1. The correct definition of φ which is the osmotically active fraction of intracellular water in the initial state is: $\varphi = \frac{v_{w_0}}{v_w}$. This is consistent with Eq. (6) being the solution of Eq. (5).
2. Eq. (7) should read: $\frac{v}{v_0} = \varphi / \left[1 + \frac{\Delta C_e}{C_{i_0}} + \frac{\Delta P_i}{RTC_{i_0}} \right] + 1 - \varphi$.
3. Eq. (9) should read: $\frac{\Delta v}{v_0} = -\frac{1}{\lambda}\left[1 - e^{-\kappa\lambda t}\right]$. Using Eq. (8), linearising Eq. (7) yields the limiting value of Eq. (9).
4. See also http://www.cis.jhu.edu/~tilak/addendum.pdf for detailed derivation of Eqs. (1), (6), (7), (9) and (10).