Supplementary Material

Highly Efficient Performance of Activated Carbon Impregnated with Ag, ZnO and Ag/ZnO nanoparticles as Antimicrobial Materials

Prashantha Kumar T.K.M[a], Triveni R. Mandlimath[a], P. Sangeetha[a], P.Sakthivel[a], S.K. Revathi[a] S.K. Ashok Kumar[a*] and Suban K Sahoo[b]

[a] Materials Chemistry Division, School of Advanced Science, VIT University, Vellore-632014, India. Phone and Fax: +914162202352; +91 4162243092

E-mail: ashokkumar.sk@vit.ac.in

[b] Department of Applied Chemistry, SV National Institute Technology, Surat, Gujarat, India.

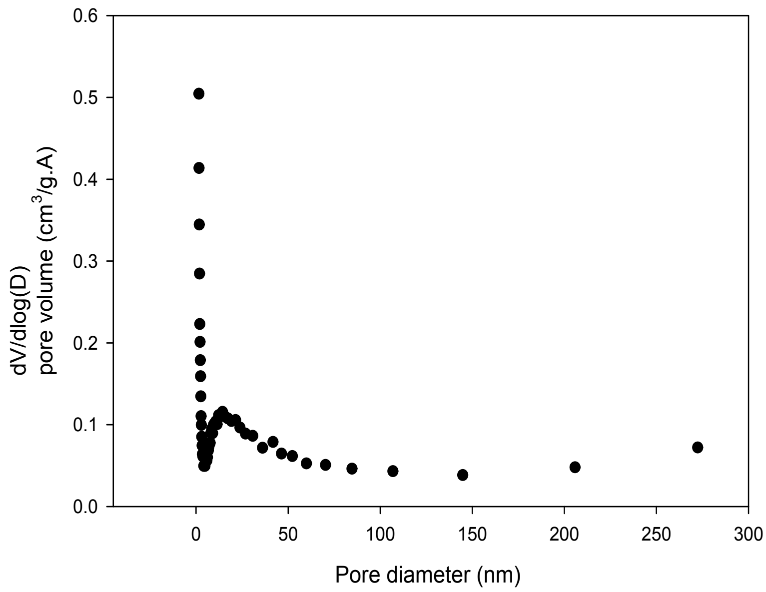


Fig.1S: The pore size distributions for AC (HJ method)

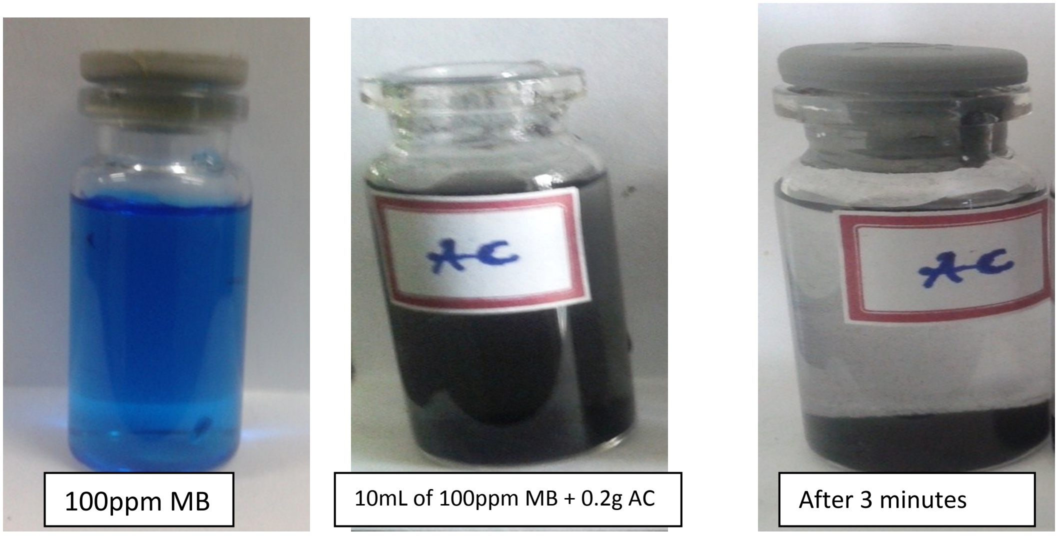


Fig. 2S: Methylene blue (MB) dye adsorption study

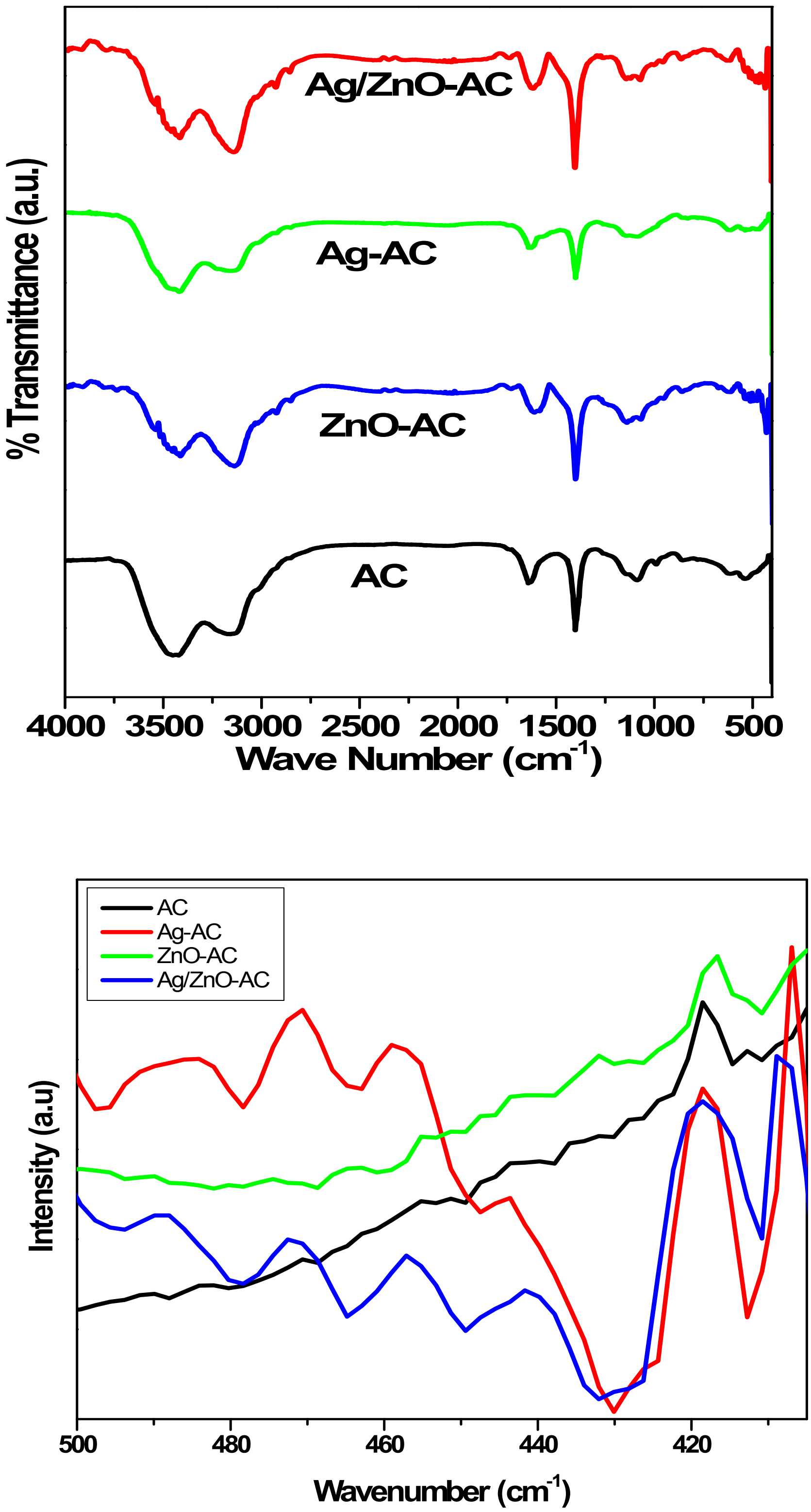


Fig. 3S: FTIR spectra of AC, Ag-AC, ZnO-AC and Ag/ZnO-AC nanohybrid material

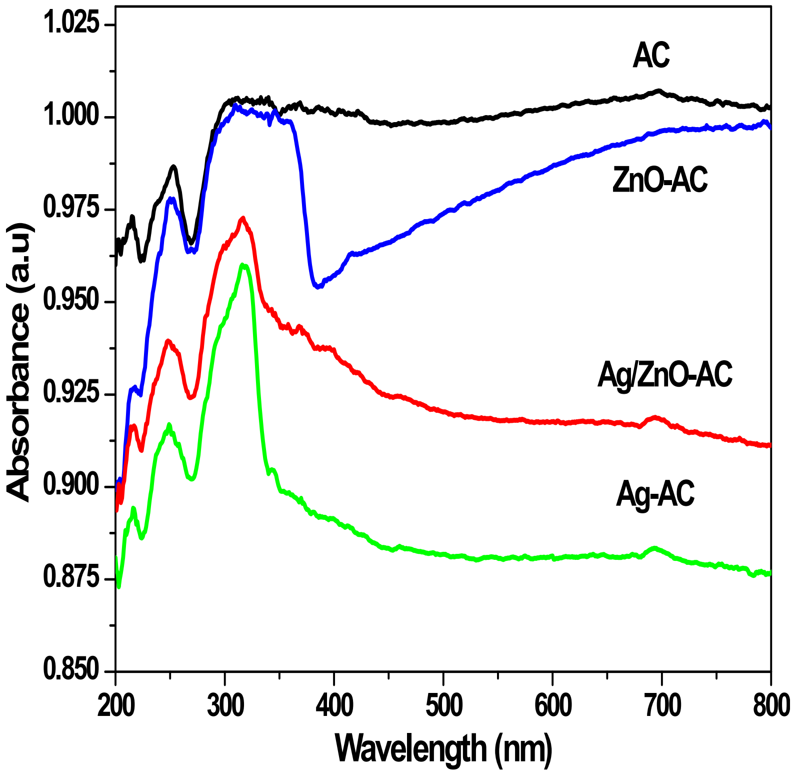


Fig. 4S: DRS spectra of AC, Ag-AC, ZnO-AC and Ag/ZnO-AC nanohybrid material

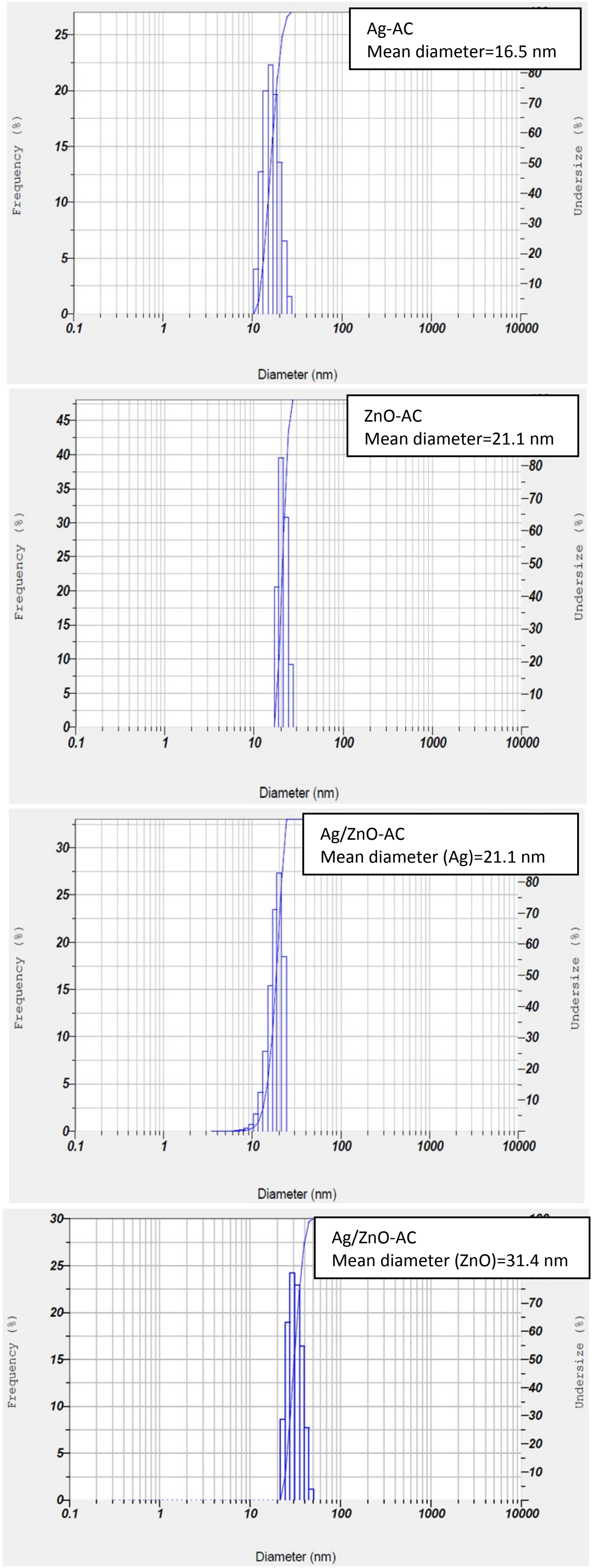


Fig. 5S: DLS characterization of Ag-AC, ZnO-AC and Ag/ZnO-AC nanohybrid materials

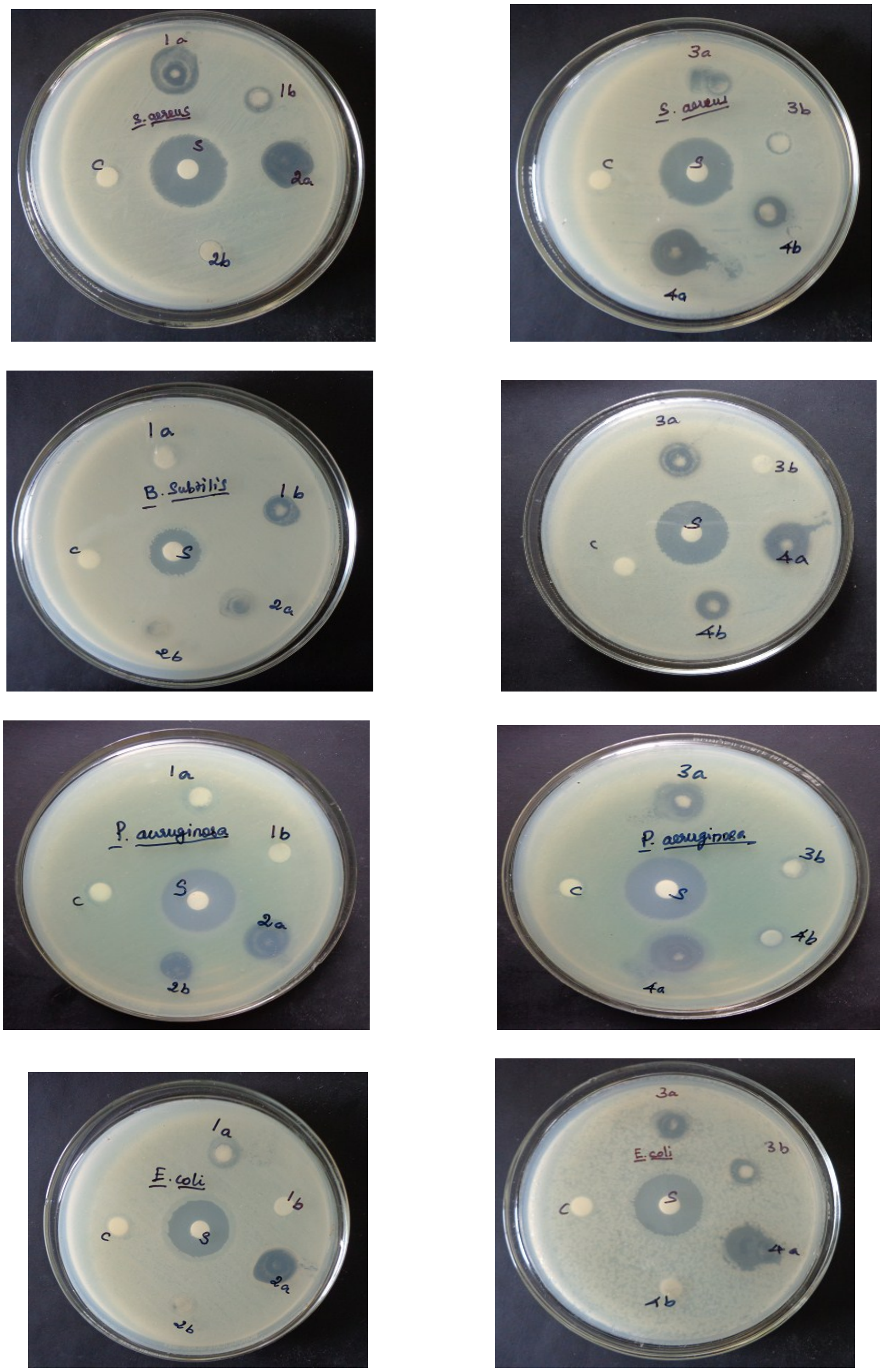
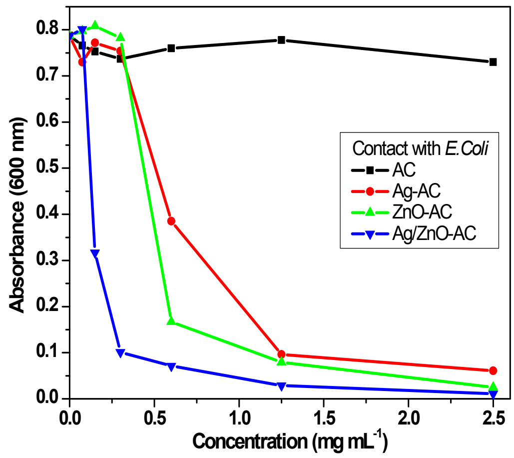


Fig. 6S: Antibacterial test for inhibition zones of 1(AC), 2(Ag-AC), 3(ZnO-AC) and 4(Ag/ZnO-AC) against selected microorganisms at different concentrations of nanohybrid materials (a-2000μg, b-1000μg).



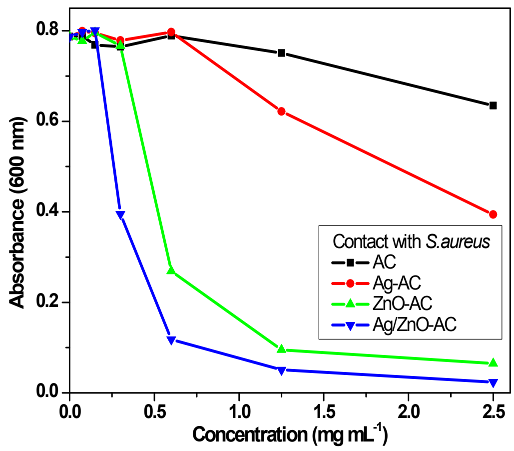
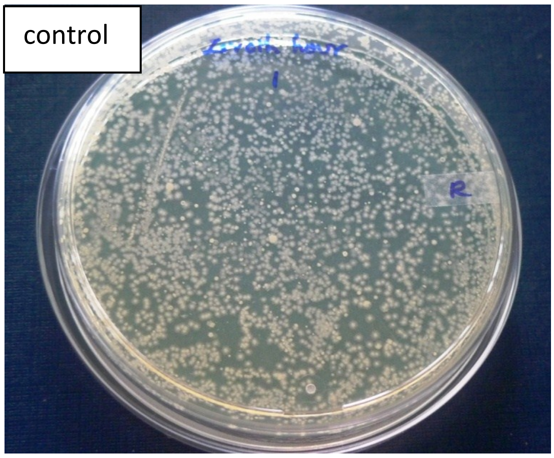
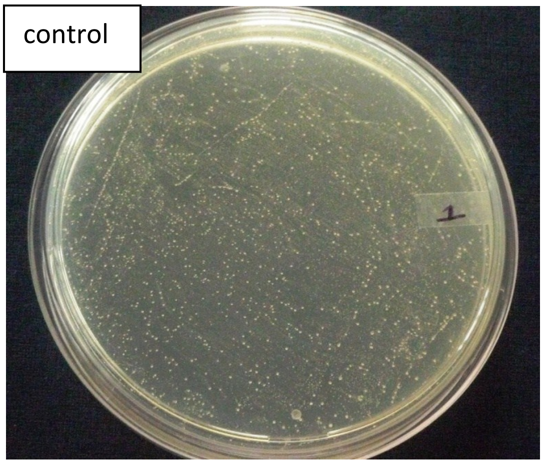
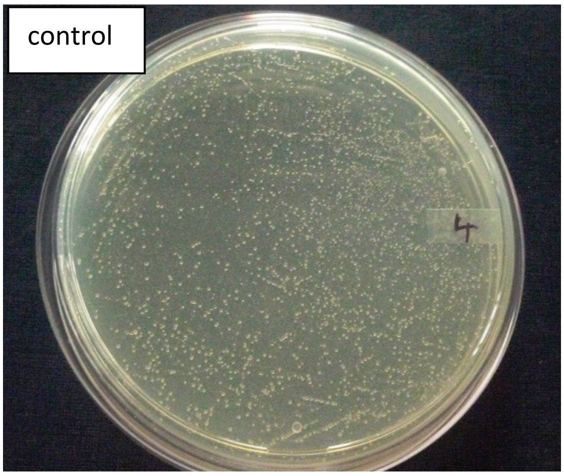
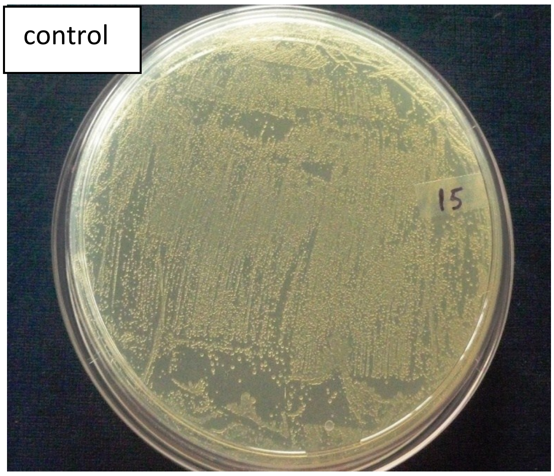


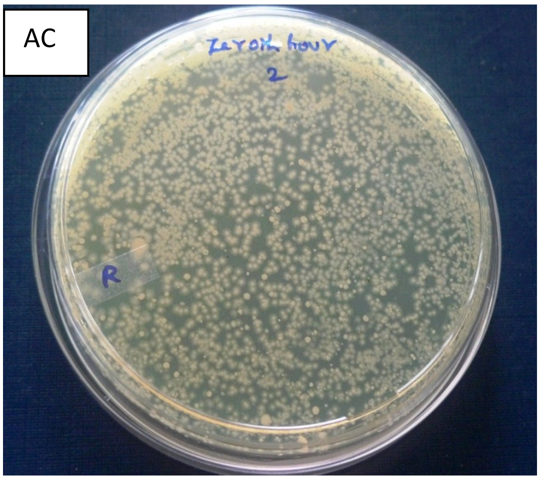
Figure 7S: MIC test performance using AC, Ag-AC, ZnO-AC and Ag/ZnO-AC nanohybrid materials *on E. Coil* and *S.aureus* microorganism

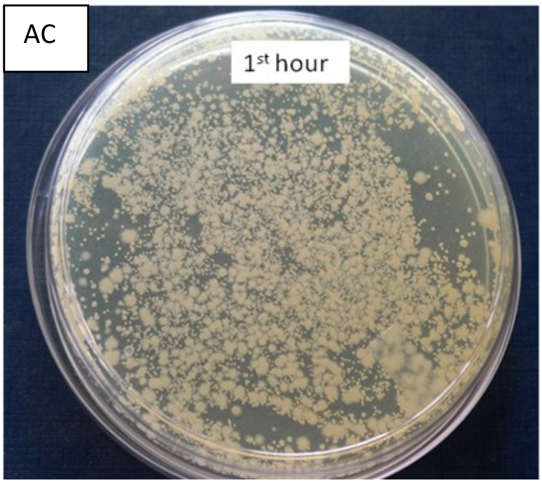

control
1
R

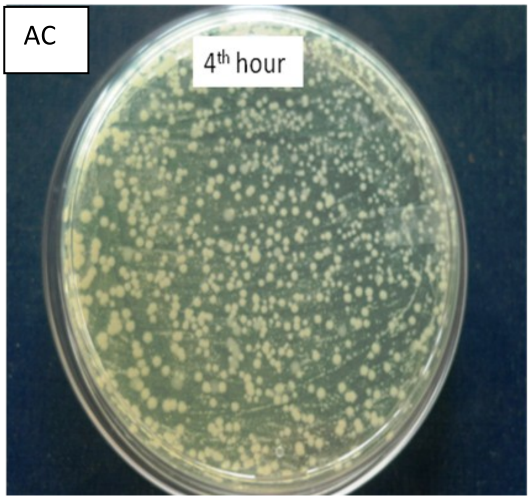

control
1

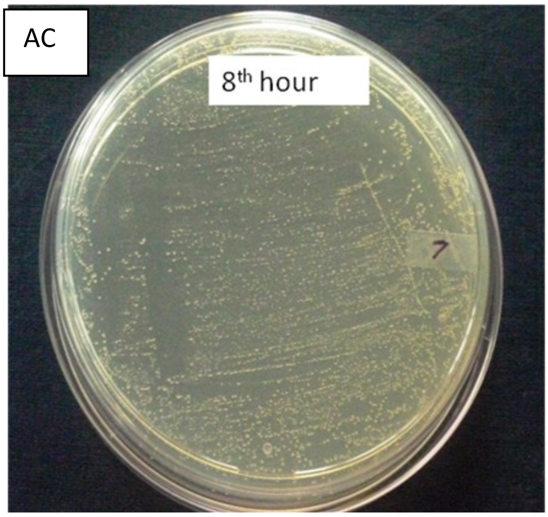

control
4

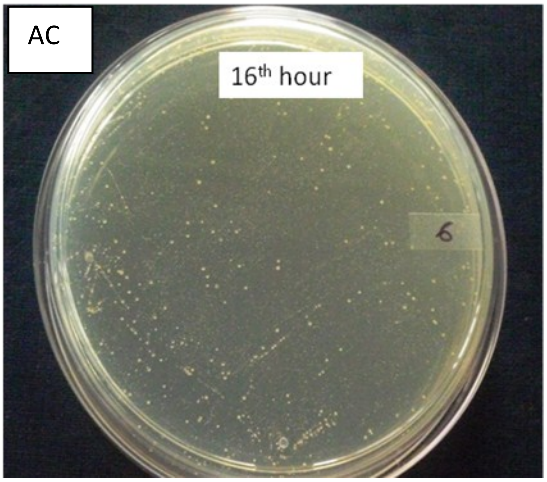

control
15

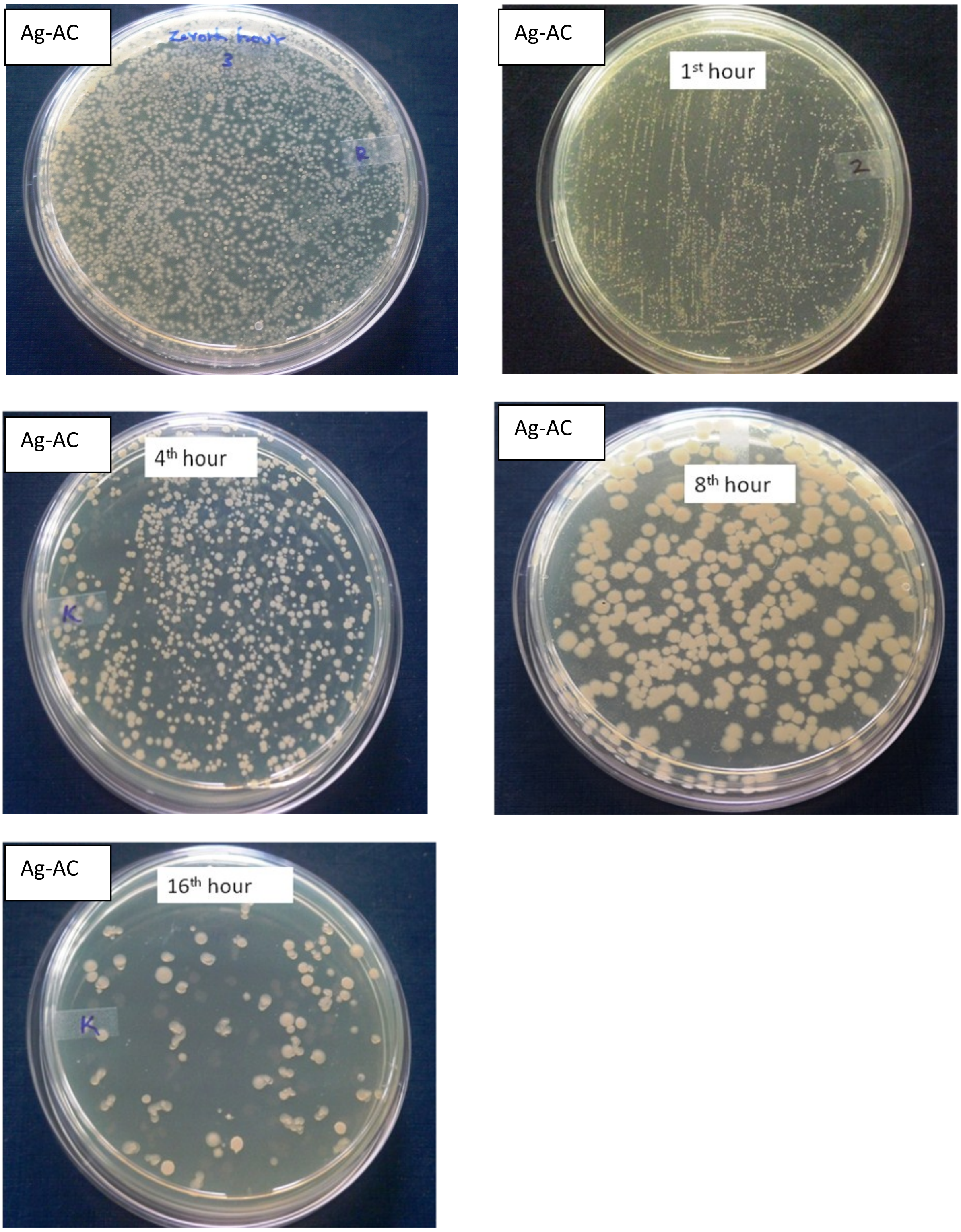

AC

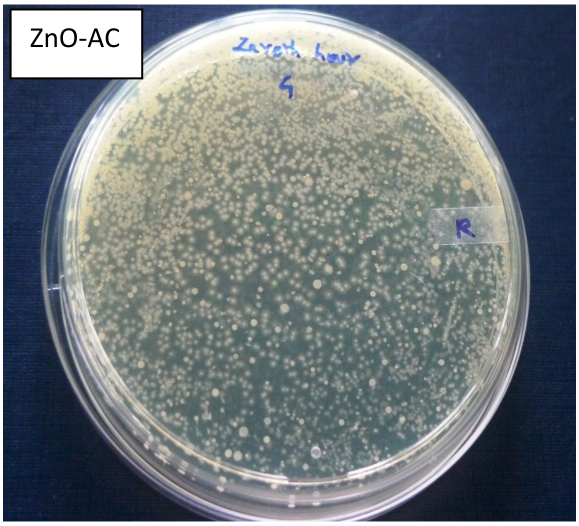

AC
1st hour

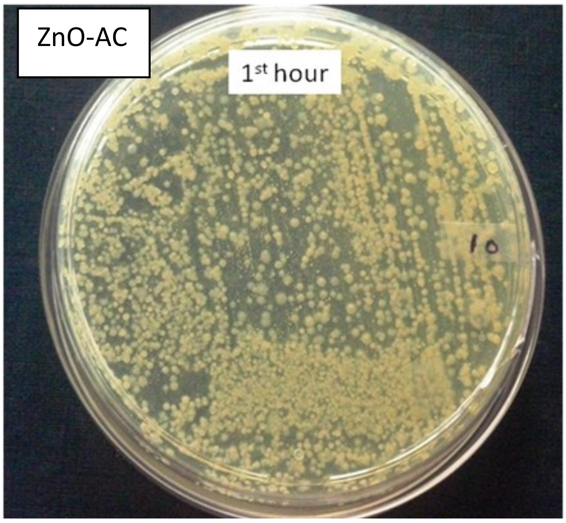

AC
4th hour

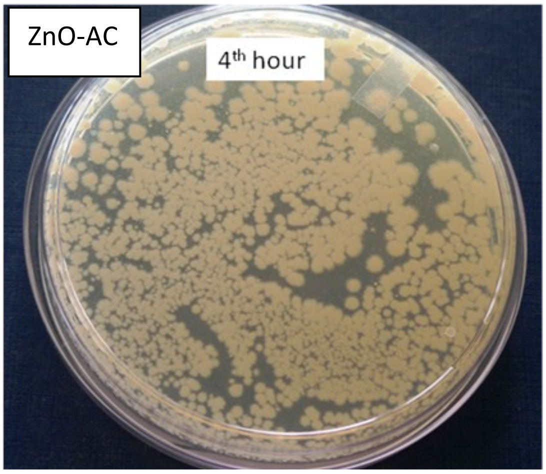

AC
8th hour

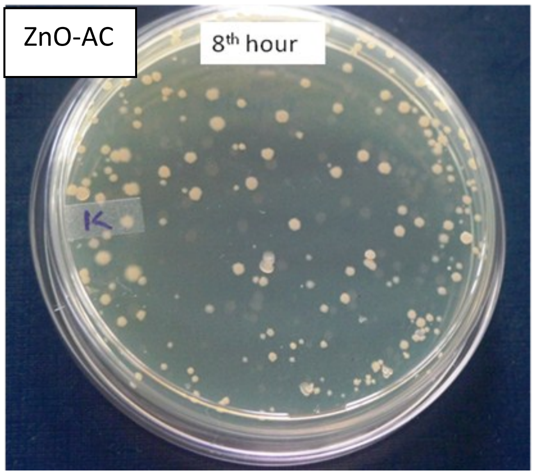

AC
16th hour

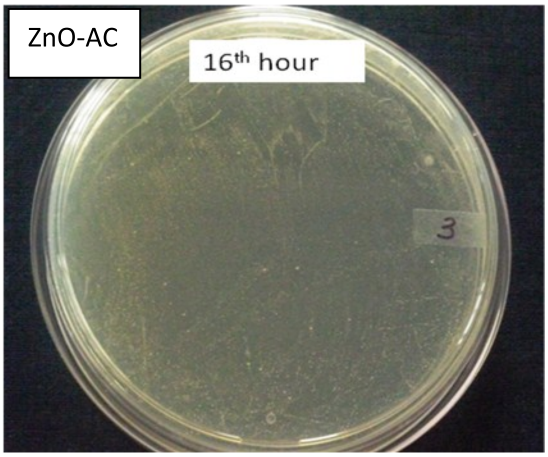

Ag-AC
Ag-AC
1st hour
Ag-AC
4th hour
Ag-AC
8th hour
Ag-AC
16th hour


ZnO-AC


ZnO-AC
1st hour


ZnO-AC
4th hour


ZnO-AC
8th hour


ZnO-AC
16th hour

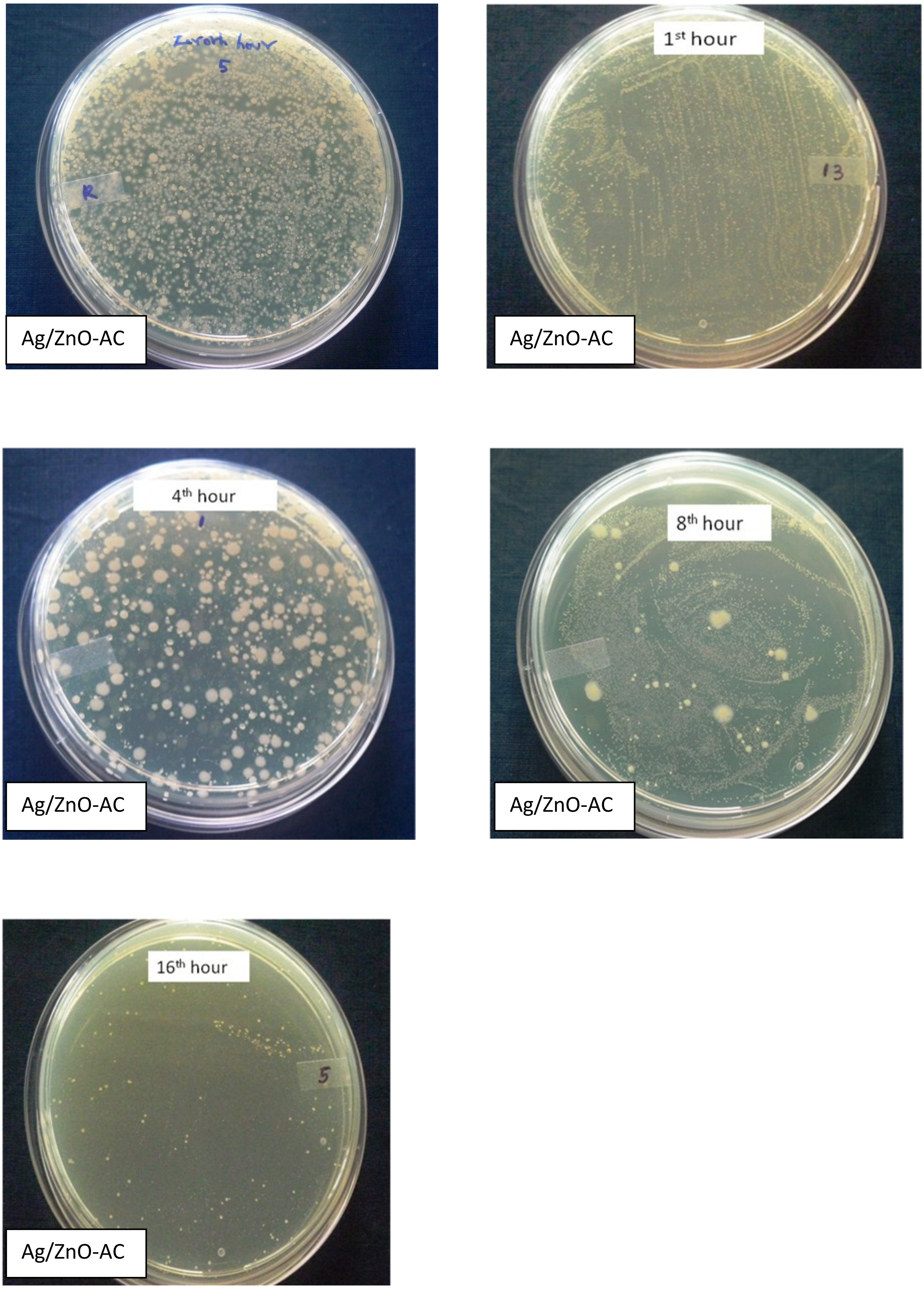


Fig. 8S: Time-kill kinetics performed in fresh MHB with control, AC, Ag-AC, ZnO-AC and Ag/ZnO-AC nanohybrid materials

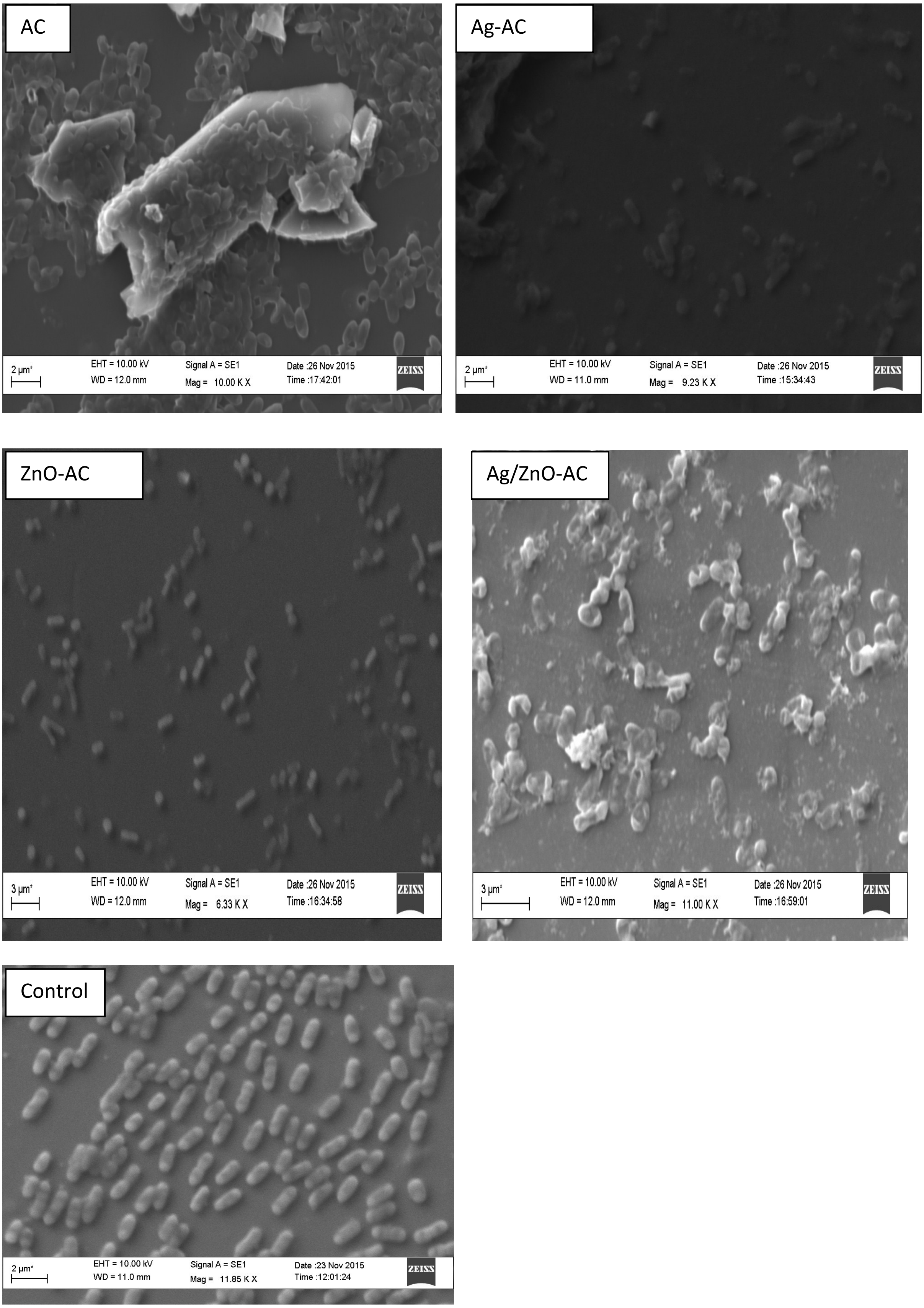


Fig. 9S: SEM images of *E. coil* taken after 24h treatment with nanohybrid maerials

Table 1S: MIC and MBC values of the nanohybrid materials

Name of the Samples	MIC mg/ml		MBC mg/ml	
	E.coli	*S. aureus*	*E.coli*	*S. aureus*
AC	>2.50	2.50	>3.0	>2.5
Ag-AC	0.6	1.25	1.2	>2.5
ZnO-AC	0.52	0.51	0.65	0.92
Ag/ZnO-AC	0.20	0.3	0.35	0.6

Table 2S: Assessment of reported work with other reports

S. No.	Name of the hybrid material	Method of preparation	Characterization techniques used	Applications
1	Ag/ZnO/C[59]	Calcination and photo deposition route	XRD, EDS, TEM, Uv-vis DRS	Photocatalyst (degradation of tetracycline hydrochloride
2	Ag/ZnO-clay[60]	Microwave-assisted synthesis	XRD, BET, TEM, FTIR	Antibacterial material
3	Ag/ZnO thin films (supported on glass substrate)[61]	RF sputtering method	XRD, FESEM, XPS, UV-vis DRS	Photodegradation of 2-chlorophenol
4	Ag/ZnO-AC[62]	Adsorption method	XRD, SEM, FT-IR, Raman and DRS	Photocatalyst (degradation of methyl orange.)
5	Graphene–Ag/ZnO[63]	Solvothermal process	XRD, FESEM, PL, XPS, and UV-vis DRS	The photocatalytic degradation of MB, MO and Rhodamine B
6	Ag/ZnO/ GO[64]	Hydrothermal method,	XRD, FESEM, PL, XPS, and UV-vis DRS	Photodegradation of methylene blue
7	Ag–ZnO/RGO[65]	Hydrothermal	XRD, FESEM, TEM, PL, XPS, and UV-vis DRS	The photocatalytic degradation of MB and RB5. Antibacterial material
5	Ag/ZnO-AC **Present study**	Sol-gel	XRD, BET, SEM, TEM, FTIR and EDX	Antibacterial material