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Colloidal - like aggregation of a functional amyloid protein

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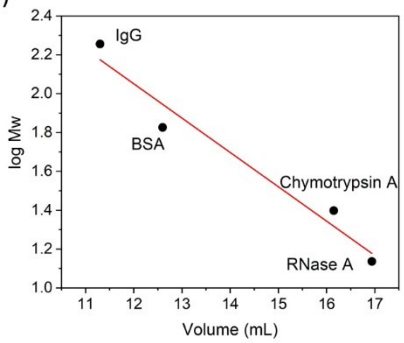
pH	Web page charge of the monomer (e^-)	Charge in Coulombs of the monomer	Charge in Coulombs of the oligomer	charge density (C/m^2)	Ψ_0 (V)	Ψ_0 (mV)	γ	Ψ_x (mV), x=1.67 nm
1	33.8	5.41E-18	1.62E-16	8.27E-02	9.59E-02	95.93292	0.732581	22.66308
1.5	33.8	5.41E-18	1.62E-16	8.27E-02	9.59E-02	95.93292	0.732581	22.66308
2	33.8	5.41E-18	1.62E-16	8.27E-02	9.59E-02	95.93292	0.732581	22.66308
2.5	33.3	5.33E-18	1.60E-16	8.15E-02	9.52E-02	95.20388	0.729274	22.55745
3	32.1	5.14E-18	1.54E-16	7.86E-02	9.34E-02	93.41289	0.721004	22.29348
3.5	29.1	4.66E-18	1.40E-16	7.12E-02	8.87E-02	88.65818	0.69802	21.56135
4	22.6	3.62E-18	1.09E-16	5.53E-02	7.67E-02	76.68602	0.633256	19.50976
4.5	12.4	1.99E-18	5.96E-17	3.04E-02	5.08E-02	50.83733	0.458252	14.03746
5	3.4	5.45E-19	1.63E-17	8.32E-03	1.61E-02	16.06786	0.155217	4.728656
5.5	-1.5	-2.40E-19	-7.21E-18	-3.67E-03	-7.18E-03	-7.18161	-0.06983	-2.12605
6	-3.6	-5.77E-19	-1.73E-17	-8.81E-03	-1.70E-02	-16.9808	-0.16388	-4.99303
6.5	-4.8	-7.69E-19	-2.31E-17	-1.17E-02	-2.23E-02	-22.3441	-0.21423	-6.53078
7	-5.6	-8.97E-19	-2.69E-17	-1.37E-02	-2.58E-02	-25.7993	-0.2461	-7.50535
7.5	-6.1	-9.77E-19	-2.93E-17	-1.49E-02	-2.79E-02	-27.906	-0.26527	-8.09247
8	-6.8	-1.09E-18	-3.27E-17	-1.66E-02	-3.08E-02	-30.7847	-0.29114	-8.88524
8.5	-7.9	-1.27E-18	-3.80E-17	-1.93E-02	-3.51E-02	-35.1384	-0.32945	-10.0615
9	-10.3	-1.65E-18	-4.95E-17	-2.52E-02	-4.39E-02	-43.9188	-0.40341	-12.3402
9.5	-15.9	-2.55E-18	-7.64E-17	-3.89E-02	-6.10E-02	-60.9854	-0.53271	-16.3544
10	-25.5	-4.09E-18	-1.23E-16	-6.24E-02	-8.23E-02	-82.3476	-0.66514	-20.5177
10.5	-35.1	-5.62E-18	-1.69E-16	-8.59E-02	-9.78E-02	-97.7835	-0.74082	-22.9265
11	-40.6	-6.50E-18	-1.95E-16	-9.94E-02	-1.05E-01	-104.973	-0.77081	-23.8877
11.2	-41.9	-6.71E-18	-2.01E-16	-1.03E-01	-1.07E-01	-106.54	-0.77693	-24.0844
11.5	-42.9	-6.87E-18	-2.06E-16	-1.05E-01	-1.08E-01	-107.714	-0.78142	-24.2288
12	-43.9	-7.03E-18	-2.11E-16	-1.07E-01	-1.09E-01	-108.863	-0.78574	-24.3678
12.5	-44	-7.05E-18	-2.11E-16	-1.08E-01	-1.09E-01	-108.976	-0.78616	-24.3814
13	-44	-7.05E-18	-2.11E-16	-1.08E-01	-1.09E-01	-108.976	-0.78616	-24.3814

Table S1. Print-out of the calculated zeta potential (Ψ_x) of a TasA **oligomer** in the pH range 1-13, at a distance x= 1.67 nm away from the surface.

pH	charge in Coulombs	charge density (C/m^2)	Ψ_0 (V)	Ψ_0 (mV)	γ	Ψ_x (V), x= 1.67 nm
1	4.33E-12	0.019515	0.035419	35.41871	0.331878	10.13622
1.5	4.33E-12	0.019515	0.035419	35.41871	0.331878	10.13622
2	4.33E-12	0.019515	0.035419	35.41871	0.331878	10.13622
2.5	4.26E-12	0.019226	0.034963	34.96342	0.327926	10.01476
3	4.11E-12	0.018533	0.033861	33.8609	0.31831	9.719309
3.5	3.72E-12	0.016801	0.031044	31.04402	0.293446	8.956075
4	2.89E-12	0.013048	0.024648	24.64823	0.235538	7.182233
4.5	1.59E-12	0.007159	0.01388	13.87965	0.134354	4.092344
5	4.35E-13	0.001963	0.003849	3.848633	0.037464	1.140561
5.5	-1.92E-13	-0.00087	-0.0017	-1.69921	-0.01655	-0.50374
6	-4.61E-13	-0.00208	-0.00407	-4.07456	-0.03966	-1.20745
6.5	-6.14E-13	-0.00277	-0.00543	-5.42833	-0.05282	-1.60803
7	-7.17E-13	-0.00323	-0.00633	-6.32882	-0.06156	-1.87421
7.5	-7.81E-13	-0.00352	-0.00689	-6.89066	-0.06701	-2.04016
8	-8.7E-13	-0.00393	-0.00768	-7.67585	-0.07461	-2.27189
8.5	-1.01E-12	-0.00456	-0.00891	-8.90606	-0.08652	-2.63446
9	-1.32E-12	-0.00595	-0.01157	-11.5718	-0.11222	-3.41763
9.5	-2.03E-12	-0.00918	-0.01766	-17.6643	-0.17035	-5.19049
10	-3.26E-12	-0.01472	-0.02755	-27.5504	-0.26205	-7.99376
10.5	-4.49E-12	-0.02027	-0.03659	-36.5912	-0.342	-10.4475
11	-5.2E-12	-0.02344	-0.04137	-41.3743	-0.38246	-11.6936
11.2	-5.36E-12	-0.02419	-0.04246	-42.4635	-0.39148	-11.9718
11.5	-5.49E-12	-0.02477	-0.04329	-43.2908	-0.39828	-12.1817
12	-5.62E-12	-0.02535	-0.04411	-44.109	-0.40496	-12.3881
12.5	-5.63E-12	-0.0254	-0.04419	-44.1904	-0.40562	-12.4086
13	-5.63E-12	-0.0254	-0.04419	-44.1904	-0.40562	-12.4086

Table S2. Print-out of the calculated zeta potential (Ψ_x) of a **TasA aggregate** in the pH range 1-13, at a distance x= 1.67 nm away from the surface.

(a)



(b)

Protein	Mw	Volume
IgG	180	11.3
BSA	67	12.6
Chymotr.A	25	16.15
RNaseA	13.7	16.94

Figure S1. Calibration curve for the gel filtration analytical column, superpose 12, describing the relation between the logarithm of the molecular weight (in kDa) and the elution volume of the proteins specified on the graph (a). The red line is a linear best fit to the data, according to y = ax+ b, with a (slope) = 0.18 ± 0.02 and b (y intercept) = 4.2 ± 0.4 (a). The table in (b) shows the detailed molecular weights (in kDa) and elution volumes that we were measured and plotted in (a).

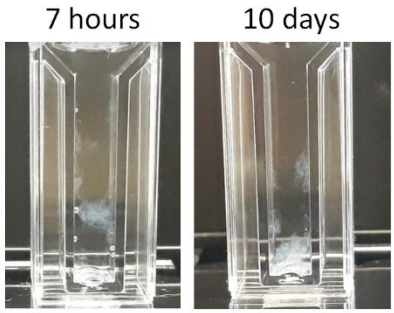


Figure S2. TasA aggregates settling down in the cuvette at longer times than those recorded with the turbidity tests (Fig. 2 (a). The images show that the aggregates continue to settle (here shown at 7 hours and 10 days following the change of the pH to 2.5) till they reach the bottom of the cuvette.

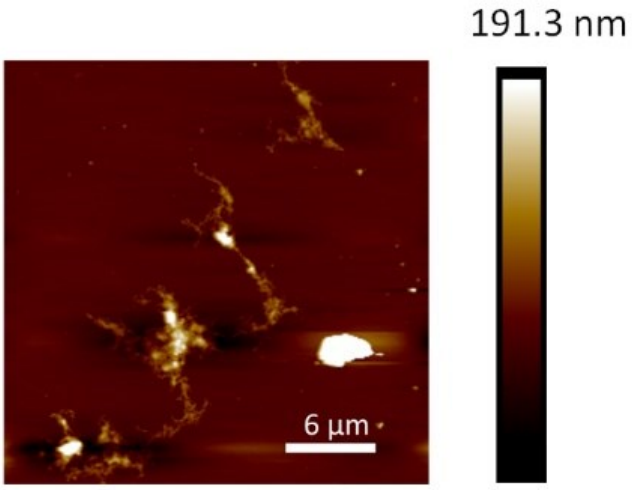


Figure S3. An AFM topography view of multiple TasA aggregates formed after the acidification of the solution.

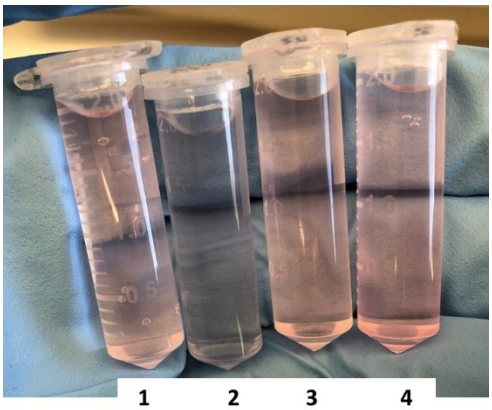


Figure S4. Gold Nanoparticles before and after pH reduction to 2.5. Epitubes 1, 2 show citrate - stabilized NPs, before (1) and after (2) solution acidification. Epitubes 3,4 show PEG-carboxylate - stabilized NPs before (3) and after (4) solution acidification. The citrate - stabilized NPs aggregated, while the PEG-carboxylate NPs remained stable in solution after changing the solution pH to 2.5.

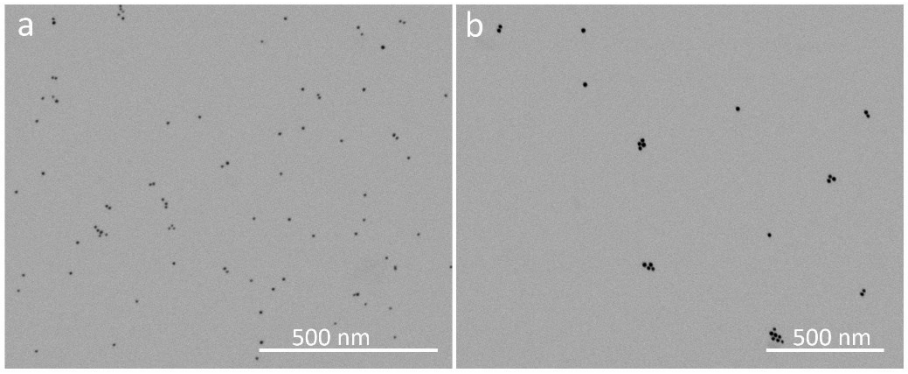


Figure S5. SEM images of Gold NPs, mixed with TasA, at pH = 8. (a) shows citrate-stabilized gold NPs and (b) shows PEG-carboxylate-stabilized gold NPs.

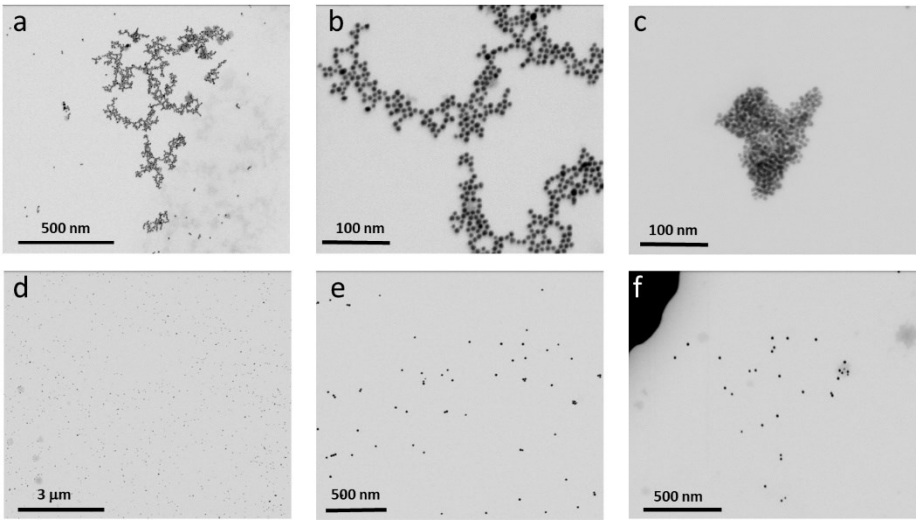


Figure S6. TEM images of gold NPs. Citrate - stabilized NPs (citrate buffer, pH =7) (a,b), (b) is a zoomed-in view of image (a). The NPs aggregates at pH 2.5 are shown in (c). PEG-Carboxylate - stabilized NPs in TDW (d, e), (e) is a zoomed-in view of image (d), and at pH 2.5 (f). Citrate - stabilized NPs aggregate at pH 2.5, while PEG-carboxylate - stabilized NPs remained stable in solution. We attribute the aggregation of citrate-stabilized NPs in water at pH =7 (a,b) to their interaction with the surface and drying effects[1].

References

1. B. Michen, C. Geers, D. Vanhecke, C. Endes, B. Rothen-Rutishauser, S. Balog and A. Petri-Fink, *Sci Rep*, 2015, **5**, 9793.