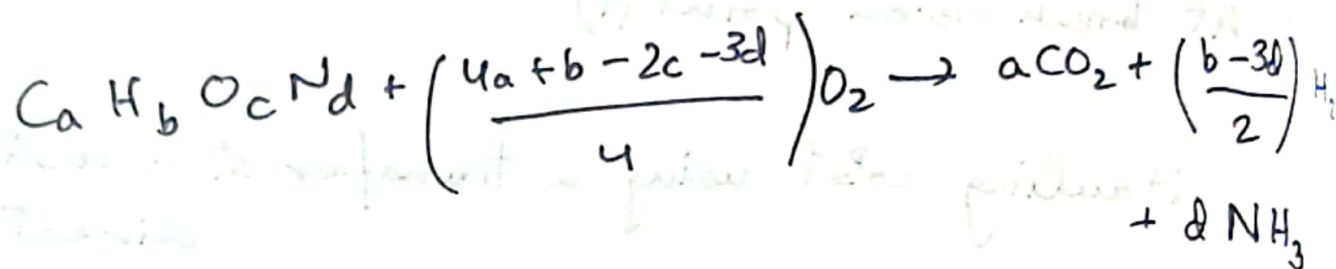
(0.40 + 0.05)

$$\therefore t = \frac{K_{ft}}{K_{hd} - K_{ht}} = \frac{0.40 \times 18}{150 \times 18 - 0.002} = 1.495 \text{ hrs}$$

ES 200

Assignment

19D1T0027 (Sanidhya Dhand)



$$\therefore a = 50$$

$$b = 100$$

$$c = 40$$

$$d = 1$$

for one mole of $C_{50}H_{100}O_{40}N$

$$\therefore \text{Amount of } O_2 \text{ req.} = \left(\frac{4a + b - 2c - 3d}{4} \right) \text{ moles} + 2d$$

$$= \frac{200 + 100 - 80 - 3}{4} + 2$$

$$= \frac{217}{4} + 2 = 56.25 \text{ moles}$$

$$\text{MW of organic comp} = 50 \times 12 + 100 + 40 \times 16 + 14$$

$$= 1354 \text{ g}$$

$$\therefore \text{No. of moles of org. comp} = \frac{1000 \times 1000}{1354}$$

$$\therefore \text{No. of moles of } O_2 \text{ reqd} = \frac{56.25 \times 1000 \times 1000}{1354}$$

$$= 4.154 \times 10^4 \text{ moles}$$

$$\therefore \text{Wt of } O_2 \text{ reqd} = 4.154 \times 10^4 \times 32$$

$$= 1329374.37 \text{ g}$$

$$= 1.329 \text{ tonnes}$$

$$\therefore 21\% \text{ of air reqd} = 1.329 \text{ tonnes}$$

$$\Rightarrow \text{Wt of air reqd} = \frac{1.329}{21} \times 100$$

$$= 6.33 \text{ tonnes}$$

→ C/N ratio reflects on the relative amount of Carbon and nitrogen in soil or plants. It is the relationship between organic matter and nitrogen content.

Since carbon and nitrogen are the two of the most important minerals for plants, regulating their composition is important.

C:N ratio can be used to control decomposition rate in soil, Nitrogen release, decay of organic matter (C), etc.