

Supplementary Material to:

Microwave-assisted incorporation of silver nanoparticles in paper for point-of-use water purification

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TABLE S1. Filter paper characteristics. Each paper was soaked in a solution of 10 mM silver nitrate and 1M glucose prior to silver nanoparticle formation in the oven. Flow rate was determined in the square plastic filter unit (Figure 1). Paper aspects of thickness, basis weight, particle retention, and cellulose type were provided by the supplier.

Supplier	Product Grade #	Basis Weight (gsm)	Thickness (mm)	Flow rate (L/hr)	Particle Retention (um)	Cellulose type	Oven temperature (°)	Heating time (min)	Silver content (mg Ag per g paper)
Ahlstrom	222	291.3	0.8255	2.4	18	cotton	77	40	1.15
Ahlstrom	243	421.2	0.9525	0.75	3	cotton	77	60	1.83
Ahlstrom	237	182.5	0.4191	2.0	3	cotton	77	40	1.54
Ahlstrom	240	249.2	0.5080	0.86	-	wood pulp	93	25	3.23
Ahlstrom	242	221.1	0.4064	0.86	-	wood pulp	93	20	2.92
Ahlstrom	322	294.8	0.5461	0.8	3	wood pulp	93	30	3.19
Ahlstrom	1326	358	0.7366	1.0	3	wood pulp	93	30	3.81
Cosmos	-	360	0.49	0.24	-	wood pulp	77	10	5.41
Domtar	-	250	0.5	0.6	-	kraft wood pulp	77	40	3.21
GP Cellulose	512	732	1.27	3.75	-	cotton linter pulp	77	90	1.89
GP Cellulose	HVE	569.5	1.15	2.2	-	high viscosity ether	77	60	1.39
Neenah	222010C	250	0.5	1.2	-	wood pulp	77	30	3.16
Whatman	Grade 3	187	0.390	0.75	6	cotton	77	40	0.95
Whatman	GB003	320	0.8	4.0	-	cotton	77	75	1.43
Whatman	GB005	556	1.5	1.71	-	cotton	77	75	2.01

TABLE S2. Antibacterial filter tests at various bacteria concentrations, silver NP concentrations, paper types, paper thicknesses, paper sizes, and flow rates.

Paper type	Basis Weight (g/m)	Shape	Number of papers in filter unit	Total Silver mass (mg)	Volume filtered (L)	Flow Rate (L/hr)	Log reduction	Standard Error
Influent <i>E.coli</i> Bacteria Concentration (CFU/mL) = 4E+09								
Domtar	250	square	1	3.85	0.1	0.4	9.71	0.07
Domtar	250	circle	1	30.8	1	4.9	8.45	0.61
GP Cellulose	732	square	1	6.6	0.1	2.0	9.78	0
GP Cellulose	732	square	5	33.15	1	1.0	9.16	0.15
Influent <i>E.coli</i> Bacteria Concentration (CFU/mL) = 1E+06								
Domtar	250	square	1	3.85	0.1	0.6	6.11	0
Domtar	250	square	1	7.7	0.1	0.8	6.01	0
Domtar	250	circle	1	30.8	1	4.9	6.01	0
GP Cellulose	732	square	1	6.6	0.1	3.0	6.11	0
* 6.5 x 6.5 cm sq								
** 20 cm diameter circle								

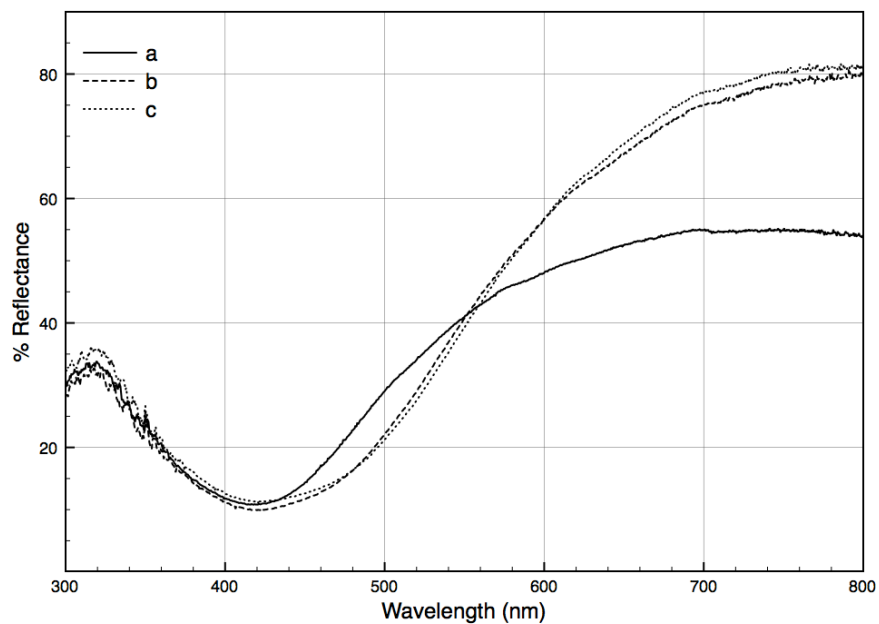


FIGURE S1. UV-Visible reflectance spectra of AgNP paper sheets prepared with sodium borohydride (a), and glucose, with the heat source either a microwave (b) or an oven at 105°C (c). All paper sheets had the same precursor Ag⁺ concentration of 10 mM.

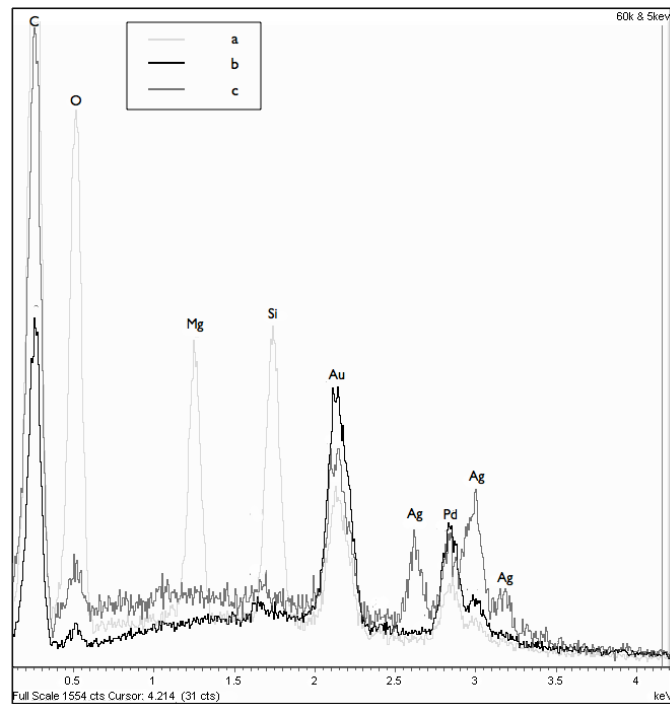


FIGURE S2. EDX spectra of (a) untreated, (b) glucose (1M), and (c) AgNP/glucose papers. Samples were sputter coated with Au Pd. The untreated paper had silicon and magnesium EDX peaks, which were not present in the AgNP samples.

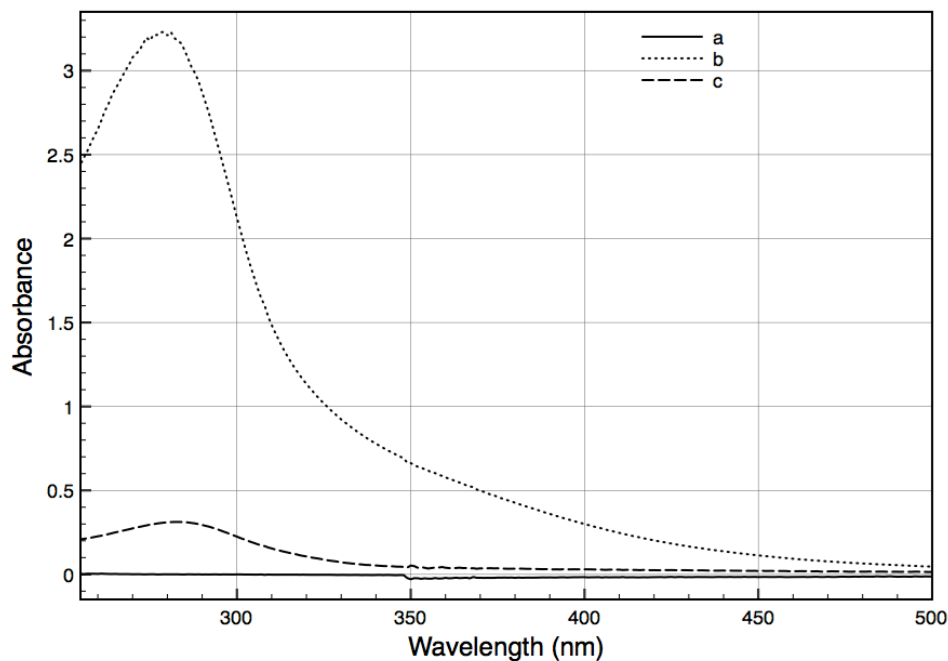
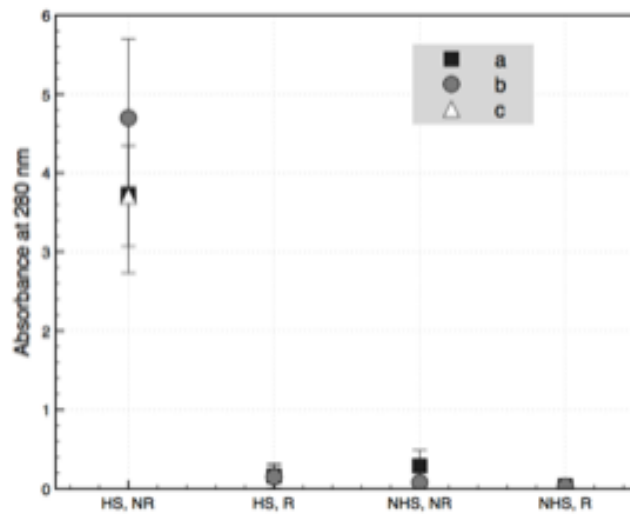


FIGURE S3. UV-Vis spectra of effluent water from rinsing AgNP paper with the same glucose concentration, 1 M, the same AgNO_3 concentration, 10 mM, and varying heating conditions: (a) heated in the oven at 105°C , (b) paper placed in a “hot spot” in the microwave, and (c) paper placed in a “cold spot” in the microwave



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FIGURE S4. UV-Visible absorbance measurements of extracted caramel byproducts generated by different microwave treatments: HS, hot spot, NHS, non hot spot, R, rotation, NR, not rotated, with differing silver concentrations: (a) 1 mM AgNO₃, (b) 10 mM AgNO₃, and (c) 0 mM AgNO₃.

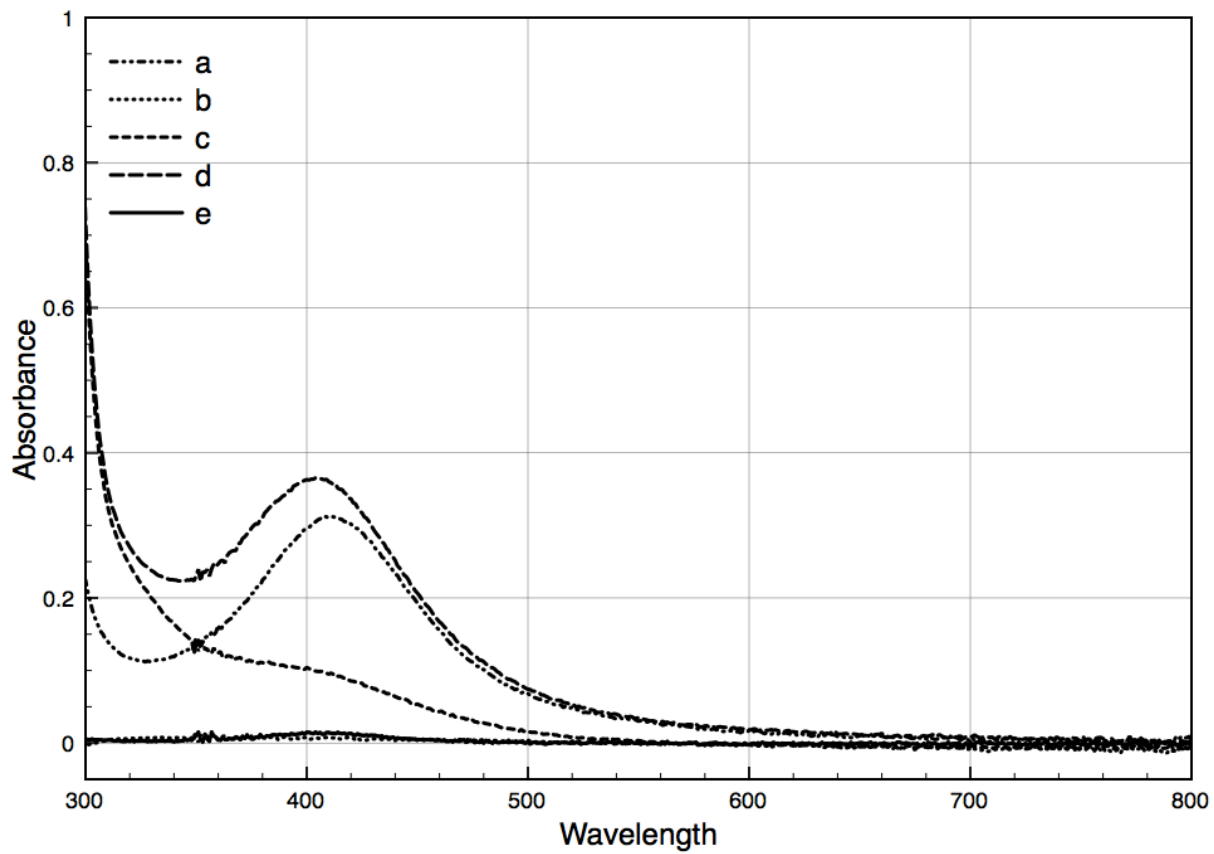


Figure S5. UV-Vis spectrophotometry of effluent waters: (a) 2.5 g/L LB broth, (b) deionized water, (c) 1 g/L tryptone, (d) 1 g/L tryptone and 0.14M NaCl, and (e) 0.1M NaCl. Note that the peaks at 420 nm indicate the presence of AgNPs in the effluent.