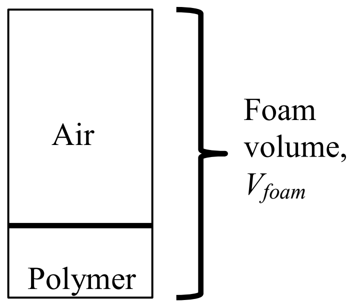
Electronic Supplementary Material (ESI) for Green Chemistry

Supplementary information S1

$$P = \frac{V_{air}}{V_{foam}} = \frac{\dfrac{m_{air}}{\rho_{air}}}{\dfrac{m_{air} + m_{polymer}}{\rho_{foam}}} = \frac{m_{air}}{m_{air} + m_{polymer}}\left[\frac{\rho_{foam}}{\rho_{air}}\right]$$

$$\rho_{air} P m_{air} + \rho_{air} P m_{polymer} = \rho_{foam} m_{air}$$

$$\Rightarrow m_{air} = \frac{\rho_{air} P m_{polymer}}{\rho_{foam} - \rho_{air} P}$$



The volume occupied by air is previously occupied by water (assume ideal):

$$V_{air} = V_{water}$$

$$\Rightarrow \frac{m_{air}}{\rho_{air}} = \frac{m_{water}}{\rho_{water}}$$

$$\Rightarrow m_{water} = \left(\frac{\rho_{water}}{\rho_{air}}\right) m_{air}$$

$$\Rightarrow m_{water} = \left(\frac{\rho_{water}}{\rho_{air}}\right) \times \left(\frac{\rho_{air} P m_{polymer}}{\rho_{foam} - \rho_{air} P}\right) = \frac{\rho_{water} P m_{polymer}}{\rho_{foam} - \rho_{air} P}$$

The energy required to heat the mass of water up is:

$$Q = m_{water} \int C_{p,water}\, dT$$

Assuming constant heat capacity of water

$$Q = m_{water} C_{p,water} \Delta T$$

$$\Rightarrow Q = \frac{\rho_{water} P m_{polymer}}{\rho_{foam} - \rho_{air} P} \times C_{p,water} \Delta T$$

$$\therefore \frac{Q}{m_{polymer}} = \frac{\rho_{water} P}{\rho_{foam} - \rho_{air} P} \times C_{p,water} \Delta T$$

→ assume: 80% porosity and foam density of 200 kg m^{-3}, neglecting heat and mass transfer effects

$$\frac{Q}{m_{polymer}} = \frac{1000 \times 0.8}{200 - 1.3 \times 0.8} \times 4.2 \times (80 - 25)$$

$$\therefore \frac{Q}{m_{polymer}} = 929\ kJ\ kg^{-1}$$

<u>Abbreviation</u>

V_{air} = volume of air, V_{foam} = volume of foam, V_{water} = volume of water,

ρ_{foam} = foam density, ρ_{air} = air density, ρ_{water} = water density,

m_{air} = mass of air in the foam, $m_{polymer}$ = mass of polymer in the foam,

m_{water} = mass of polymer in the foam, Q = energy requirement

P = porosity, $C_{p,water}$ = heat capacity of water, dT = temperature difference