Powdered Cross-linked Gelatin Methacryloyl as an Injectable Hydrogel for Adipose Tissue Engineering

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Supplementary Information

S1 ^{1}H-NMR spectrum of the methacryloyl modified gelatin (GelMA)

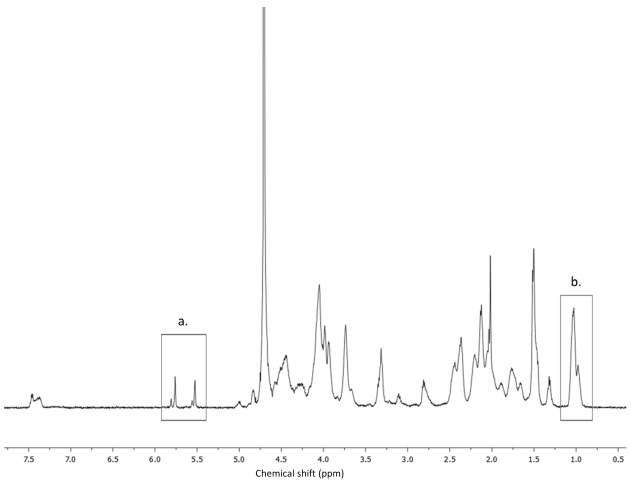

Figure S1: ^{1}H-NMR spectrum of the methacryloyl modified gelatin (GelMA). The peaks corresponding with the protons of the methacryloyl functionalities are indicated with a. The peak that is marked with b corresponds to the hydrogens from the chemically inert valine, leucine and isoleucine amino acids.

S2 Microscopic images of the GelMA powder particles

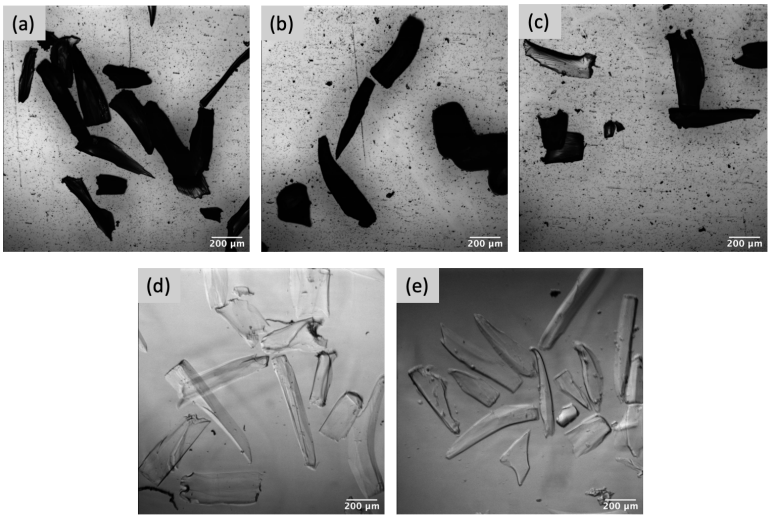

Figure S2: Microscopic images showing the rectangular shape of the $<$ 100 µm particles (a-c) in a 10 w/v% gel and (d-e) diluted in water.

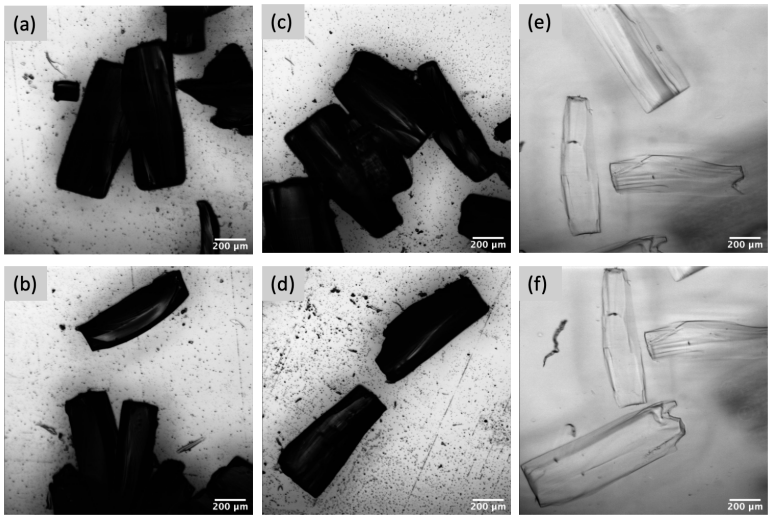

Figure S3: Microscopic images showing the rectangular shape of the 100-212 µm particles (a-b) in a 10 w/v% gel prior to injection, (c-d) in a 10 w/v% gel after injection through a 18G needle (inner diameter 838 µm) and (e-f) diluted in water.

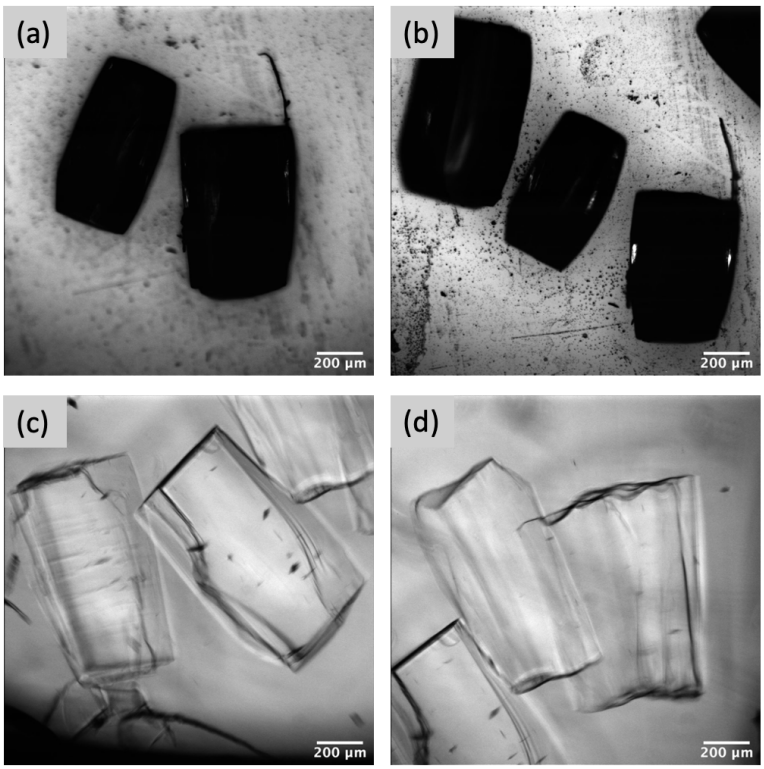

Figure S4: Microscopic images showing the rectangular shape of the 212-300 µm particles (a-b) in a 10 w/v% gel and (c-d) diluted in water.

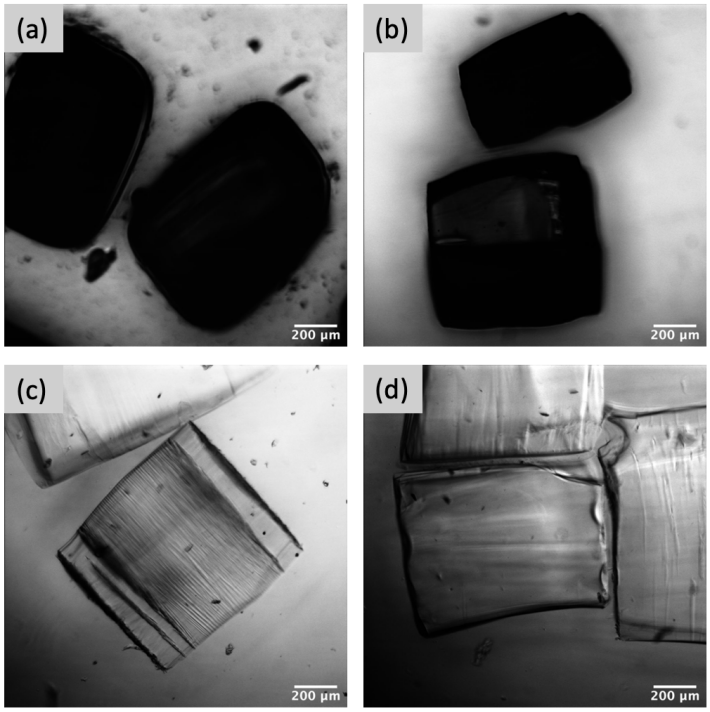

Figure S5: Microscopic images showing the rectangular shape of the 300-400 µm particles (a-b) in a 10 w/v% gel and (c-d) diluted in water.

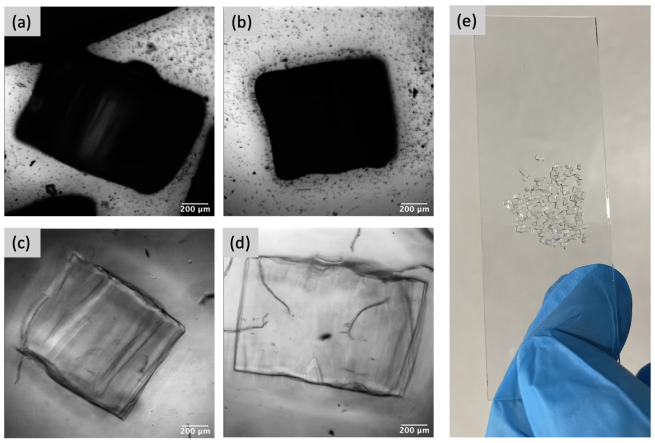

Figure S6: Microscopic images showing the rectangular shape of the 400-500 µm particles (a-b) in a 10 w/v% gel and (b-c) diluted in water. (e) Image of the swollen gel particles in a 10 w/v% gel.

S3 PSD's of the water-swollen GelMA particles

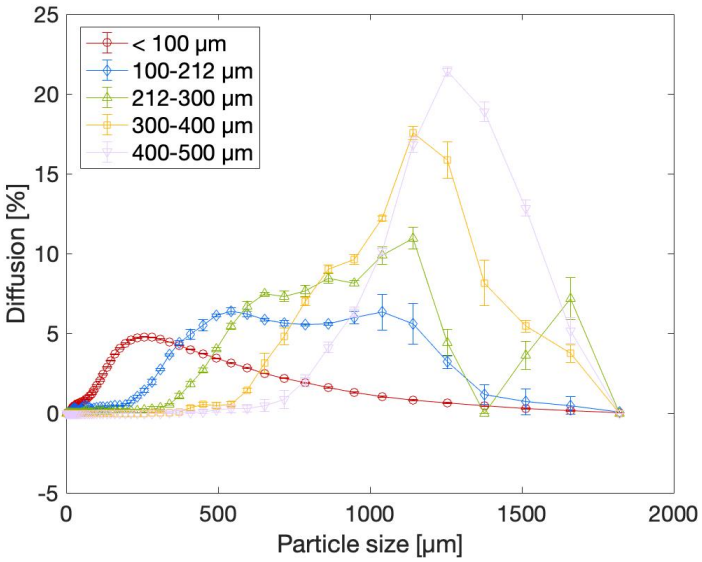

Figure S7: PSD's of particles of size fractions $<$ 100 µm, 100-212 µm, 212-300 µm, 300-400 µm and 400-500 µm swollen in water.

S4 Raw data of the micromechanics experiments

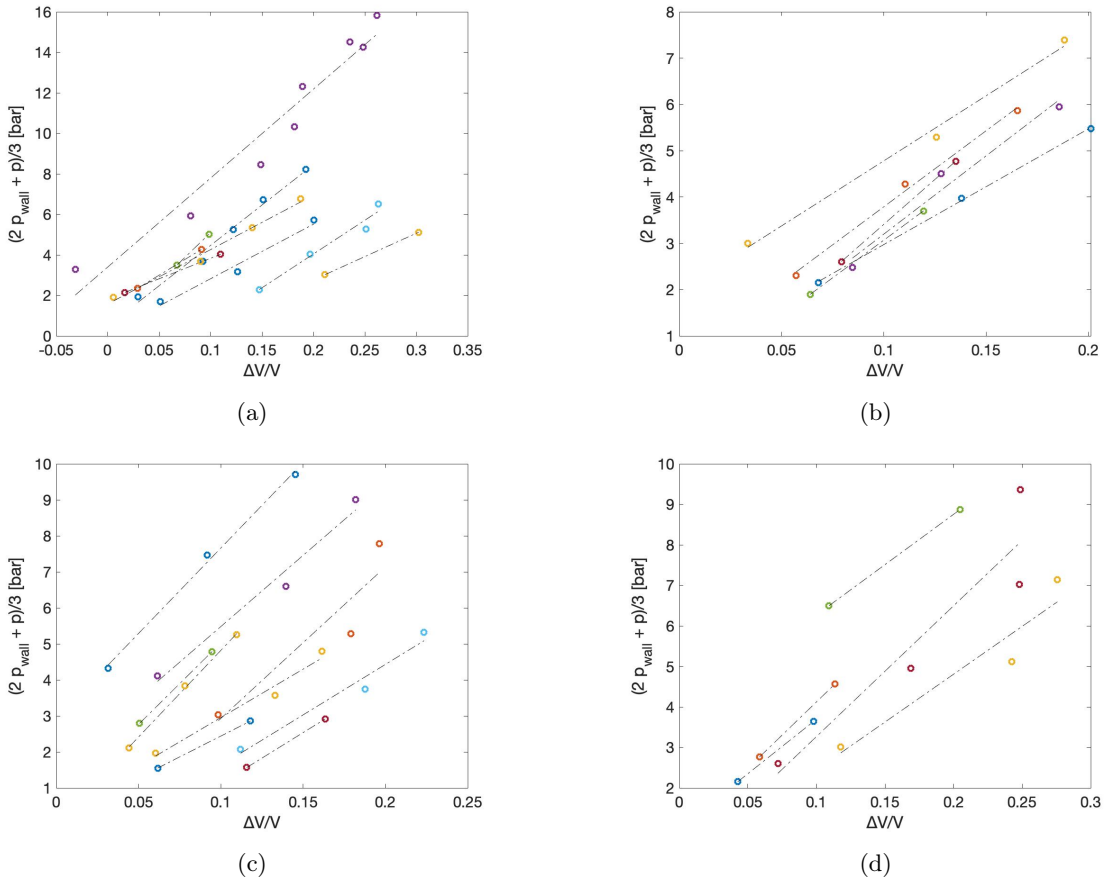

Figure S8: Raw data of $(2p_{\text{wall}} + p)/3$ plotted against $\Delta V/V$ used for the calculation of the compression modulus of particles swollen in (a) water, (b) 1 mM NaCl, (c) 10 mM NaCl and (d) diluted PBS.

S5 Raw data of the zeta potential experiments

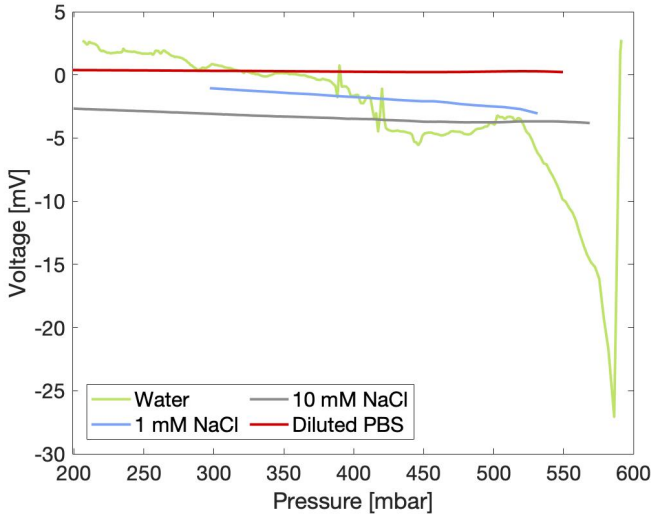

Figure S9: Raw data obtained during zeta potential measurements indicating the unstable measurement of particles swollen in water compared to salt solutions.

S6 Time sweep of a 10 w/v% bulk GelMA hydrogel

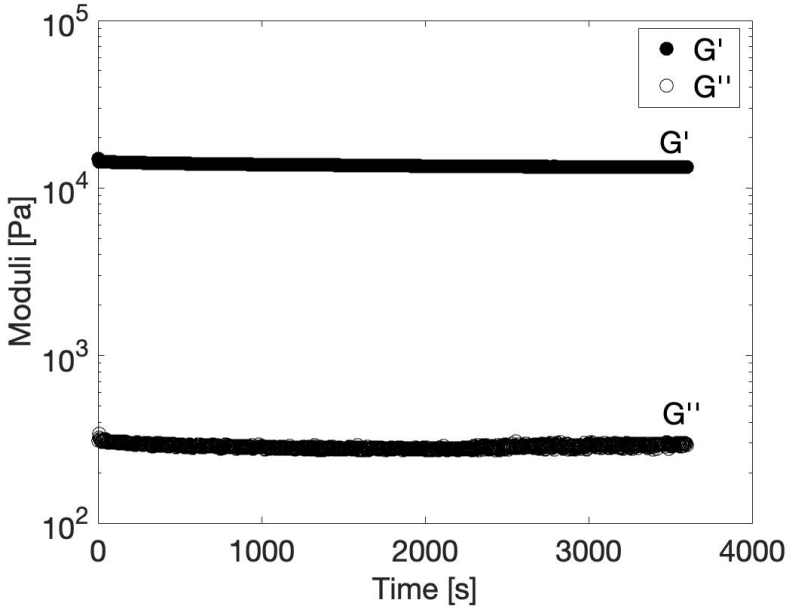

Figure S10: Time sweep at 1 % strain and 10 rad/s of a bulk GelMA hydrogel of 10 w/v% in water at room temperature.

S7 Strain sweep of the 212-300 µm microgel at various temperatures

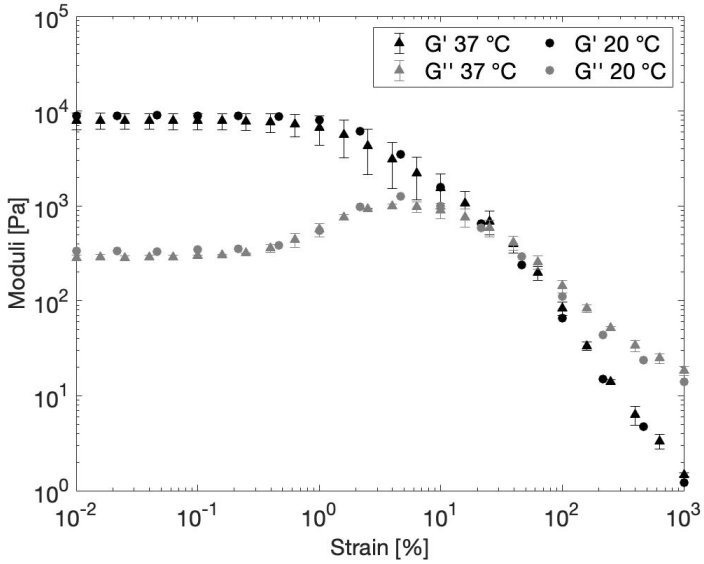

Figure S11: Strain sweep at 10 rad/s of a microgel constituting of 212-300 µm particles in water at 20 °C and 37 °C indicating that temperature has no effect on the yielding.

S8 Injectability of the GelMA microgels

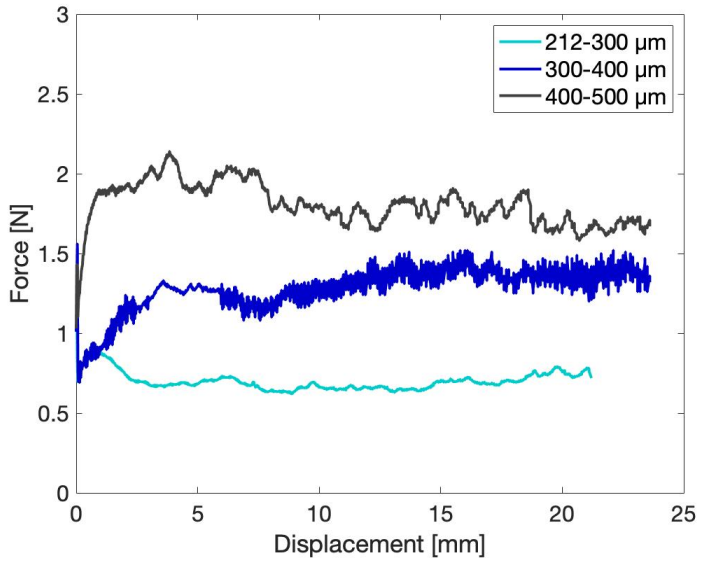

Figure S12: Force versus displacement curves of 10 w/v% hydrogels in water constituting of the 212-300 µm, 300-400 µm and 400-500 µm particle size fractions that were pushed through a syringe of 1.9 mm tip diameter in 42 s.

S9 CD reproducibility of the diluted PBS-swollen GelMA particles

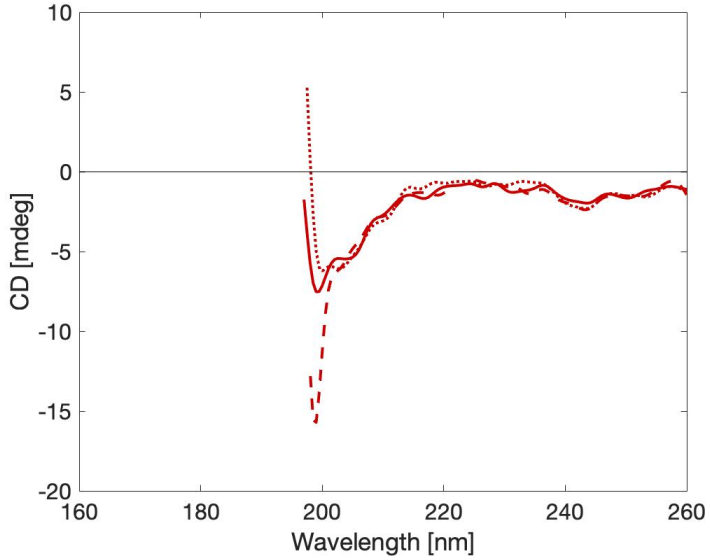

Figure S13: Triplicate spectra showing good reproducibility of 100-212 µm particles swollen in diluted PBS.