Supplementary Information for

Abiotic streamers in a microfluidic system

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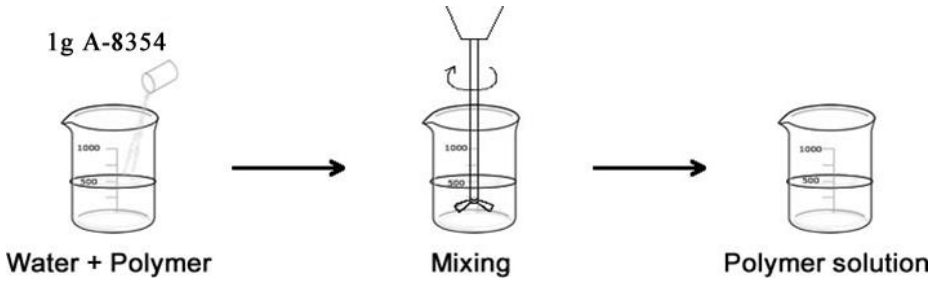

Figure S1: Schematic of the preparation of polymer solution at room temperature. 1g of polymer powder were mixed with 500mL of normal tap water (0.2% w/w PAM solution) and mixed at 600 rpm for at least 3 hours to ensure homogenization.

Table S1: Properties of PAM. (* For 0.2% solution obtained from bulk rheology)

Weight average molar mass, Mw $(\frac{g}{mol})$	Number average molar mass ,Mn $(\frac{g}{mol})$	Polydispersity index (PDI)	Radius of gyration, *Rw* (nm)	Relaxation time scale, λ (s)*
22.6×10^6	7.6×10^6	2.96	191.9	2.07

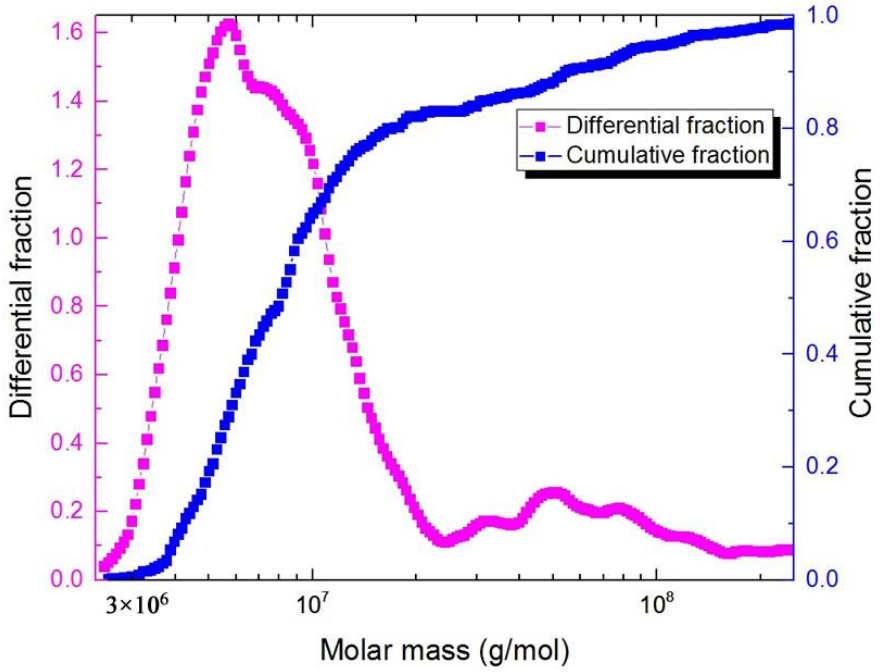

Figure S2. AF4 analysis of different molar mass fraction, differential and cumulative molar mass distribution of PAM (0.2% w/w) solution at room temperature. The weight average molar mass, *Mw*, was 22.6×10^6 g/mol.

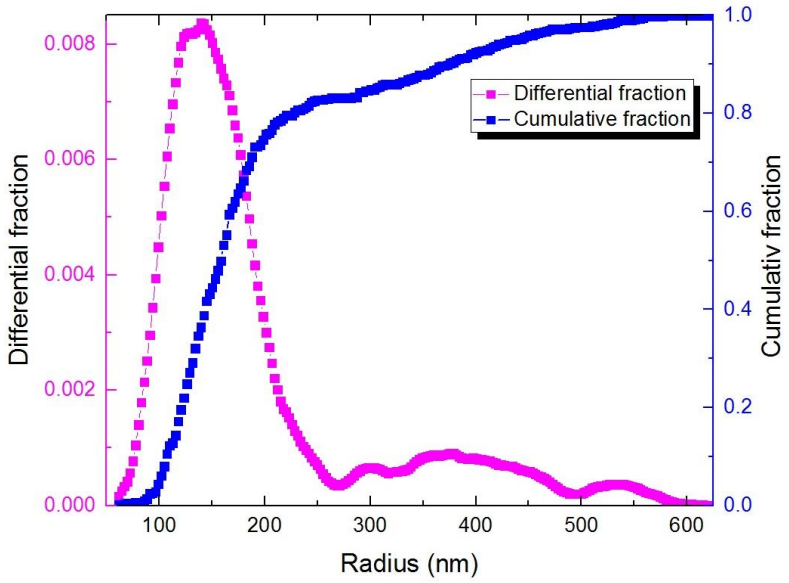

Figure S3. AF4 fractograms of PAM (0.2% w/w) solution showing differential radius and cumulative radius distribution at room temperature. It indicates the small presence of high radius polymer molecules with leading presence of radius *Rw* ~191.9nm.

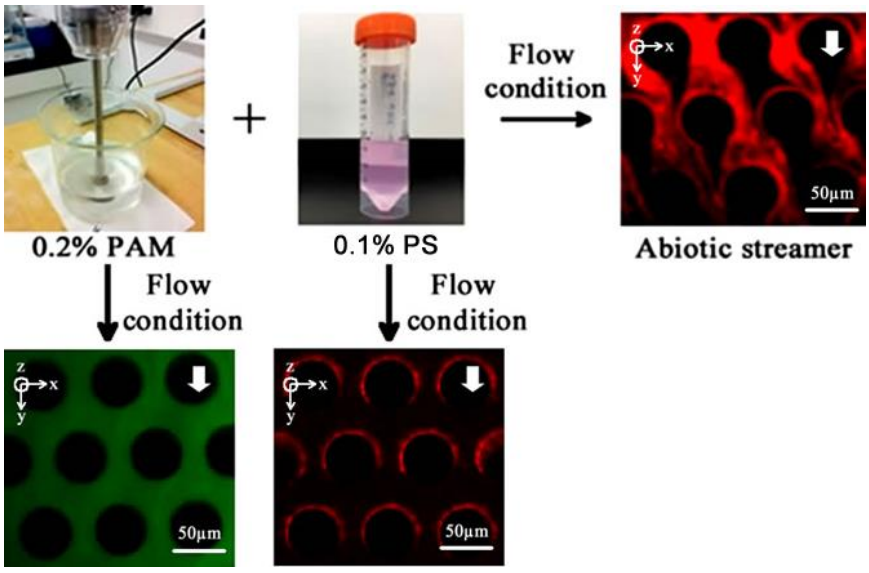

Figure S4: Control experiments for the investigation of streamer formation confirms that streamer forms for the combined flow of PAM (0.2% w/w) and PS (0.1%w/w) solution only.

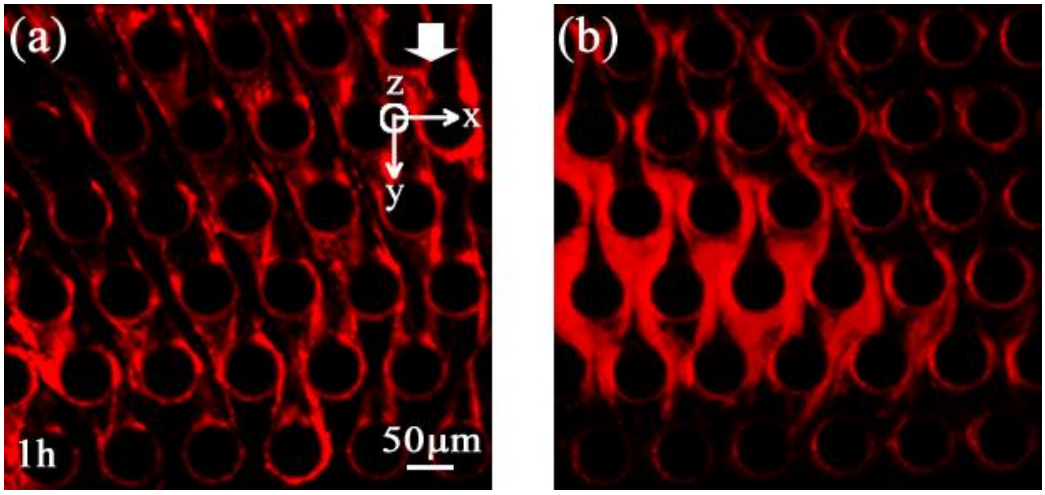

Figure S5. Different morphology of streamer formation at various pH values. Streamers formed after one hour for Q_{PAM}=10µL/h and Q_{PS}=30µL/h at (a) pH=4 and (b) pH=9.

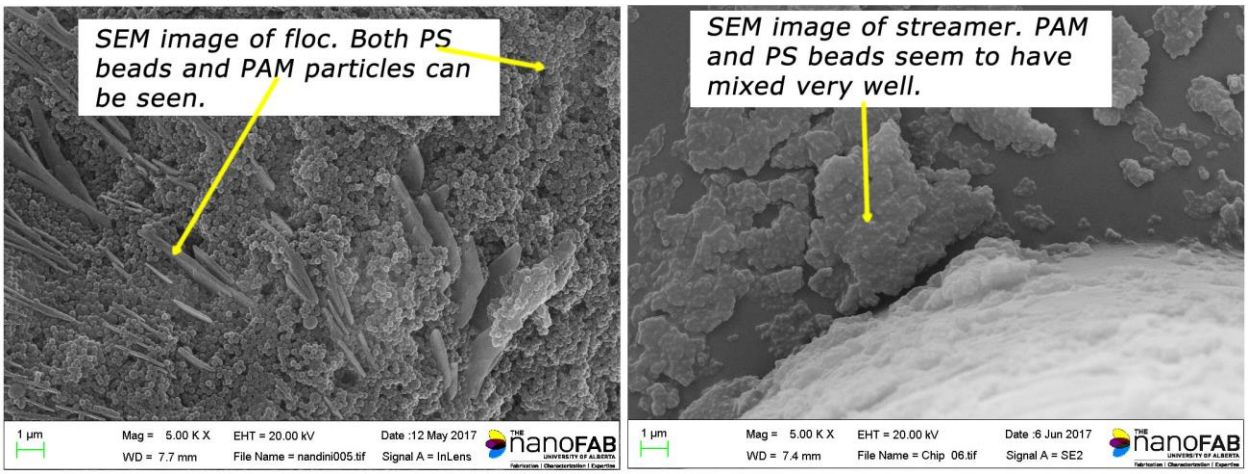

Figure S6: (Left) SEM image of a floc (Right) SEM Image of a streamer fragment. The SEM imaging was done for a mixing volume ratio (PAM:PS) of 1:4 at pH 5 for the floc and flow rate Q_{PAM}=10µL/h and Q_{PS}=40µL/h for the streamer experiment.

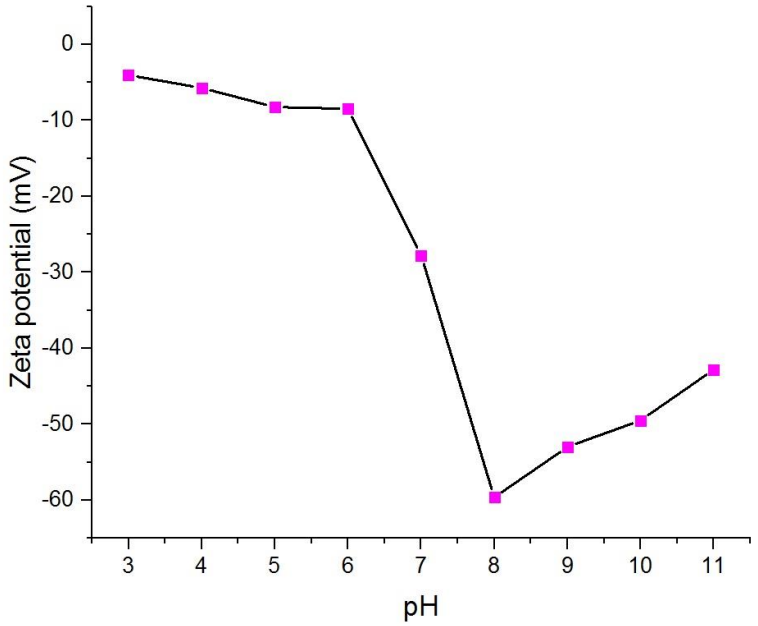

Figure S7: Zeta potential of anionic PAM (0.005%) as a function of pH.

Sample calculation for Weissenberg number:

$Wi = \lambda\dot{\gamma} = \lambda\frac{U}{L}$ where $\dot{\gamma}$ is the shear rate, U is the velocity scale and L is the length scale. One condition when streamer formation occurs is $Q_{PAM} = 5\ \mu$L/h and $Q_{PAM} = 10\ \mu$L/h. This yields $U = 7.4 \times 10^{-5}$ m/s. Using $L = 50 \times 10^{-6}$ m and using the relaxation time scale obtained from bulk rheology (Fig. 2) we get $Wi \sim 3$.

Supplementary video

Supplementary video 1: Video shows viscous abiotic streamer formation for short time scale and elastic abiotic streamer formation for long time scale. Video runs at real time and scale bars are 50µm**.**