ES200 Assignment

19D170027

Sanidhya Anand

$$H_u(kJ/kg) = 53.5(F + 3.6CP) + 372PLR$$

$$= 53.5(0.15 + 3.6 \times 0.55) + 372(0.10)$$

$$= \cancel{151.155}\ kJ/kg = E_w$$

151.155

Total moisture content: Let us assume 1kg waste

∴ Food wastes = 0.15 kg ∴ $(\text{Moisture})_{\text{Food}}$ = 70% of 0.15 kg
= 0.105 kg

Paper wastes = 0.45 kg ∴ $(\text{Moisture})_{\text{Paper}}$ = 6% of 0.45
= 0.027 kg

Cardboard wastes = 0.10 kg ∴ $(\text{Moisture})_{\text{cardboard}}$ = 5% of 0.10
= ~~0.05~~
0.005 kg

Plastic = 0.10 kg ∴ $(\text{Moisture})_{\text{Plastics}}$ = 2% of 0.1
= 0.002 kg

Garden trimmings = 0.10 kg
∴ $(\text{Moisture})_{GT}$ = 60% of 0.1
= 0.06 kg

Wood = 0.05 kg ∴ $(\text{Moisture})_{\text{wood}}$ = 20% of 0.05
= 0.01 kg

Tin cans = 0.05 kg ∴ $(\text{Moisture})_{TC}$ = 3% of 0.05
= 0.0015 kg

$\therefore$ Total moisture content $= 0.105 + 0.027 + 0.005 + 0.002 + 0.06 + 0.01 + 0.0015$

$= 0.2105$ kg (in 1 kg MSW)

$\therefore$ Moisture content $= 21.05\%$

$\therefore E_w(\text{dry basis}) = 15145.5 \times \frac{100}{100-21.05}$

$= \cancel{19145.66}$ kJ/kg

191.4566

E_w (ash free dry basis):

% ash $= 6\%$

$\therefore E_w(\text{ash free dry basis}) = \cancel{15145.5}\ 151.155 \times \frac{100}{100-6-21.05}$

$= \cancel{20720.36}$ kJ/kg

207.2036

ES200 Assignment <u>Lec 3</u>

Sanidhya Anand

19D170027

1] $t_1 = 20$ min

$t_2 = 25$ min

$d_l = 8$ min

$H = 8$ hrs

$W = 0.15$

$t_{net} = m + u + d_l + s + h$

$h = \frac{60 km}{90 km/h} = \frac{2}{3}$ hr/trip

$m + u = 0.4$ hr/trip

$s = 0.133$ hr/trip

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

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

$= 4.533$

$\therefore$ 4 trips are possible.

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

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

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

(b) $A_3 = A_2 - A_4$

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

$B_3 = B_2 - B_4$

$= 5 - 3$

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

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

$= \dfrac{8}{2+8} = 80\%$ pure

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

ES200 Assignment lec4

Sanidhya Anand

19D170027.

→ At break-even point (t)

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

$$K_d = K_t$$

$\therefore$ ~~$K_d = K_{ft}$~~

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

~~$k_{hd} = \$\, 20/hr / 18\,m^3 / 325\,kg/m^3 = 1.11/325$~~

$$k_{hd} = \frac{\$\,20/hr}{325 \times 18\ kg} = \cancel{0.0342}\ 0.0034\ \$/hr\text{-}kg$$

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

(0.40 + 0.05)

$$\therefore t = \frac{K_{ft}}{k_{hd} - k_{ht}} = \frac{\dfrac{0.45 \times 18}{150\cancel{385} \times 18}}{0.002} \cancel{+ 0.05} = \boxed{1.495\ hrs}$$

ES 200

Assignment

19DIT0027 (Sanidhya Anand)

$$C_aH_bO_cN_d + \left(\frac{4a+b-2c-3d}{4}\right)O_2 \rightarrow aCO_2 + \left(\frac{b-3d}{2}\right)H_2O + dNH_3$$

$$dNH_3 + 2dO_2 \longrightarrow dH_2O + dHNO_3$$

$\therefore$ $a = 50$

$b = 100$

$c = 40$

$d = 1$

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

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

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

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

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

$= 1354$ g

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

Scanned with CamScanner

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

$\frac{3d}{4} + 2d$

$5d$

$= 4.154 \times 10^4$ moles

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

$= 1329394.39$ g

$= 1.329$ tonnes

$\therefore$ 21% of air reqd $= 1.329$ tonnes

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

$= 6.33$ 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.

Scanned with CamScanner