Figure 1. Flowsheet of a single effect absorption refrigeration cycle.

Figure 2. $\sigma$-Profile (A) and $\sigma$-potential (B) of the refrigerants used in this study.
Figure 3. $\sigma$-Profile of cations (A) and anions (B), $\sigma$-potential of cations (C) and anions (D) of a representative group of ILs.
Figure 4. Screening of Henry’s law constants of water (A), ammonia (B), R-134a (C) and n-pentane (D) refrigerants at 298K in 900 ILs calculated by COSMO-RS using [C+A] molecular model.
Figure 5. Excess enthalpy ($h^E$) and Gibbs free energy ($g^E$) of selected refrigerant-IL mixtures in terms of intermolecular interaction contributions.

Figure 6. Comparison of experimental VLE data to calculated values using COSMO-based/Aspen HYSYS methodology for (A) H$_2$O-IL and (B) methanol-IL pairs.
Figure 7. Comparison of COP and \( f \) ratio calculated using COSMO-based/Aspen HYSYS methodology with the data calculated by other authors. Data collected in Table S4 of Supplementary Material.

Figure 8. COP calculated for each refrigerant/IL pair versus the saturation composition (mass fraction) in the absorber, calculated for the base case operating conditions of absorption refrigeration cycle. Filled symbols correspond to proposed refrigerant-IL pairs in this work.
Figure 9. COP calculated for each refrigerant/IL pair versus the mass cooling capacity (MCC) calculated for the case base operating conditions of absorption refrigeration cycle. Filled symbols correspond to selected refrigerant-IL pairs in this work.
Figure 10. Refrigerant+IL mass flow in the pump feed vs \( f \) ratio for each refrigerant/IL pair calculated for the case base operating conditions of absorption refrigeration cycle. Filled symbols correspond to selected refrigerant-IL pairs in this work.
Figure 11. Refrigerant+IL mass flow in the pump feed vs $f$ ratio for each refrigerant/IL pair compared to the MCC of the refrigerant, calculated for the case base operating conditions of absorption refrigeration cycle. Filled symbols correspond to selected refrigerant-IL pairs in this work.
Figure 12. Results of the main efficiency parameters of absorption refrigeration cycle for each pair refrigerant-IL selected among highest absorption capacity. Traditional pairs as H2O/LiBr [16] and NH3/H2O [22] are included to compare.
Figure 13. Calculated COP vs generator temperature for the selected refrigerant-IL systems.

Figure 14. $f$ ratio (A) and required total mass flow rate in the absorber (B) vs generator temperature.
Figure 15. Calculated COP (A) and absorber pressure vs evaporator temperature (B).

Figure 16. Calculated $f$ ratio (A) and total mass flow (B) in the absorber vs evaporator temperature.