Supplementary materials

Algorithm of Modelling of Drinking Water Recarbonization

1. Input data

- $Q(H_2O)$, $Q(CO_2)$, T, S_{FBRR}, V_{FBRR}, V_{VT}, d_p, μ, ρ_s, ρ_l

2. Hydraulic measurements

- $\Delta P = f(w)$
- $H = f(w)$
- minimum fluidization velocity w_P (Figure 1)

3. Saturation kinetics of water with Ca^{2+} and Mg^{2+}

- Ca^{2+}, Mg^{2+}, pH, κ, $T = f(t)$
- Parameter values of recarbonization equation (Eq. 11)
- Mass balances – calculation of:
  - Rate of HCD consumption (kg/d).
  - Specific production of calcium / magnesium (g/kg).
  - Specific consumption of CO_2 (g/kg).

4. Continuous measurements - changes of operating parameters - Q (CO_2), Q (H_2O)

- Ca^{2+}, Mg^{2+}, pH, κ, $T = f(t)$
- Multiple regression analyses:
  - Values of regression coefficients (Eq. 12)

5. Optimization of recarbonation parameters

- Optimal values of independent variables $Q(H_2O)$ and $Q(CO_2)$ for minimal and maximal values of dependent variables:
  - Ca^{2+}
  - Mg^{2+}
  - $Ca^{2+} + Mg^{2+}$
  - Ca^{2+}/Mg^{2+}

6. Scaling up of recarbonization system

- Input data for scaling up:
  - $Q(H_2O)$, $Q(CO_2)$, T, d_p, μ, ρ_s, ρ_l, $(Ca^{2+}, Mg^{2+})_{inflow}$, $(Ca^{2+}, Mg^{2+})_{outflow}$
- Desing of:
  - Flow rate of water concentrate of $(Ca^{2+}, Mg^{2+})_{outflow}$
  - Volume of water tank V_{WT} (m^3)
  - Mass rate of HCD (kg/d)
  - Dimensions of FBRR - V_{FBRR} (m^3), S_{FBRR} (m^2), HF_{BRR} (m)
  - Mass rate of CO_2 (kg/d)

Figure S1. Algorithm of Modelling of Drinking Water Recarbonization.

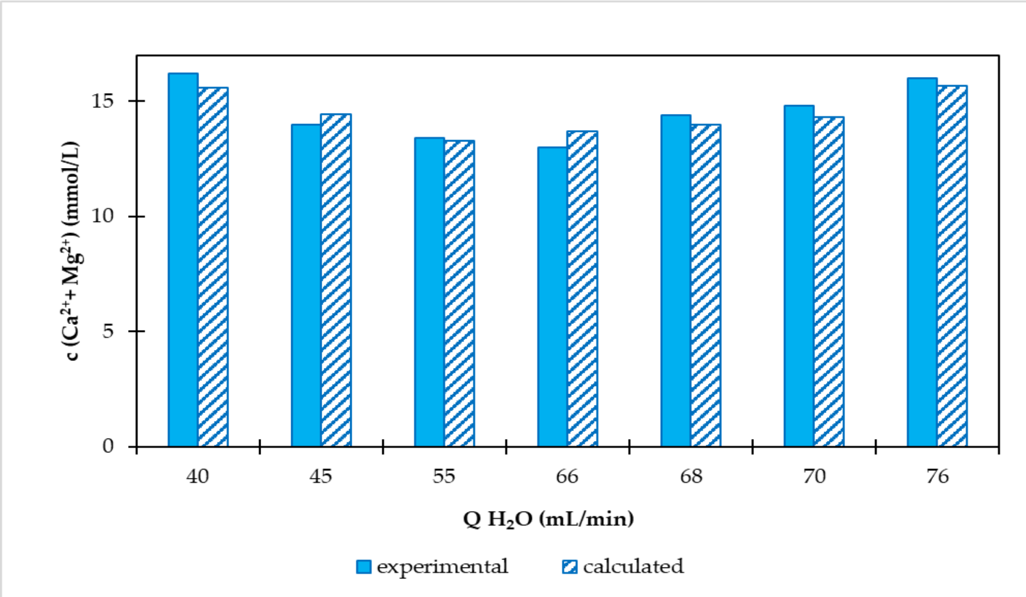

Figure S2. Calculated and measured concentrations of Ca^{2+}+Mg^{2+} at different flows of treated water and CO_2 flow at the level of 0.5 L/min during operation of the laboratory FBRR.

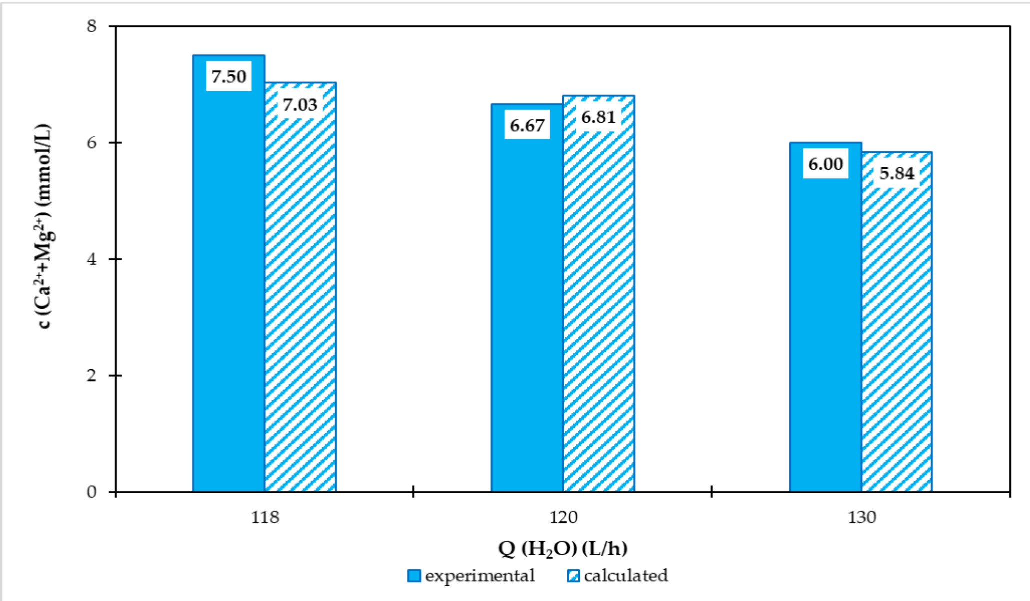

Figure S3. The total concentration of the sum of Ca^{2+} and Mg^{2+} ions in drinking water at Q(CO_2) = 0.5 L/min.

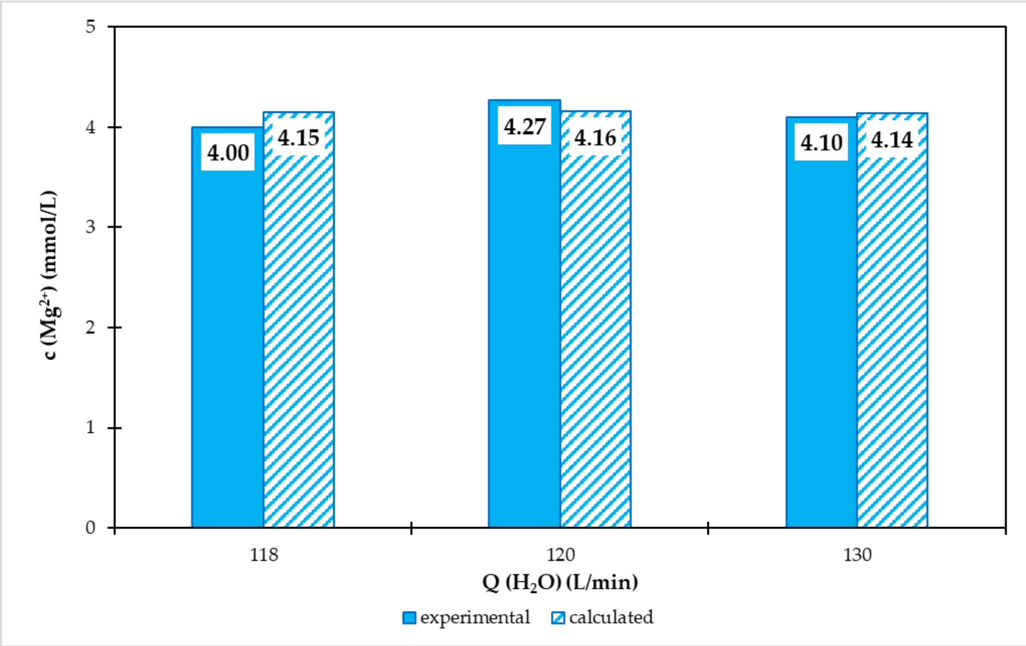

Figure S4. Molar concentration of Mg^{2+} in drinking water at Q(CO_2) = 0.5 L/min.

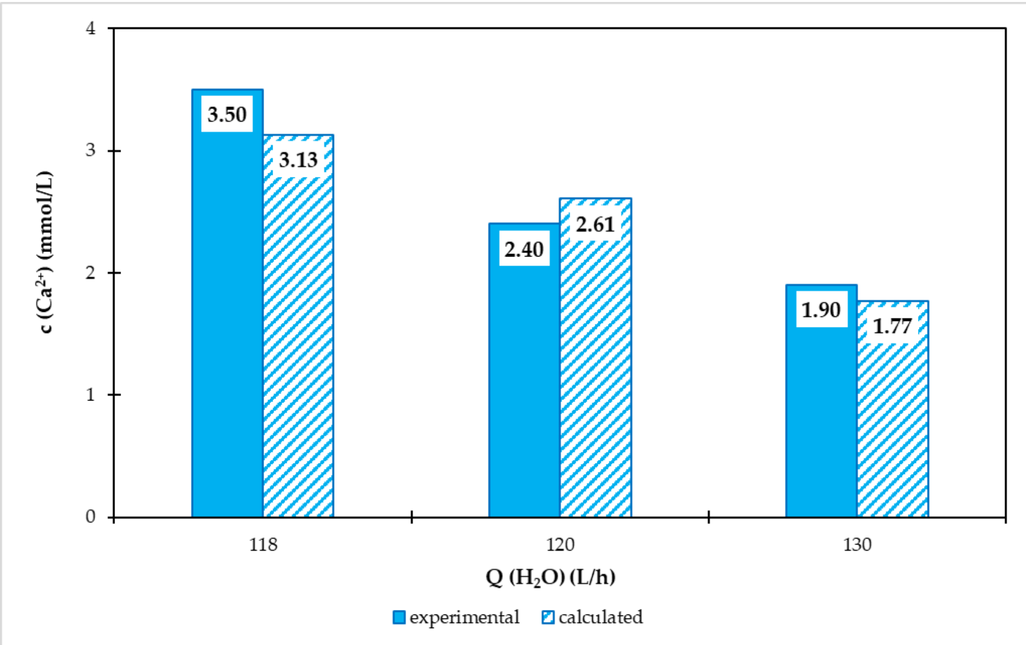

Figure S5. Molar concentration of Ca^{2+} in drinking water at Q(CO_2) = 0.5 L/min.

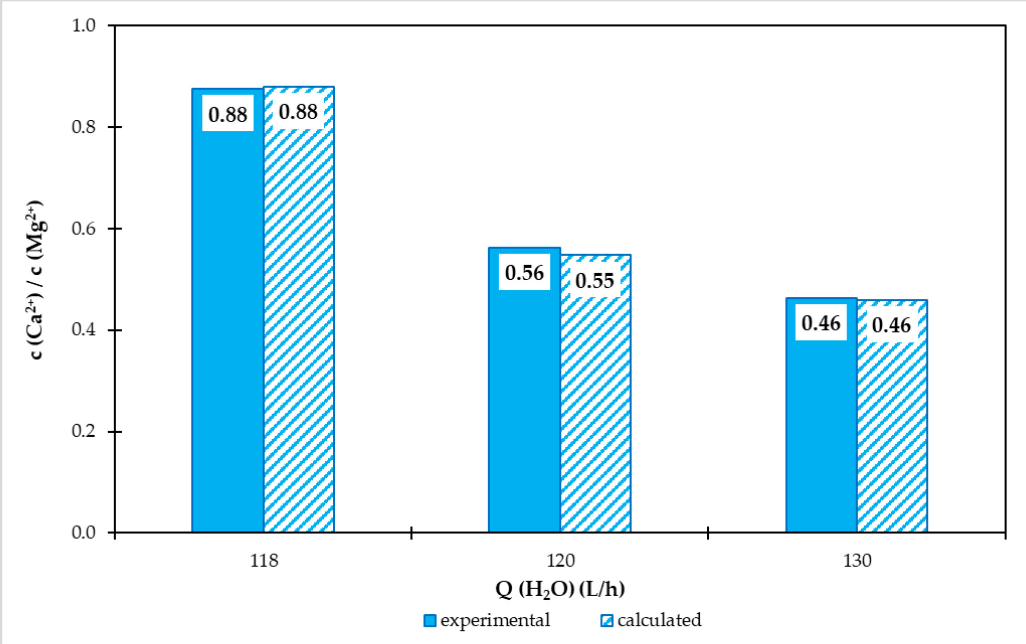

Figure S6. Molar concentration ration of Ca^{2+} and Mg^{2+} in drinking water at Q(CO_2) = 0.5 L/min.

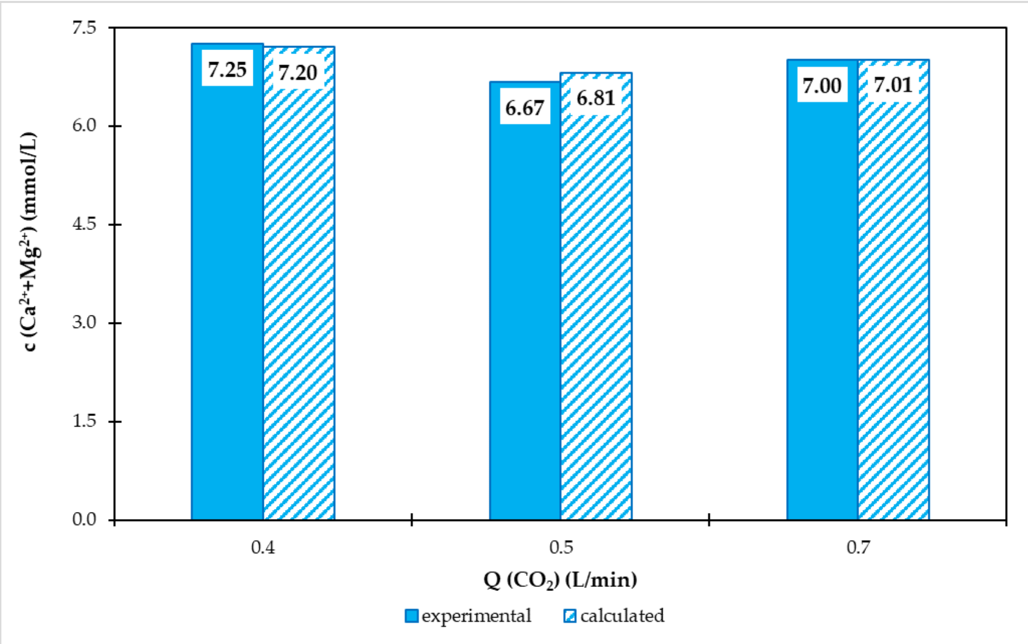

Figure S7. Molar concentration of the sum of Ca^{2+} and Mg^{2+} in drinking water at Q(H_2O) = 120 L/h.

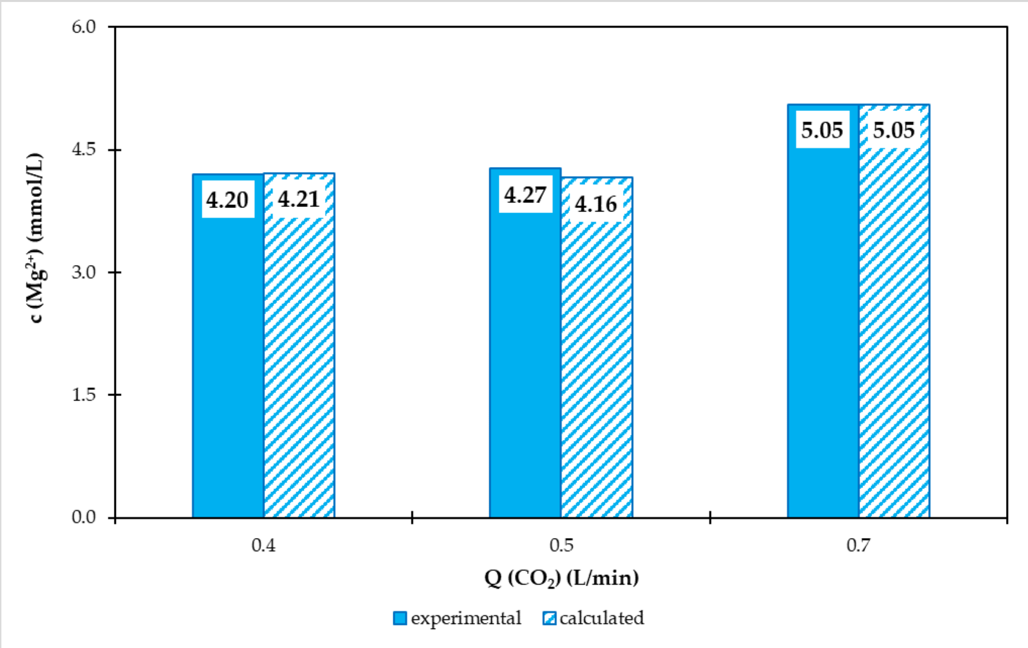

Figure S8. Molar concentration of the sum of Mg^{2+} in drinking water at Q(H_2O) = 120 L/h.

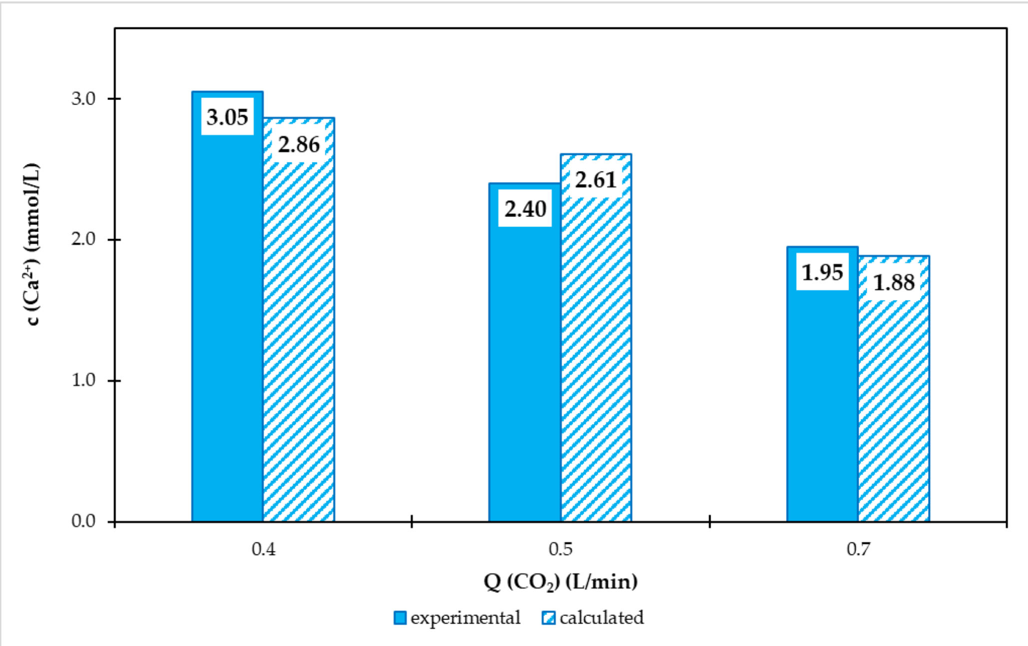

Figure S9. Molar concentration of the sum of Ca^{2+} in drinking water at Q(H_2O) = 120 L/h.

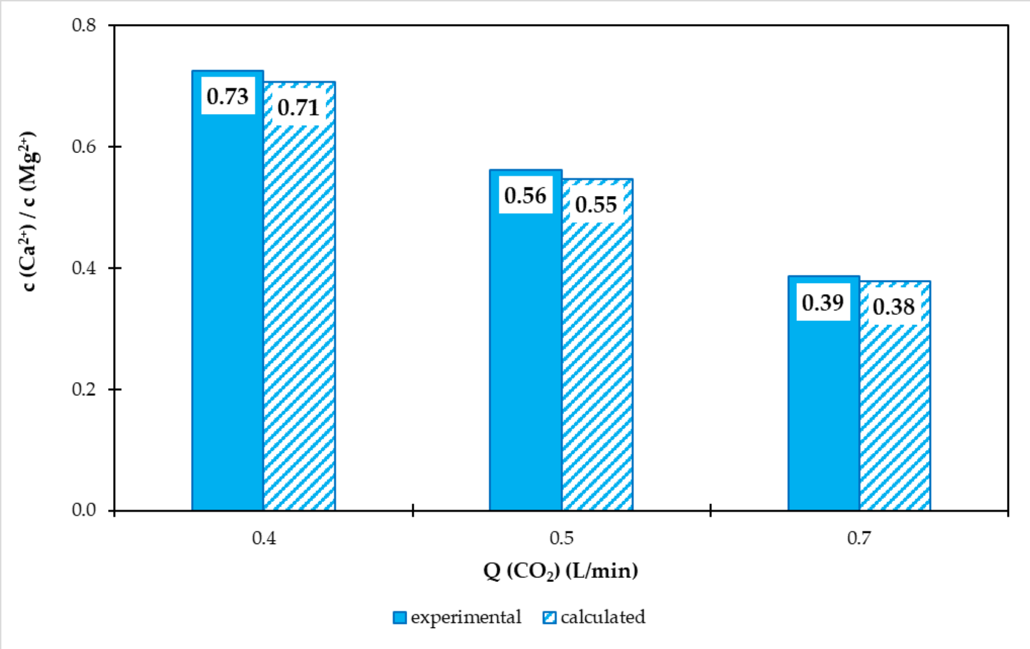

Figure S10. Molar ratio of Ca^{2+} and Mg^{2+} concentration in drinking water at Q(H_2O) = 120 L/h.