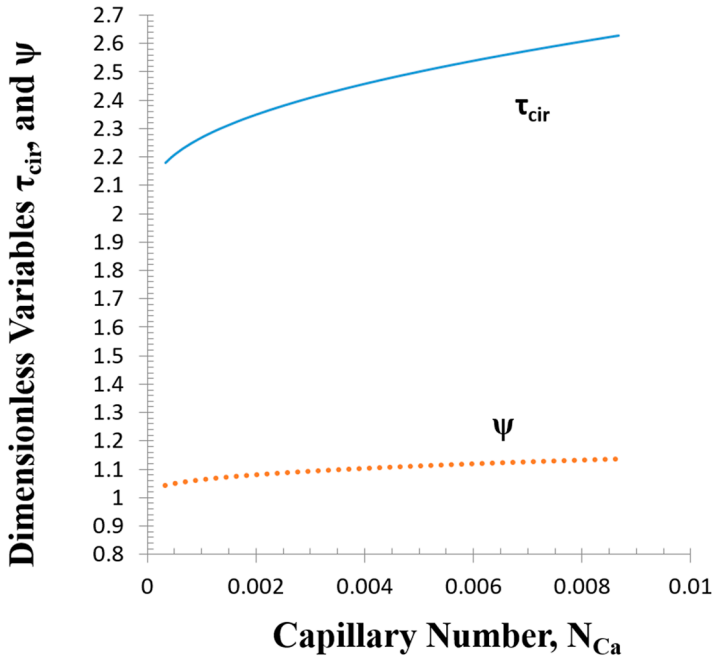

Figure 5.9 Dimensionless recirculation time τ_{cir} and dimensionless bubble velocity $\psi = U_b/U_m$ *versus* Capillary number: Upper limit of Capillary number corresponds to a total superficial velocity U_m yielding a Reynolds number $Re_L = 2100$.

5.3.2.2 Absolute Recirculation Times

Now that dimensionless liquid slug recirculation times and bubble velocities are available for a set of system conditions and properties, only slug lengths are needed to compute the reference time l_s/U_b and then the absolute recirculation time from $\tau_{cir}l_s/U_b$. Liu *et al.*[30] proposed a dimensional correlation for slug length *versus* gas- and liquid-phase Reynolds numbers, and Su *et al.*[31] reformulated this correlation to a dimensionless form as

$$\frac{l_s}{D} = 0.3694\left(\mathrm{Re}_L^{'}\right)^{0.585}\mathrm{Re}_G^{\ -0.483}. \tag{5.14}$$

where Re'_L and Re_G are Reynolds numbers of the gas and liquid phases based on tube diameter and the respective superficial velocities:

$$\mathrm{Re}_L^{'} = \frac{U_{LS}D}{\nu_L},\ \mathrm{Re}_G = \frac{U_{GS}D}{\nu_G}. \tag{5.15}$$

For superficial liquid velocities corresponding to slug-flow crystallizers seeded by upstream coaxial and radial mixers by Jiang *et al.*,[2] the absolute slug length is plotted *versus* superficial gas velocity in Figure 5.10. For the actual values of the superficial gas velocity U_{GS} used in the two experiments, the measured and calculated liquid slug lengths are given in Table 5.1. Eqn