$$V_S\omega^2 r\rho_p - 6\pi\mu r_p v_p - V_S\rho_l\omega^2 r = 0$$

$$\omega^2 r(\rho_p - \rho_l) - \frac{6\pi\mu r_p v_p}{V_S} = 0$$

$$\omega^2 r(\rho_p - \rho_l) = \frac{6\pi\mu r_p v_p}{\frac{4}{3}\pi r_p^3}$$

$$v_p = \frac{4r_p^2\omega^2 r(\rho_p - \rho_l)}{18\mu}$$

Appendix B: Calculation of velocity of reinforcement particle at 220 rpm at a mould radial distance of 29mm

$$v_p = \frac{4r_p^2\omega^2 r(\rho_p - \rho_l)}{18\mu}$$

$$v_{p(sand)} = \frac{4\times(0.4\times10^{-3})^2\times23.038^2\times(29\times10^{-3})^2\times(1600-737)}{18\times2.66\times10^{-3}} = 0.177 m/\sec$$

Similarly

$$v_{p(wood)} = \frac{4\times(0.1\times10^{-3})^2\times23.038^2\times(29\times10^{-3})^2\times(892-737)}{18\times2.66\times10^{-3}} = 0.00199 m/\sec$$

where,

$r_p = 0.4\times10^{-3} m$ for sand particles

$r_p = 0.1\times10^{-3} m$ for wood particles

$\omega = 23.03 rad/\sec$

$r = 0.029 m$

$\rho_{p(wood)} = 892 kg/m^3$

$\rho_{p(sand)} = 1600 kg/m^3$

$\rho_l = 737 kg/m^3$ at 130 °C

$\mu = 2.66\times10^{-3} Pas$

Appendix C: Estimation of time taken by the particle to reach the mould wall

$$v_p = \frac{4r_p^2\omega^2 r(\rho_p - \rho_l)}{18\mu}$$

$$\frac{dr}{dt} = \frac{4r_p^2\omega^2 r(\rho_p - \rho_l)}{18\mu}$$

$$\frac{r - r_0}{t - t_0} = \frac{4r_p^2\omega^2 r(\rho_p - \rho_l)}{18\mu}$$

At t=0 and $r_0=0.1\times10^{-3}$ m

$$t = \frac{(r - 0.1\times10^{-3})\times18\mu}{4r_p^2\omega^2 r(\rho_p - \rho_l)}$$

For sand particles

$$t_{sand} = \frac{(0.029 - 0.1\times10^{-3})\times18\times2.66\times10^{-3}}{4\times(0.4\times10^{-3})^2\times23.038^2\times(29\times10^{-3})^2\times(1600-737)} = 0.1629\text{s}$$

For wood particles

$$t_{sand} = \frac{(0.029 - 0.1\times10^{-3})\times18\times2.66\times10^{-3}}{4\times(0.1\times10^{-3})^2\times23.038^2\times(29\times10^{-3})^2\times(892-737)} = 14.51\text{s}$$

Appendix D: Temperature of the melt at the particular time taken by particles to reach the mould wall

$$T(t) = T_a + (T_0 - T_a)e^{-kt}$$

For sand particles

$$T(0.1629) = 20 + 110e^{-4.054\times10^{-5}\times0.1629} = 129.999^\circ C$$

For wood particles

$$T(014.51) = 20 + 110e^{-4.054\times10^{-5}\times14.51} = 129.935^\circ C$$

Appendix E: Viscosity of the melt at a particular time taken by the particles to reach the mould wall

$$\mu = A\exp\left(\frac{Q}{R.T}\right)$$

For sand particles

$$\mu(0.163) = 1.0973\times10^{-5}\exp\left(\frac{17519.36}{8.31441\times402.99}\right) = 2.04698\times10^{-3} Pas$$

For wood particles

$$\mu(14.51) = 1.0973\times10^{-5}\exp\left(\frac{17519.36}{8.31441\times402.935}\right) = 2.04844\times10^{-3} Pas$$

Appendix F: Expression to find out the position of particle at a particular time period

$$v_p = \frac{4r_p^2\omega^2 r(\rho_p - \rho_l)}{18\mu}$$

$$\frac{dr}{dt} = \frac{4r_p^2\omega^2 r(\rho_p - \rho_l)}{18\mu}$$

$$dr = \frac{4r_p^2\omega^2 r(\rho_p - \rho_l)}{18\mu}dt$$

$$\int_{r0}^{r(t)}\frac{1}{r}dr = \int_0^t\frac{4r_p^2\omega^2(\rho_p - \rho_l)}{18\mu}tdt$$

$$\ln(r(t)) - \ln(r(0)) = \frac{4r_p^2\omega^2 t(\rho_p - \rho_l)}{18\mu}$$

$$e^{\ln(r(t))} = e^{\left[\ln(r(0)) + \frac{4r_p^2\omega^2 t(\rho_p - \rho_l)}{18\mu}\right]}$$

$$r(t) = r_0\exp\left[\frac{4r_p^2\omega^2 r(\rho_p - \rho_l)}{18\mu}\right]$$