

Supplementary Material

Green Synthesized Silver Nanoparticles Immobilized on Activated Carbon Nanoparticles: Antibacterial Activity Enhancement Study and Its Application on Textiles Fabrics

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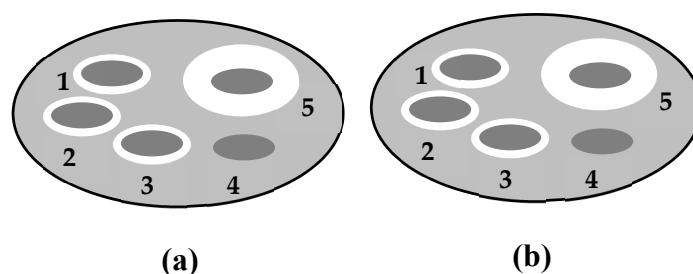


Figure S1. Schematic illustration of the antibacterial properties test of the fabricated ACNPs, AgNPs, and AgNPs-immobilized ACNPs. (a). Petri dish loaded with *E. coli* bacterial solid culture, (b). Petri dish loaded with *S. aureus* bacterial solid culture, (1). Whatman filter paper wetted with ACNPs, (2) that soaked with AgNPs, (3) flowed with AgNPs-immobilized ACNPs, (4). Whatman filter paper washed with distilled water (negative control), no clear zone generated, (5). Whatman filter paper wetted with antibiotic amoxicillin (positive control) with the broadest clear area. A clear spot with various wide was generated around samples 1, 2, and 3.

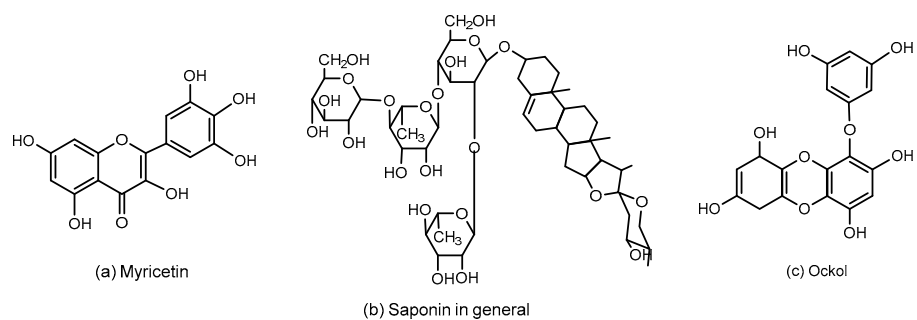


Figure S2. Representative molecular structure of (a) flavonoid⁴¹, (b) saponin^{42–43}, and (c) tannin⁴⁴.

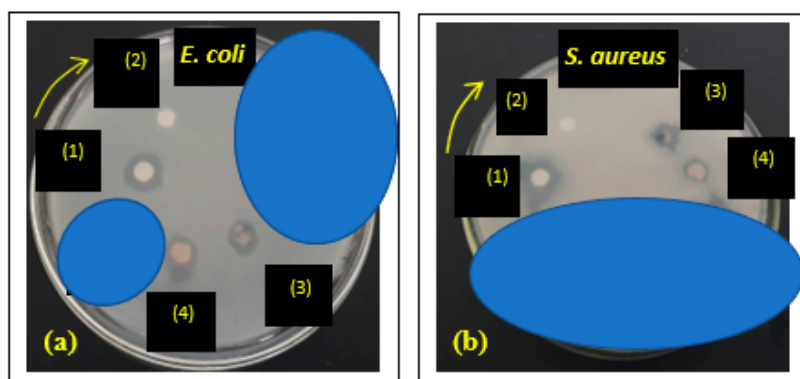


Figure S3. Antibacterial activity test towards (a) *E. coli*, (b) *S. aureus*. Here (1). Amoxicillin antibiotic (positive control), (2) Distilled water (negative control), (3). AgNPs-immobilized ACNPs; (4). AgNPs.

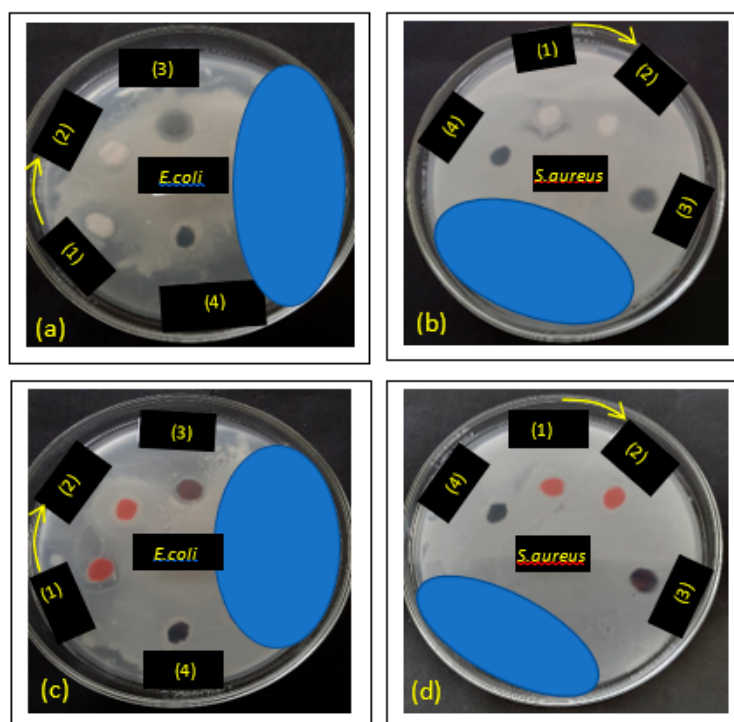


Figure S4. Antibacterial activity test for cotton fabrics towards (a) *E. coli*; (b) *S. aureus*; and polyester fabrics towards (c) *E. coli*; (d) *S. aureus*. Here, (1). Wetted with amoxiciline (positive control); (2). Wetted with distilled water (negative control); (3). Wetted with AgNPs-incorporated ACNPs of 5% w/v in concentration; (4). Wetted with ACNPs of 5% w/v in concentration.

Table S1. Assignment of the synthesized AgNPs FTIR spectra, in detail.

FTIR spectra		Represented Atomic Bonds Vibration	References Number
Wavenumber Peaks/cm ⁻¹	References		
3843	3744–3943	free O-H stretching of water vapor	[40]
3372	3431	bonded O-H stretching of phenol	[38,39]
	3427–3436	bonded O-H stretching	[36]
	3423,15	free O-H stretching of phenol	[37]
	3420,77	free O-H stretching of alcohol	[37]
2925	2922	C-H aliphatic stretching	[38,39]
1742	1744	C=O stretching	[36,38,39]
1623	1630,32; 1631,43	C=C aromatics stretching	[37]
1312	1375	N-O stretching	[38,39]
1033	1034	C-O stretching	[36]
605	616–672, 522–575	C-C aliphatic bending	[36]
	593–630	N=O stretching	[40]

Table S2. Completely summary of the clear zone generated around the textile fabric disks, which wetted with the stated materials and positioned on *E. coli* and *S. aureus*'s bacterial culture.

Textile Fabrics Wetted With Materials of 1% w/v in Concentration		Clear Zone			
		<i>E. coli</i>		<i>S. aureus</i>	
		Radius/mm	% Antibacterial Activity*	Radius/mm	% Antibacterial Activity *
Cotton	ACNPs	0	0	0	0
	AgNPs-immobilized ACNPs	0	0	0	0
	Amoxicillin (positive control)	70	21	180	55.73
	Distilled water (negative control)	0	0	0	0
Polyester	ACNPs	0	0	0	0
	AgNPs-immobilized ACNPs	0	0	0	0
	Amoxicillin (positive control)	323	100	204	63.16
	Distilled water (negative control)	0	0	0	0

* % Antibacterial activity = (Clear zone generated around the material tested ÷ The most expansive clear area developed around positive control) × 100 %

Textile fabrics wetted with materials of 5% w/v in concentration		Clear Zone			
		<i>E. coli</i>		<i>S. aureus</i>	
		Radius/mm	% Antibacterial Activity *	Radius/mm	% Antibacterial Activity *
Cotton	ACNPs	0	0	0	0
	AgNPs-immobilized ACNPs	2.00	19.23	1.40	13.36
	Amoxicillin (positive control)	10.40	100	8.50	81.73
	Distilled water (negative control)	0	0	0	0
Polyester	ACNPs	0	0	0	0
	AgNPs-immobilized ACNPs	3.30	31.73	2.20	21.15
	Amoxicillin (positive control)	8.30	79.81	7.90	75.96
	Distilled water (negative control)	0	0	0	0

* % Antibacterial activity = (Clear zone generated around the material tested ÷ The most expansive clear area developed around positive control) × 100 %

Textile fabrics wetted with materials of 10% w/v in concentration		Clear zone			
		<i>E. coli</i>		<i>S. aureus</i>	
		Radius/mm	% Antibacterial activity*	Radius/mm	% Antibacterial activity*
Cotton	ACNPs	0	0	0	0
	AgNPs-immobilized ACNPs	0.00	0.00	0.00	0.00
	Amoxicillin (positive control)	204	63.16	323	100
	Distilled water (negative control)	0	0	0	0
Polyester	ACNPs	0	0	0	0
	AgNPs-immobilized ACNPs	0.00	0.00	0.00	0.00
	Amoxicillin (positive control)	255	78.95	100	30.96
	Distilled water (negative control)	0	0	0	0

* % Antibacterial activity = (Clear zone generated around the material tested ÷ The most expansive clear area developed around positive control) × 100 %