Assuming a concentration-independent flux with an Arrhenius dependence on temperature, and using temperature- and composition-averaged physical properties, an exact analytical expression is derived for the average flux in an adiabatic, single-pass pervaporation module. The envelope of industrially feasible operating conditions for alcohol dehydration systems is completed. The range of feasible activation energies of permeation is established for IPA-water and ethanol–water systems. Within this range a simple approximation to the exact analytical expression is derived. A parameter $J_r/J_{reheat}$ is proposed where $J_{reheat}$ is the flux at the retentate composition and feed temperature. It can be used to determine the optimum membrane area within an adiabatic module for systems with concentration-dependent flux and concentration-independent flux. Results indicate that permeate-to-feed ratios above the current industry norm of 5% are economically feasible in some cases. The impact of a recycle on the average flux, retentate composition, retentate temperature and permeate-to-feed ratio is explored. Equations are developed relating flowrates and compositions to the recycle ratio. A module is modelled for concentration-independent flux, concentration-dependent flux and desalination. The results indicate that increases in average flux can be achieved through use of a recycle for some industrial applications including desalination.