**Supporting Information for**

# From Batch to Continuous Free-Radical Solution Polymerization of Acrylic Acid Using a Stirred Tank Reactor

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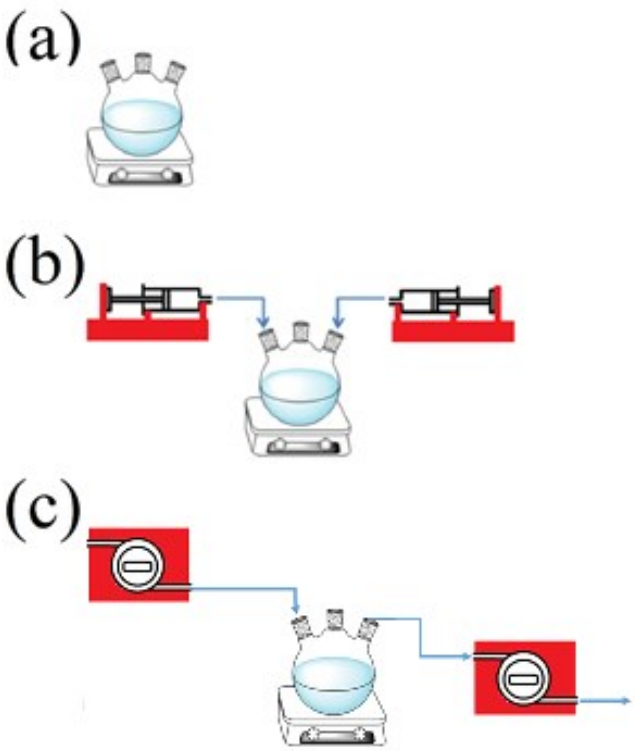


***Figure S1. Schematic representations of reactor configurations used during the experimental activity. (a) Batch, (b) semibatch, and (c) continuous stirred tank reactor (CSTR).***

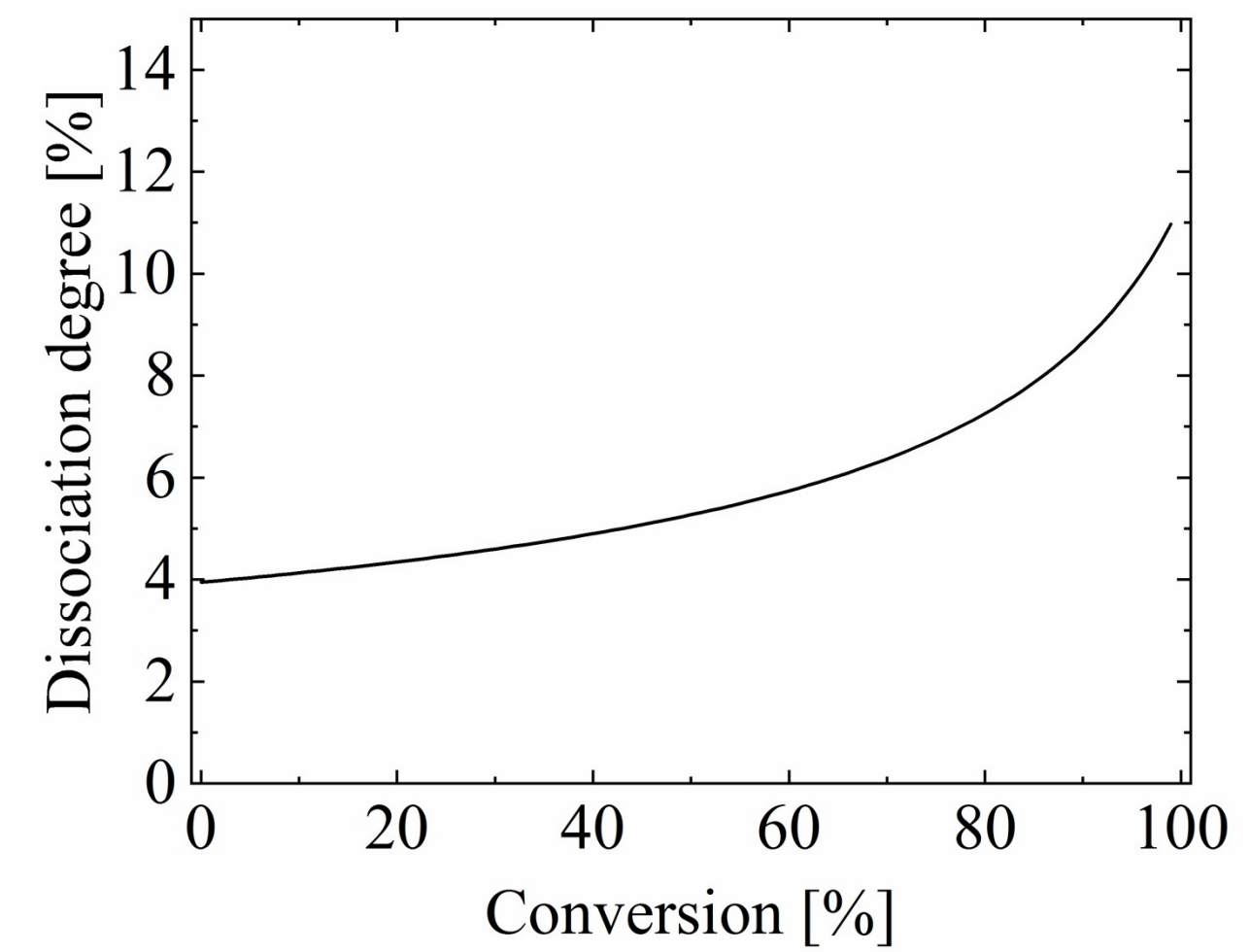


***Figure S2. Monomer dissociation degree as a function of its conversion. The trend shows a low dissociation degree in the worst investigated scenario (i.e. batch at 5 % w/w solid content).***

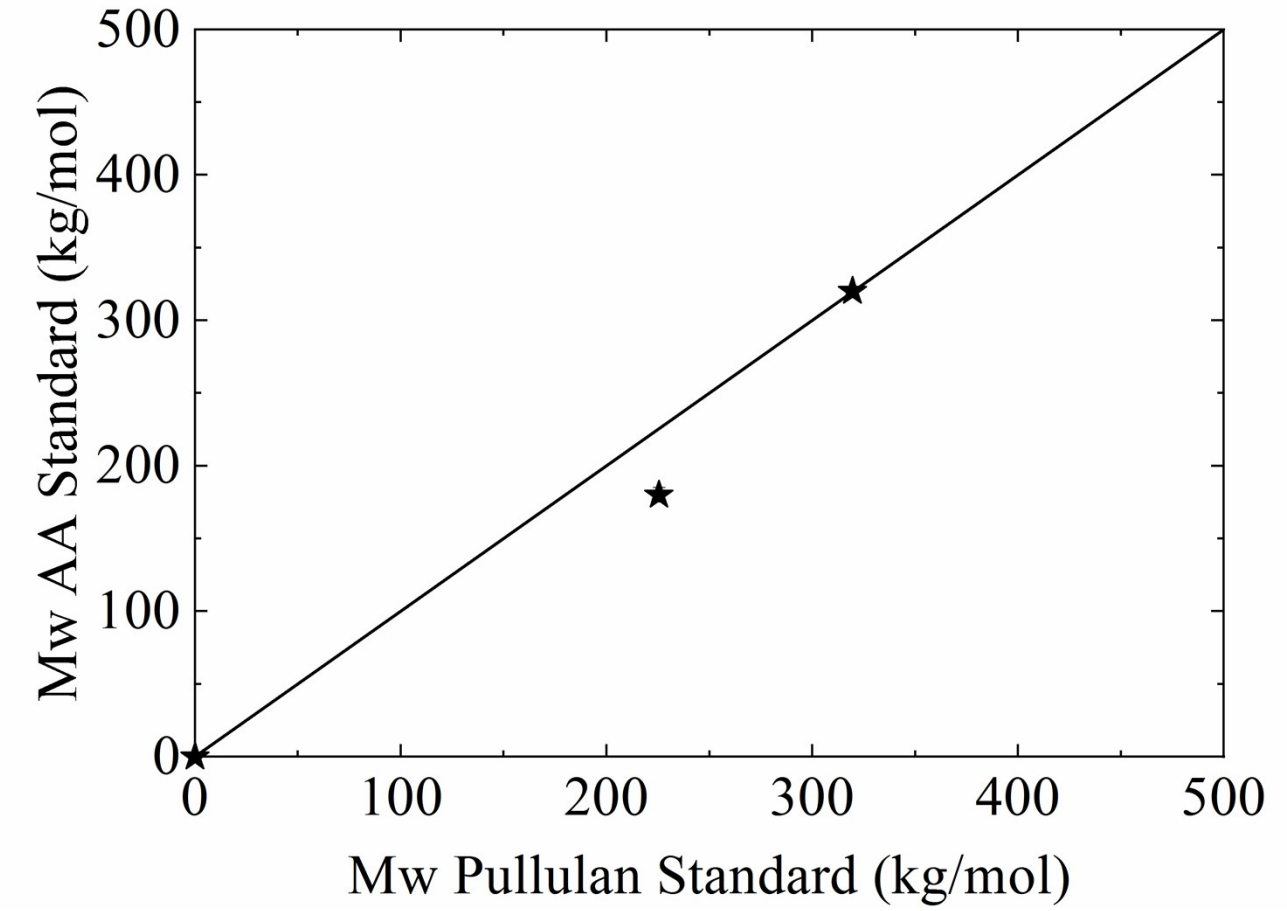


***Figure S3. Comparison between AA and pullulan based Mw taken during the reproduction of the semi batch experiment reported in Table 7, Reaction 6, initially proposed by Minari et al.. Since the experimental points (★) lay on the bisector, we considered the absence of deviation between the two standards.***

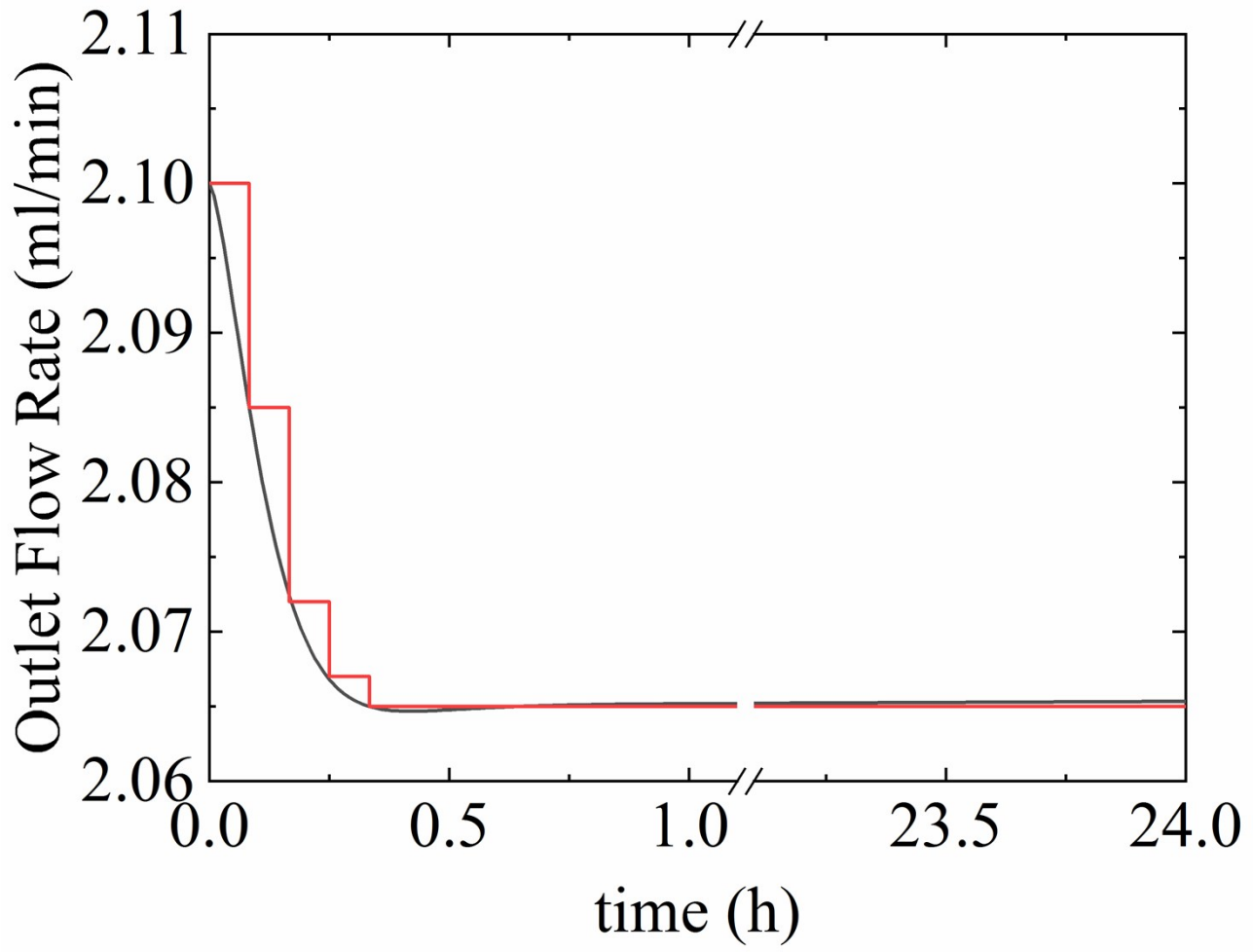


*Figure S4. Experimental discretization (red line) of the model outlet volumetric flow rate (black line).*

*Table S1. Recipes obtained through the optimization procedure that guarantees a final polymer content of 20% w/w, the imposed monomer conversion and weight-average molecular weight of 4.0 $10^5$ g/mol.*

| Reaction | Monomer Conversion | Inlet Monomer | Inlet Water [M] | Inlet Initiator | Inlet Volumetric | Temperature [°C] |
|---|---|---|---|---|---|---|

| | [%] | [M] | | [M] | Flow Rate [L/min] | |
|---|---|---|---|---|---|---|
| 10 | 0.970 | 2.86 | 44.06 | 0.02 | $3.38\ 10^{-4}$ | 60 |
| 11 | 0.960 | 2.89 | 43.94 | 0.03 | $6.09\ 10^{-4}$ | 60 |
| 12 | 0.950 | 2.92 | 43.82 | 0.05 | $9.62\ 10^{-4}$ | 60 |
| 13 | 0.940 | 2.95 | 43.70 | 0.07 | $1.40\ 10^{-3}$ | 60 |
| 14 | 0.930 | 2.98 | 43.57 | 0.09 | $1.93\ 10^{-3}$ | 60 |
| 15 | 0.920 | 3.02 | 43.44 | 0.12 | $2.54\ 10^{-3}$ | 60 |
| 16 | 0.910 | 3.05 | 43.31 | 0.15 | $3.25\ 10^{-3}$ | 60 |
| 17 | 0.900 | 3.08 | 43.17 | 0.19 | $4.06\ 10^{-3}$ | 60 |
| 18 | 0.850 | 3.27 | 42.45 | 0.45 | $9.60\ 10^{-3}$ | 60 |
| 19 | 0.800 | 3.47 | 41.63 | 0.84 | $1.79\ 10^{-2}$ | 60 |

***Table S2. Recipes obtained through the optimization procedure that guarantees a final polymer content of 35% w/w, the imposed monomer conversion and weight-average molecular weight of 4.0 $10^5$ g/mol.***

| Reaction | Monomer Conversion [%] | Inlet Monomer [M] | Inlet Water [M] | Inlet Initiator [M] | Inlet Volumetric Flow Rate [L/min] | Temperature [°C] |
|---|---|---|---|---|---|---|
| 20 | 0.980 | 4.96 | 35.68 | 0.03 | $3.14\ 10^{-4}$ | 60 |
| 21 | 0.975 | 4.98 | 35.58 | 0.04 | $4.54\ 10^{-4}$ | 60 |
| 22 | 0.970 | 5.01 | 35.48 | 0.05 | $6.53\ 10^{-4}$ | 60 |
| 23 | 0.960 | 5.06 | 35.27 | 0.09 | $1.20\ 10^{-3}$ | 60 |
| 24 | 0.950 | 5.11 | 35.06 | 0.14 | $1.81\ 10^{-3}$ | 60 |
| 25 | 0.940 | 5.17 | 34.84 | 0.20 | $2.60\ 10^{-3}$ | 60 |
| 26 | 0.930 | 5.22 | 34.62 | 0.27 | $3.53\ 10^{-3}$ | 60 |
| 27 | 0.920 | 5.28 | 34.39 | 0.36 | $4.60\ 10^{-3}$ | 60 |
| 28 | 0.910 | 5.34 | 34.16 | 0.45 | $5.80\ 10^{-3}$ | 60 |
| 29 | 0.900 | 5.40 | 33.92 | 0.55 | $7.10\ 10^{-3}$ | 60 |
| 30 | 0.850 | 5.71 | 32.65 | 1.22 | $1.57\ 10^{-2}$ | 60 |
| 31 | 0.800 | 43.71 | 56.25 | 2.11 | $2.73\ 10^{-2}$ | 60 |

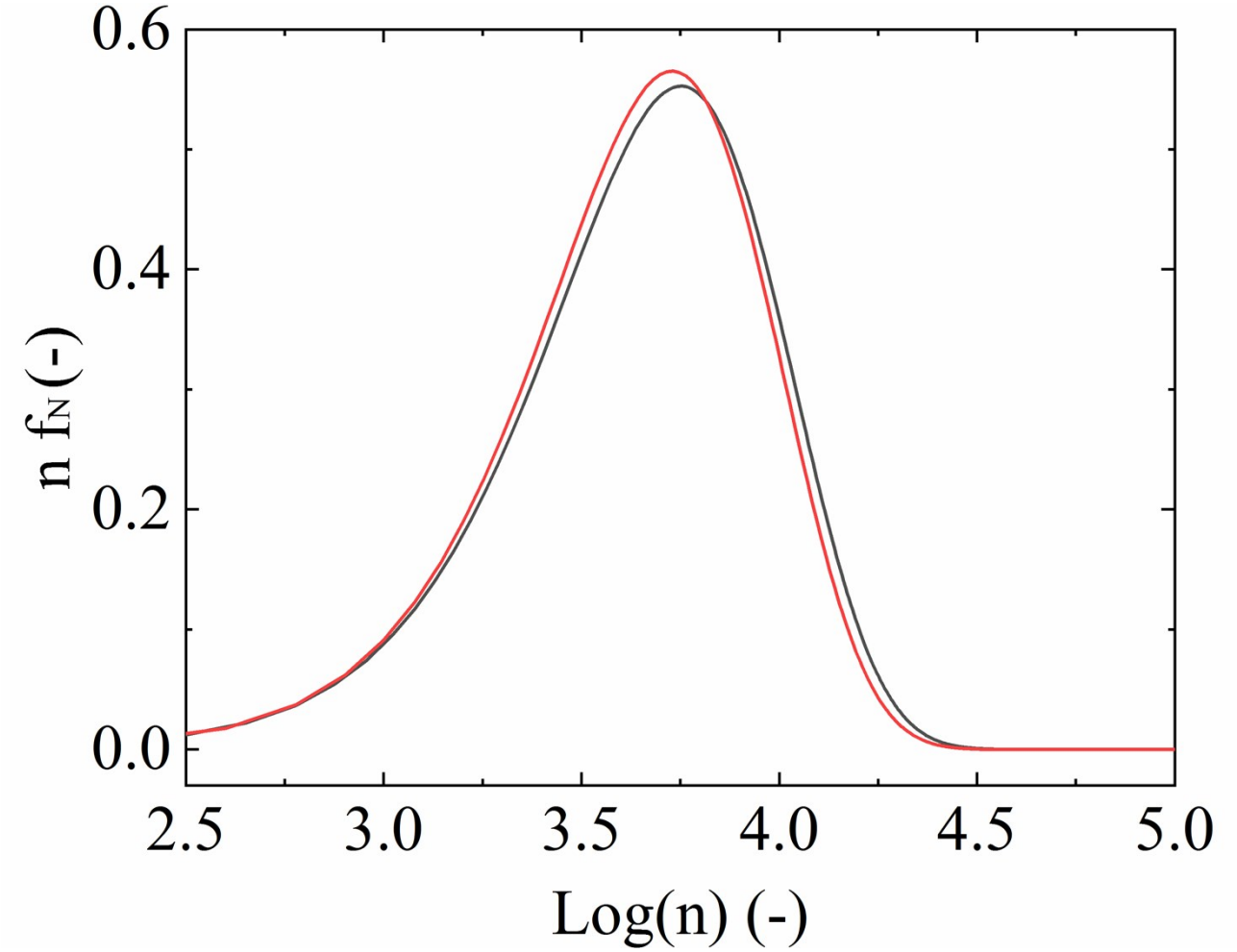


***Figure S5. Molecular weight distribution of the polymer produced in semibatch (black curve; Table 7, Reaction 6) and in CSTR (red curve; Table S2, entry 20).***