-Supporting information-

Preparation of a CNF Porous Membrane and in situ synthesis of silver nanoparticle (AgNP)

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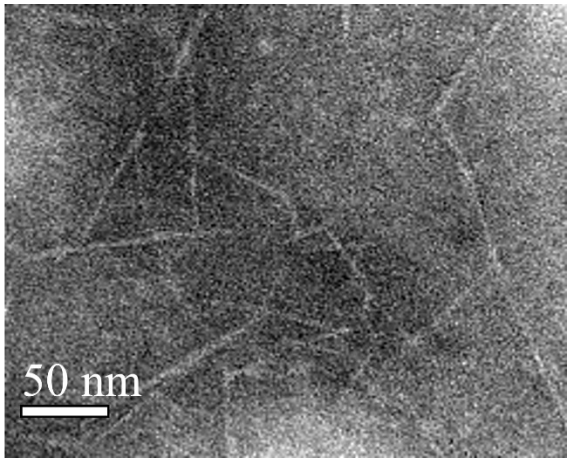


Fig. S1 TEM image of TEMPO-oxidized CNF.
The sample was negatively stained with 1% ammonium molybdate solution prior to TEM observation.

Table S1. Photo images of CNF assembly (CNF-DB) prepared by mixing CNF (2000 ppm) and DB of different concentrations in Milli-Q water.

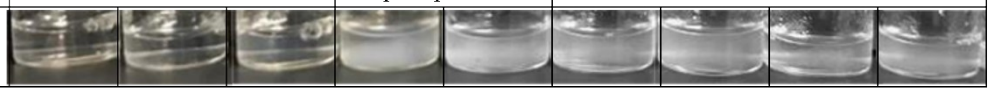
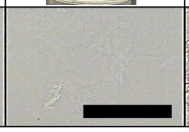
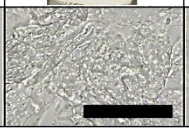
CNF /ppm	2000								
DB /mM	0.5	1.0	1.4	2.5	5.0	10	20	50	100
State of suspension	Dispersed			Aggregated and precipitated		Formation of assembly			
Photo images									

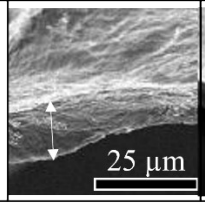
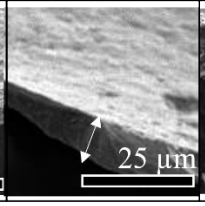
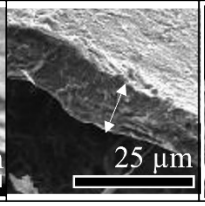
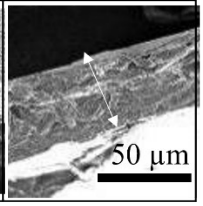
Table. S2 Photo and OM images of CNF assembly (CNF-DB) prepared by mixing CNF (5000 or 10000 ppm) and DB of different concentrations in 50 mM NaCl aqueous solution. All scale bars are 50 μm.

CNF /ppm	**5000**			
DB /mM	**0.25**	**2.5**	**10**	**100**
State of suspension	Dispersed		Aggregated	Formation of assembly
Photo				
OM image				

CNF /ppm	**10000**			
DB /mM	**0.25**	**2.5**	**10**	**100**
State of suspension	Dispersed		Aggregated	Precipitated
Photo				
OM image				No datum


Precipitates

Table S3. Photo and SEM images of naturally dried CNF-DB$_x$ (CNF-DB$_x$-ND). The samples were prepared by centrifugal concentration of CNF-DB assembly at 10000 r.p.m.

DB /mM	5.0	10	50	100
Photo				
SEM image				

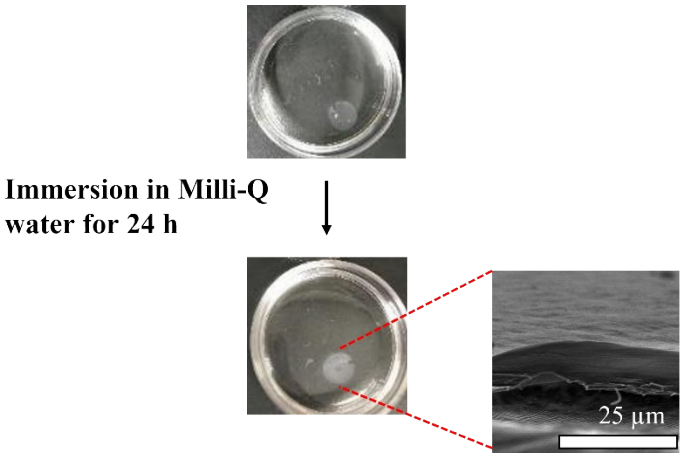


Fig. S2. Photo images showing the structural stability of CNF-DB_{100}-ND in Milli-Q water. The inset shows its cross-sectional SEM image 24 h after immersion in Milli-Q water.

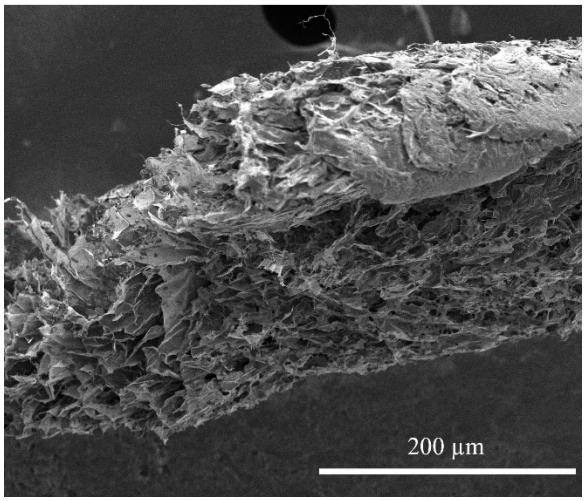
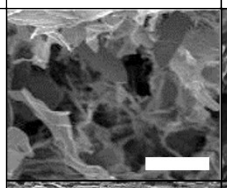
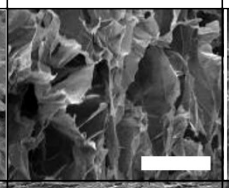
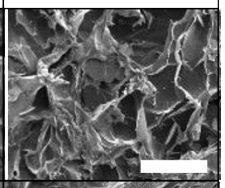
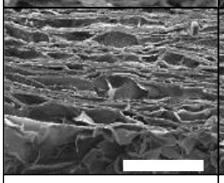
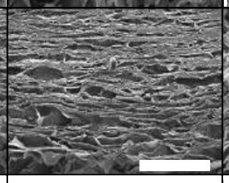
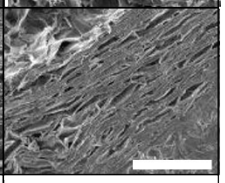


Fig. S3 SEM image showing the edge of CNF-DB_5 –FD.

Table S4. SEM images of CNF-DB_5–FD prepared with different rotational speeds of centrifugation. All scale bars are 50 μm.

Rotational speed /r.p.m.	**2500**	**5000**	**10000**	**15000**
CNF-DB_5-sol	Sol was not formed			
SEM image (surface)				
SEM image (cross section)				
Layer spaces /μm		4.6±2.4	5.6±2.4	2.4±0.9

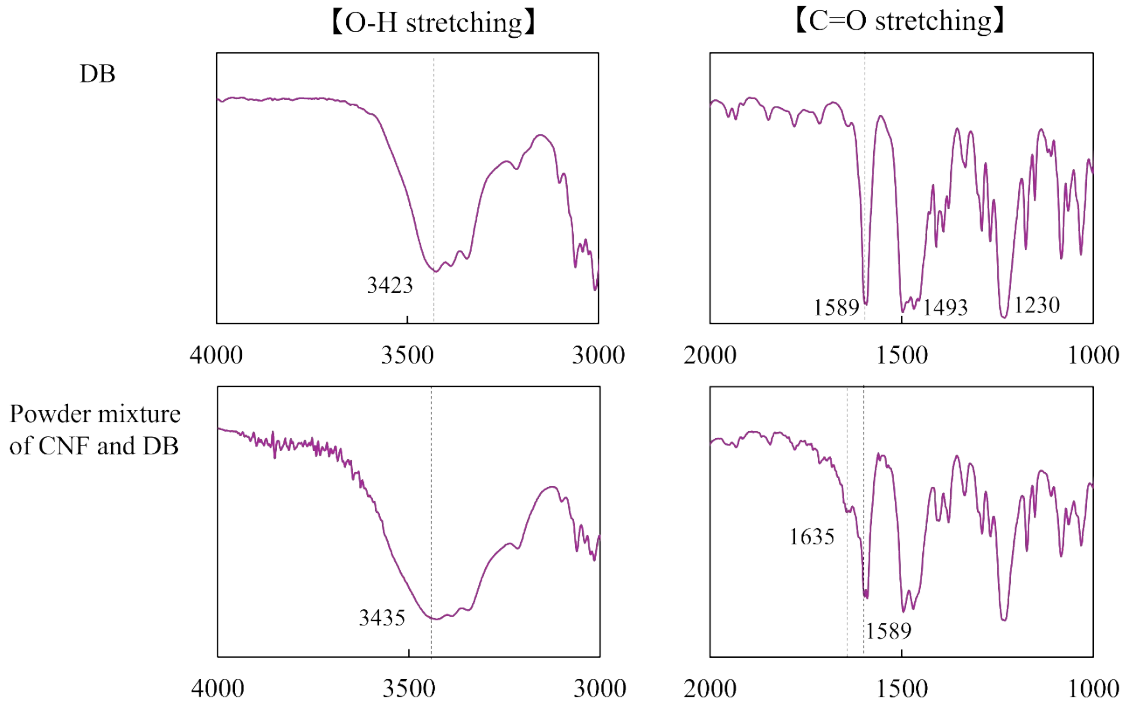


Fig. S4 FT-IR spectra of C=O stretching band (right) and O-H stretching band (left) for DB (upper) and a powder mixture of CNF and DB (lower). The numbers indicate the wavenumber corresponding to each vibration mode.

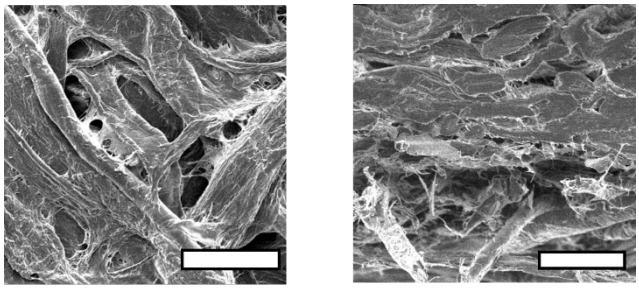


Fig. S5 SEM images of the surface (left) and the cross-section (right) of a filter paper. All scale bars are 50 μm.

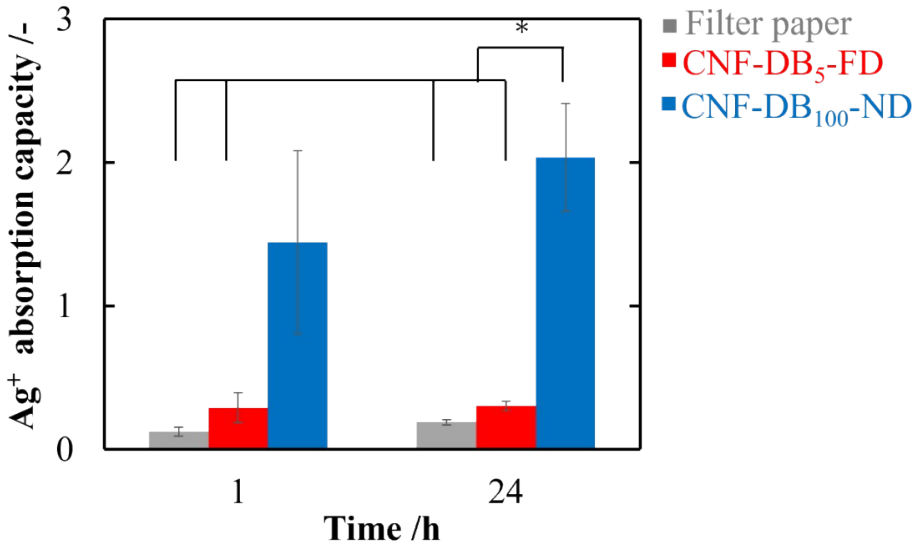


Fig. S6 Ag^+ absorption capacity of a filter paper, CNF-DB_{100}-ND and CNF-DB_5-FD (*p<0.01).

The absorption capacity was estimated using the following equation.

Absorption capacity = Weight of absorbed Ag ions (mg) /Weight of the CNF membrane (mg)

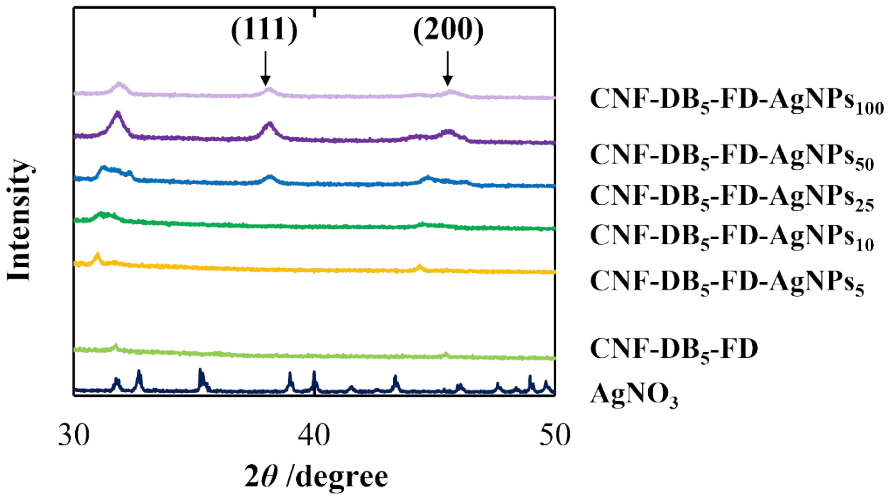
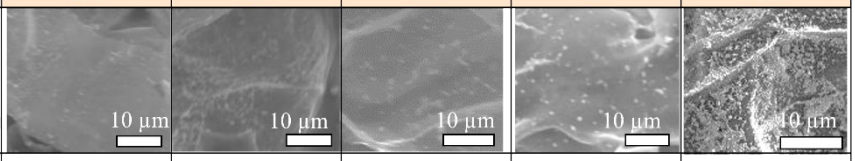


Fig. S7 XRD profiles for AgNPs generated on CNF-DB_5-FD at different $AgNO_3$ concentrations using $NaBH_4$ as a reducing agent.

Table S5. Characterization of CNF-DB_5–FD-$AgNPs_y$ prepared by reduction with sodium citrate under microwave irradiation for 10 min.

	Ag^+ /mM				
	5.0	**10**	**25**	**50**	**100**
SEM images					
Ag composition /wt%	4.5	10.2	9.9	8.9	28.1

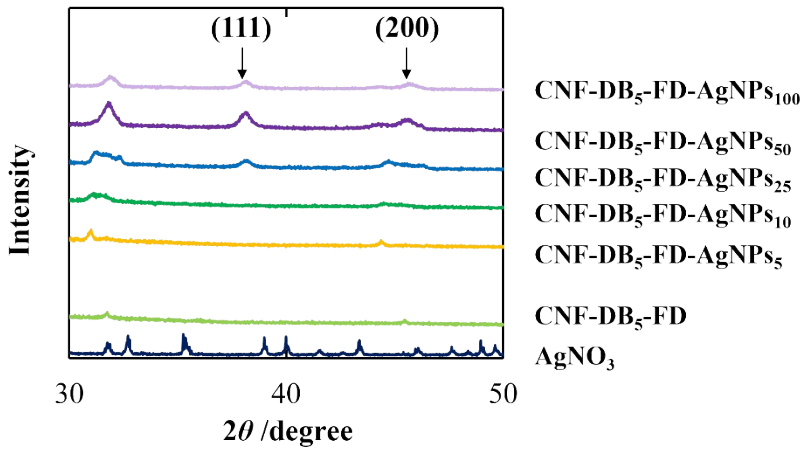


Fig. S8 XRD profiles of CNF-DB_5-FD-$AgNPs_y$ prepared by reduction with sodium citrate under microwave irradiation for 10 min.

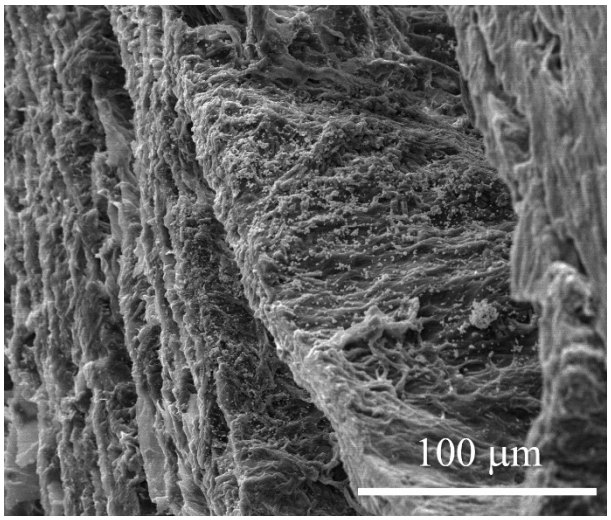


Fig. S9 SEM image of CNF-DB_5-FD-$AgNPs_{25}$ prepared by reduction with sodium citrate under microwave irradiation for 5 min.