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Antibacterial and anticancer activities of three novel lectin conjugated chitosan nanoparticles.

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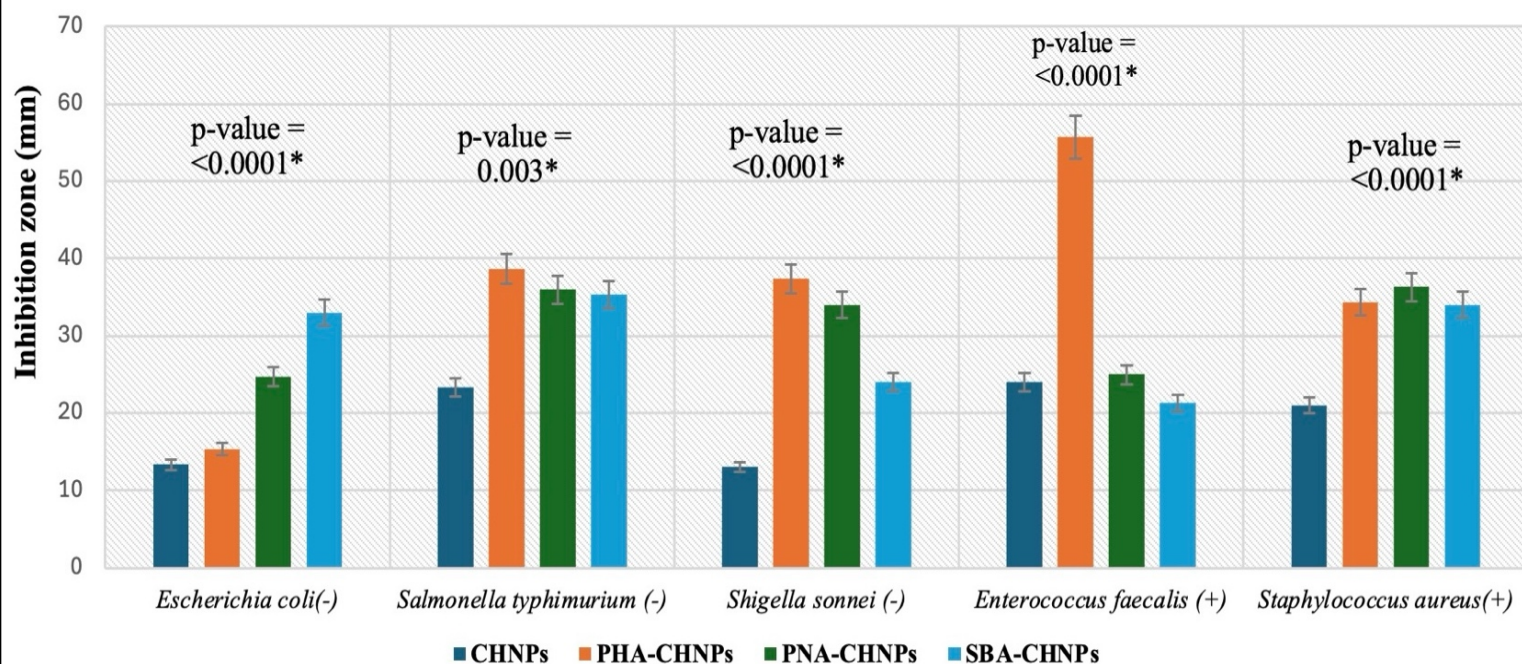**Antibacterial activity by agar well diffusion**

Figure S1 shows the antibacterial activity of chitosan nanoparticles (CHNPs) of concentration 10 mg/ml and three lectins conjugated chitosan nanoparticles (PHA-CHNPs, SBA-CHNPs, and PNA-CHNPs) using 400 µl of glutaraldehyde (%25) against five tested strains Gram-negative bacteria (-) and Gram-positive bacteria. Statistically significant results were observed in all cases, as indicated by the p-values ($p < 0.05$).
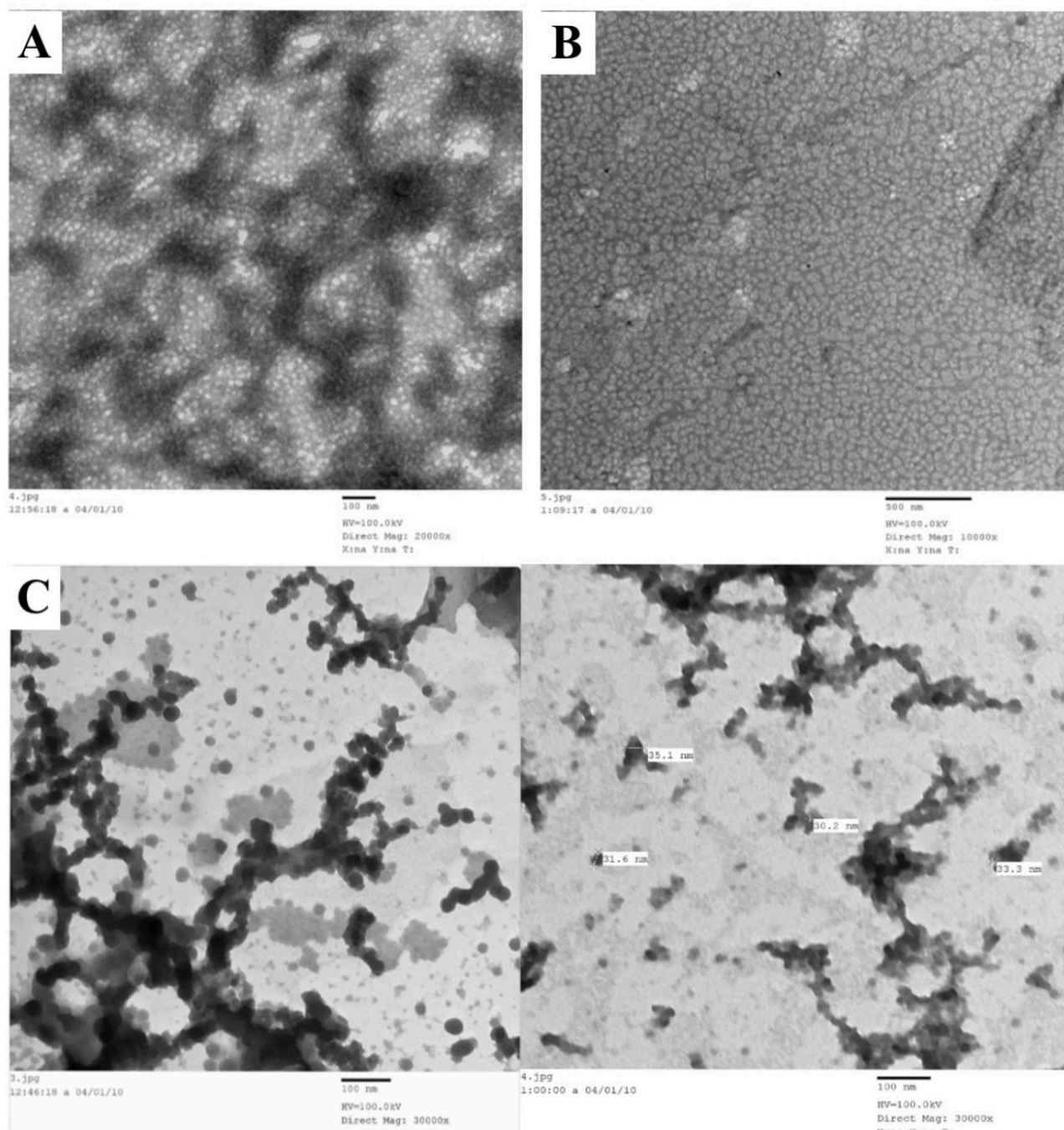
Figure S2 shows TEM photomicrographs of **A** = chitosan nanoparticles; **B**= pure lectins (PHA); and **C** = lectin conjugated chitosan nanoparticles **(PHA-CHNPs)** using 400 µl of 0.25% glutaraldehyde. PHA = phytohaemagglutinin lectin.
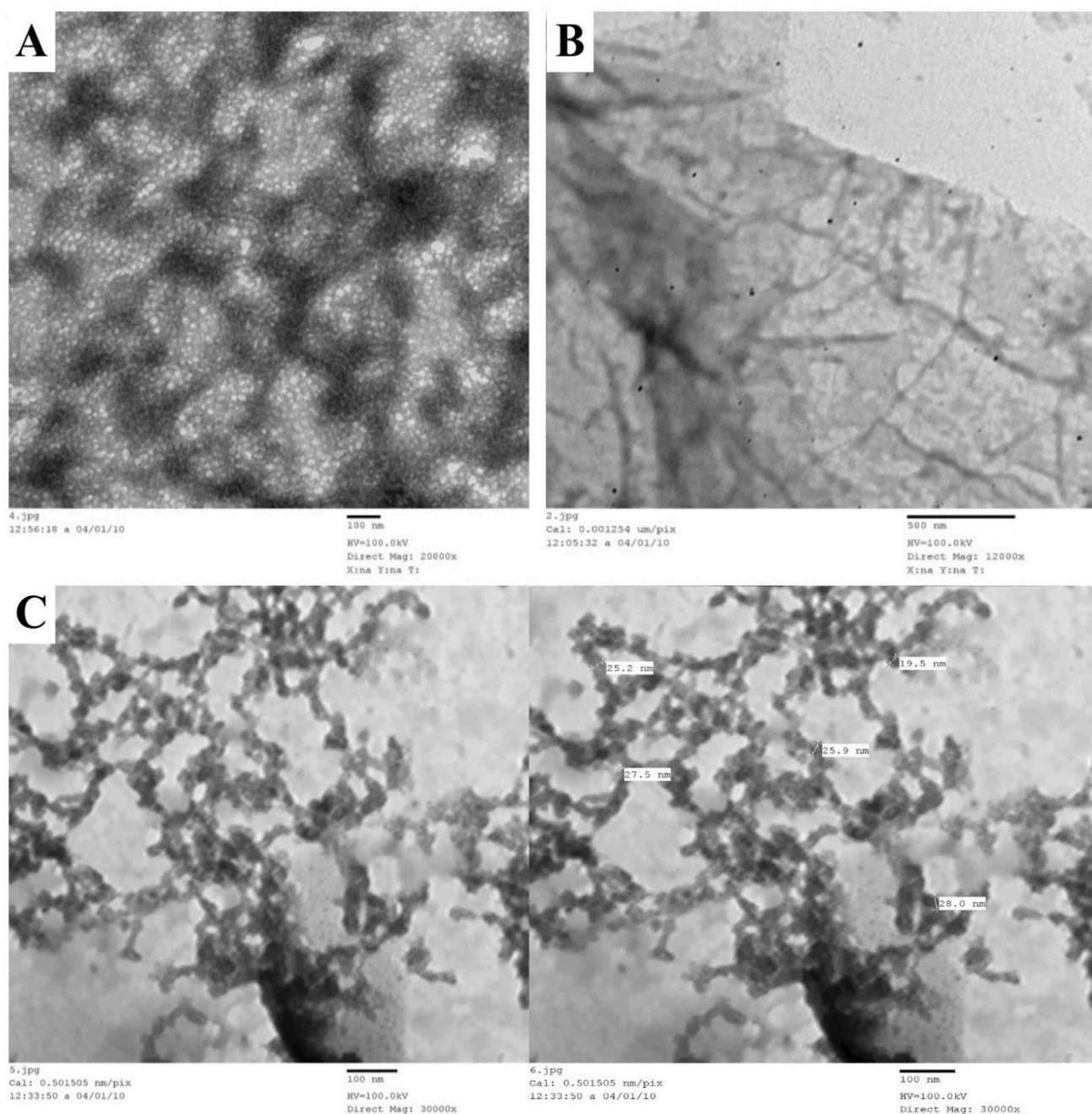
Figure S3 shows TEM photomicrographs of **A** = chitosan nanoparticles; **B**= pure lectins (PHA); and **C** = lectin conjugated chitosan nanoparticles **(PNA-CHNPs)** using 400 µl of 0.25% glutaraldehyde. PNA = peanut agglutinin lectin.
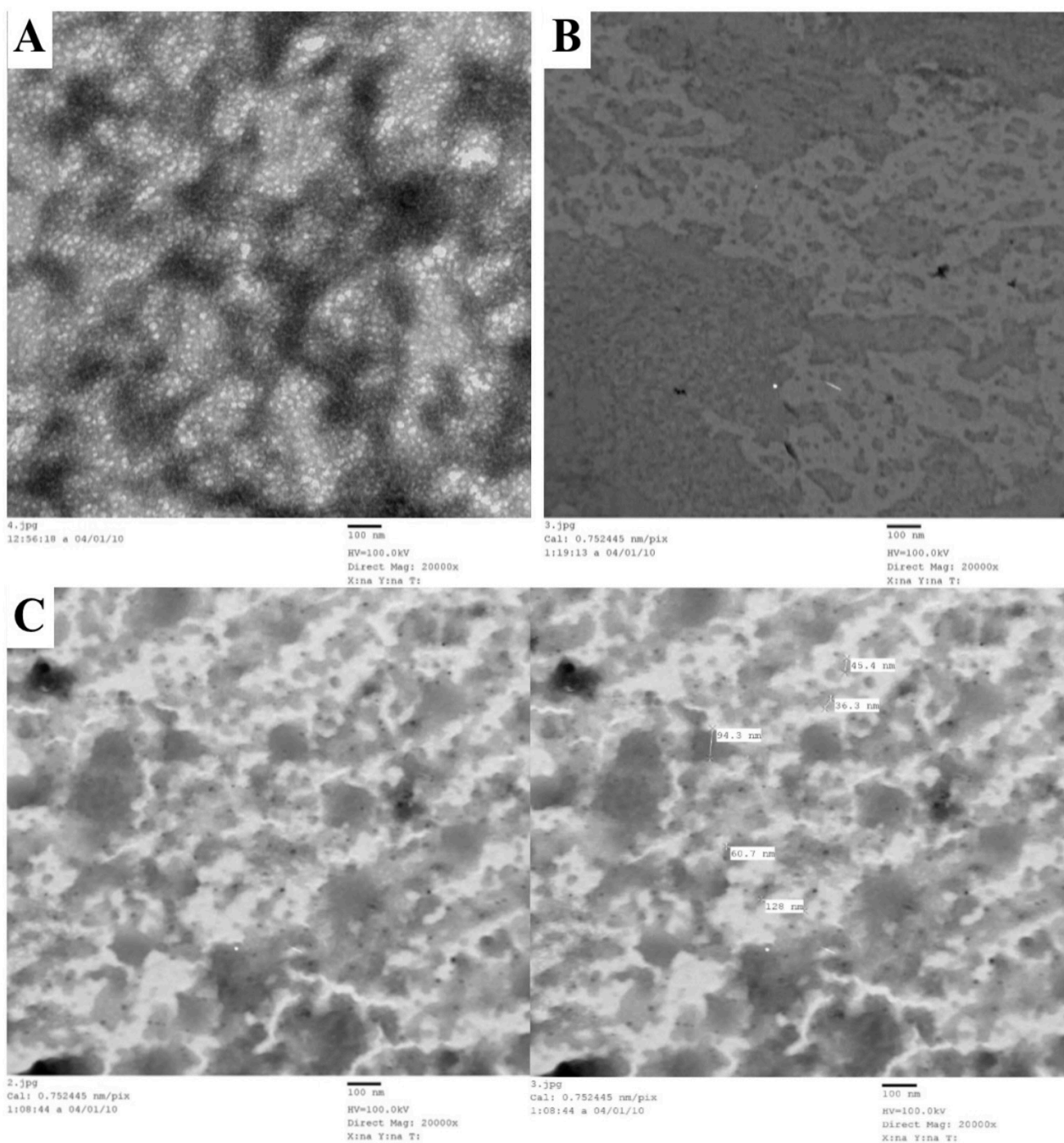
Figure S4 shows TEM photomicrographs of **A** = chitosan nanoparticles; **B**= pure lectins (PHA); and **C**= lectin conjugated chitosan nanoparticles **(SBA-CHNPs)** using 400 µl of 0.25% glutaraldehyde. SBA = soybean agglutinin lectin.
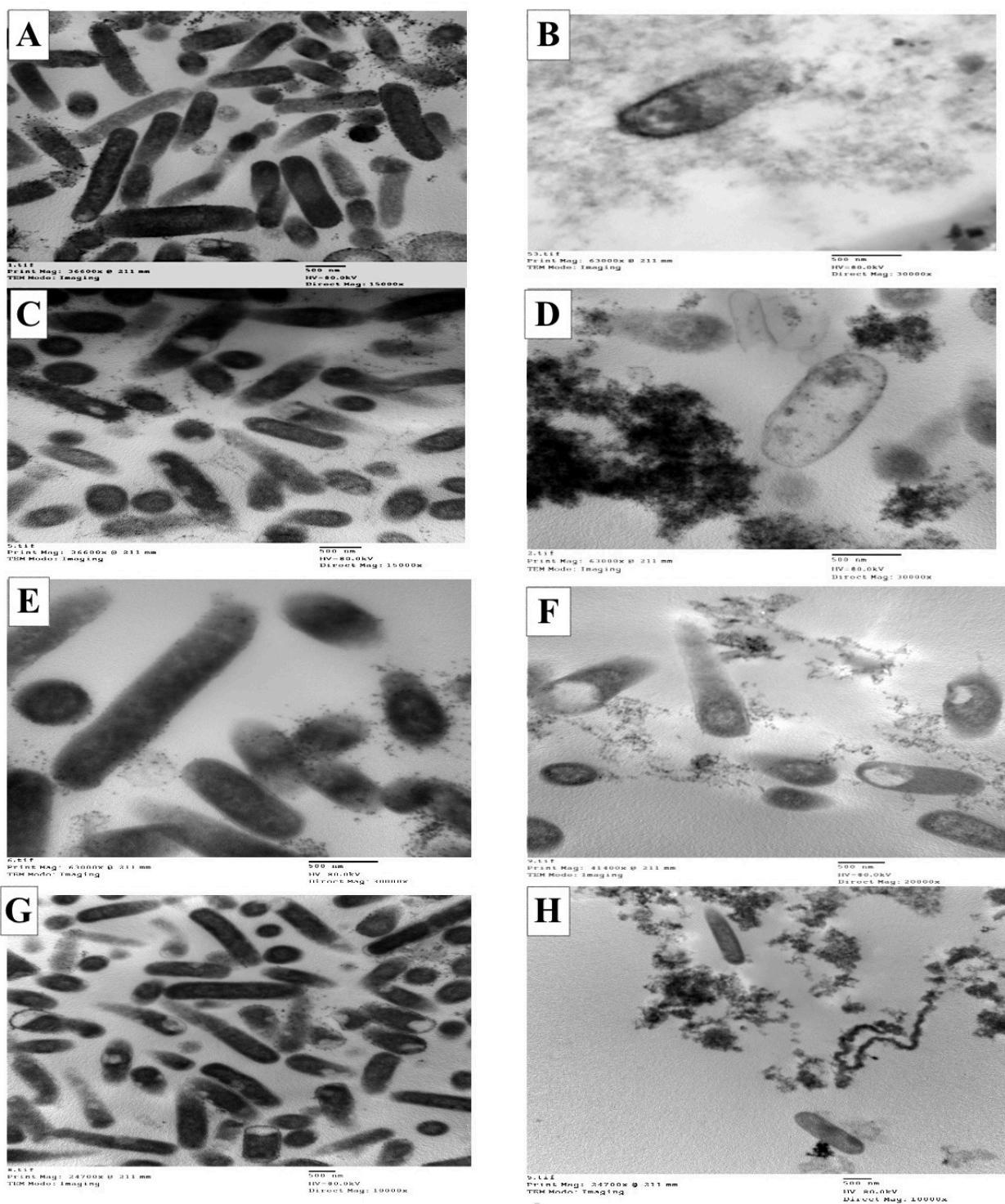
Figure S5 shows TEM photomicrographs of *Escherichia coli,* **A**= control without treatmeant , **B**=chitosan nanoparticles; **C, E, G**= pure lectins PHA, PNA, and SBA respectively; **D, F, H**=lectins conjugated chitosan nanoparticles PHA-CHNPs, PNA-CHNPs, and SBA-CHNPs respectively using 400 µl of 0.25% glutaraldehyde. PHA = Phytohaemagglutinin lectin, PNA= Peanut agglutinin lectin, and SBA=Soybean agglutinin lectin.

Figure S6 shows TEM photomicrographs of *Salmonella Typhimurium,* **A=** control without treatmeant , **B**=chitosan nanoparticles; **C, E, G** = pure lectins PHA, PNA, and SBA respectively; **D, F, H** =lectins conjugated chitosan nanoparticles PHA-CHNPs, PNA-CHNPs, and SBA-CHNPs respectively using 400 µl of 0.25% glutaraldehyde. PHA = phytohaemagglutinin lectin, PNA= peanut agglutinin lectin, and SBA=soybean agglutinin lectin.
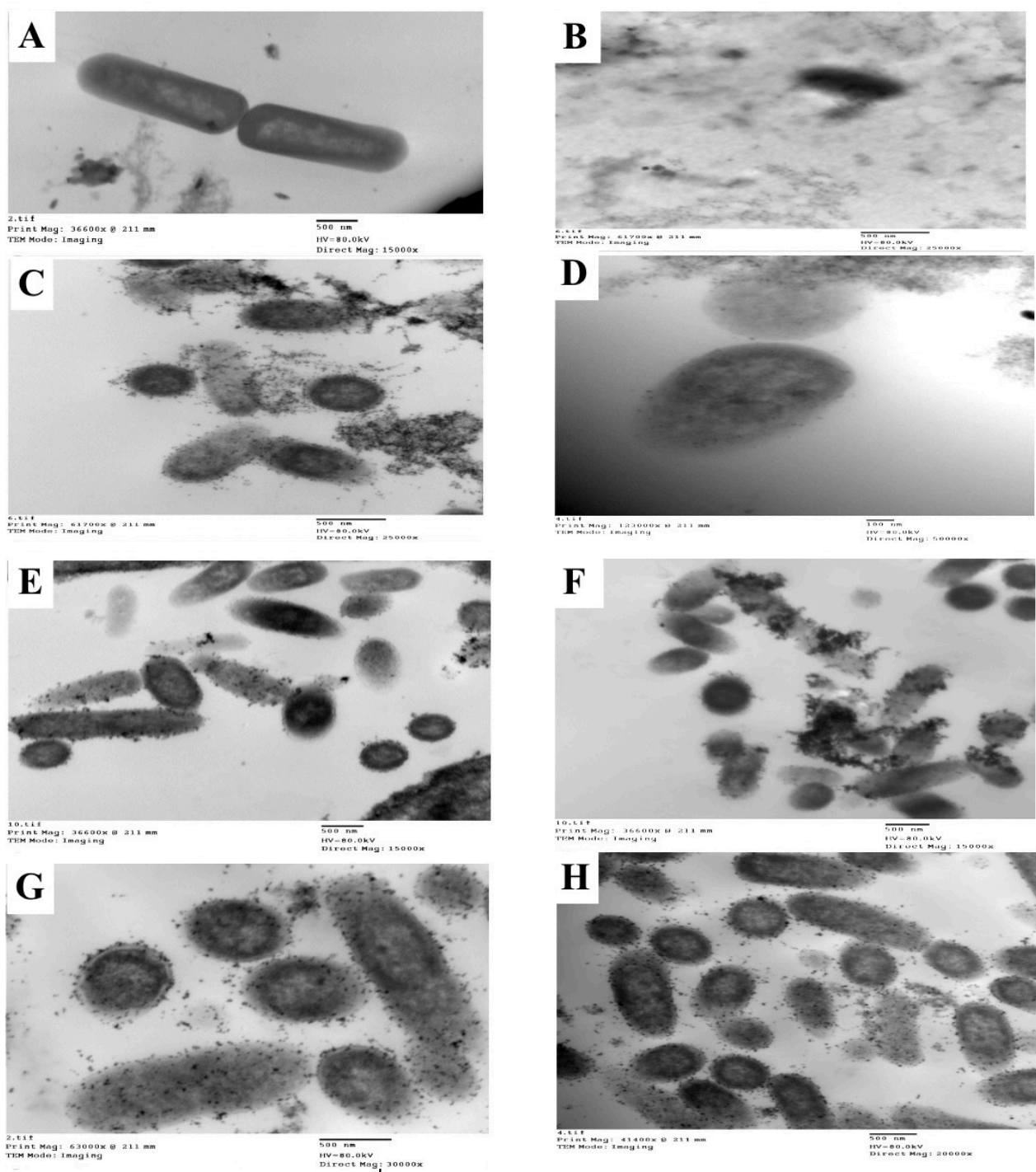
Figure S7 shows TEM photomicrographs of *Shigella Sonnei,* **A**= control without treatmeant , **B**=chitosan nanoparticles; **C, E, G** = pure lectins PHA, PNA, and SBA respectively; **D, F, H** =lectins conjugated chitosan nanoparticles PHA-CHNPs, PNA-CHNPs, and SBA-CHNPs respectively using 400 µl of 0.25% glutaraldehyde. PHA = phytohaemagglutinin lectin, PNA= peanut agglutinin lectin, and SBA=soybean agglutinin lectin.
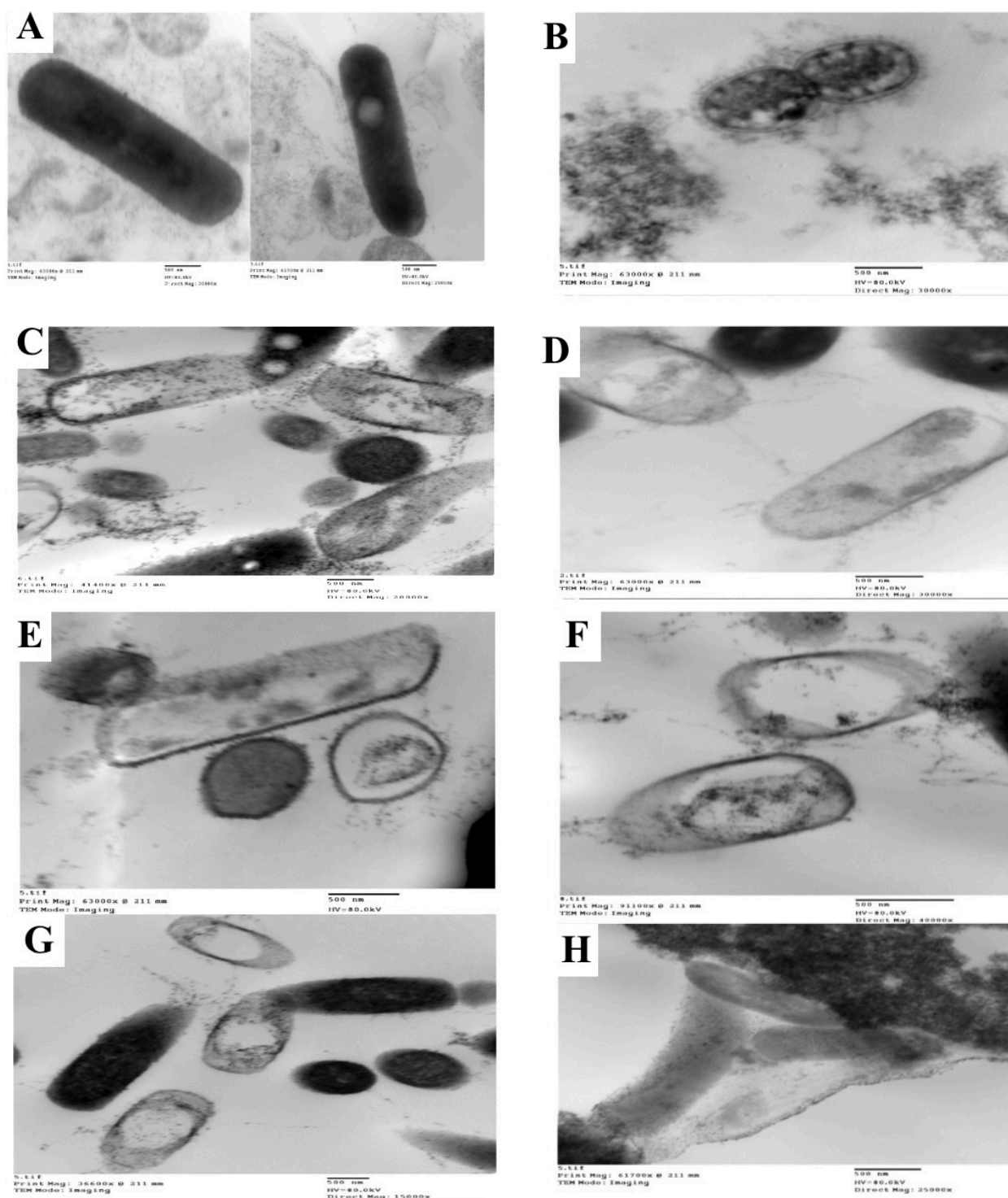
Figure S8 shows TEM photomicrographs of *Enterococcus faecalis,* **A**= control without treatmeant , **B**=chitosan nanoparticles **C, E, G** = pure lectins PHA, PNA, and SBA respectively; **D, F, H** =lectins conjugated chitosan nanoparticles PHA-CHNPs, PNA-CHNPs, and SBA-CHNPs respectively using 400 µl of 0.25% glutaraldehyde. PHA = phytohaemagglutinin lectin, PNA= peanut agglutinin lectin, and SBA=soybean agglutinin lectin.
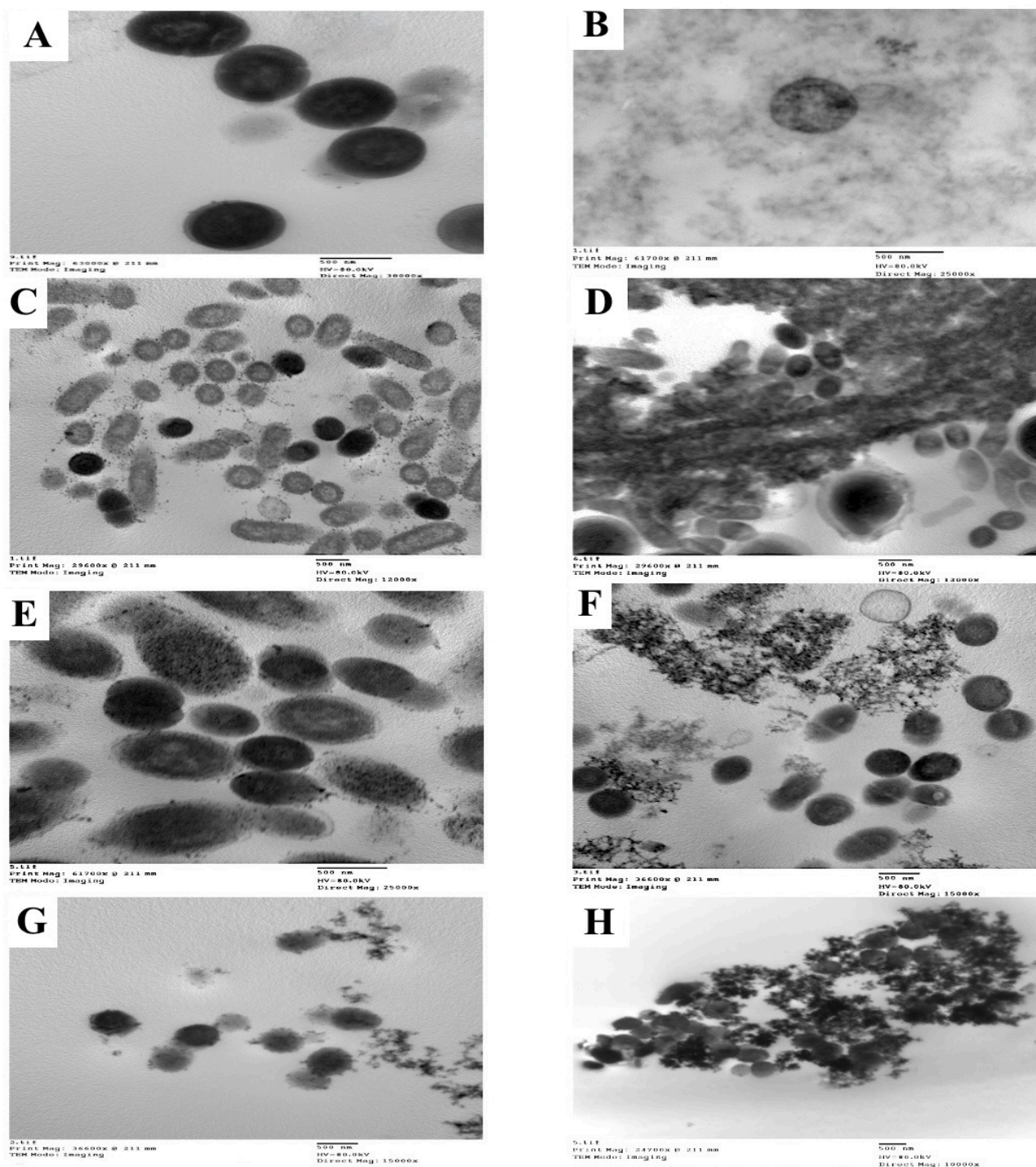
Figure S9 shows TEM photomicrographs of ***Staphylococcus aureus***, **A**= control without treatmeant , **B**=chitosan nanoparticles; **C, E, G** = pure lectins PHA, PNA, and SBA respectively; **D, F, H** =lectins conjugated chitosan nanoparticles PHA-CHNPs, PNA-CHNPs, and SBA-CHNPs respectively using 400 µl of 0.25% glutaraldehyde. PHA = phytohaemagglutinin lectin, PNA= peanut agglutinin lectin, and SBA=soybean agglutinin lectin.
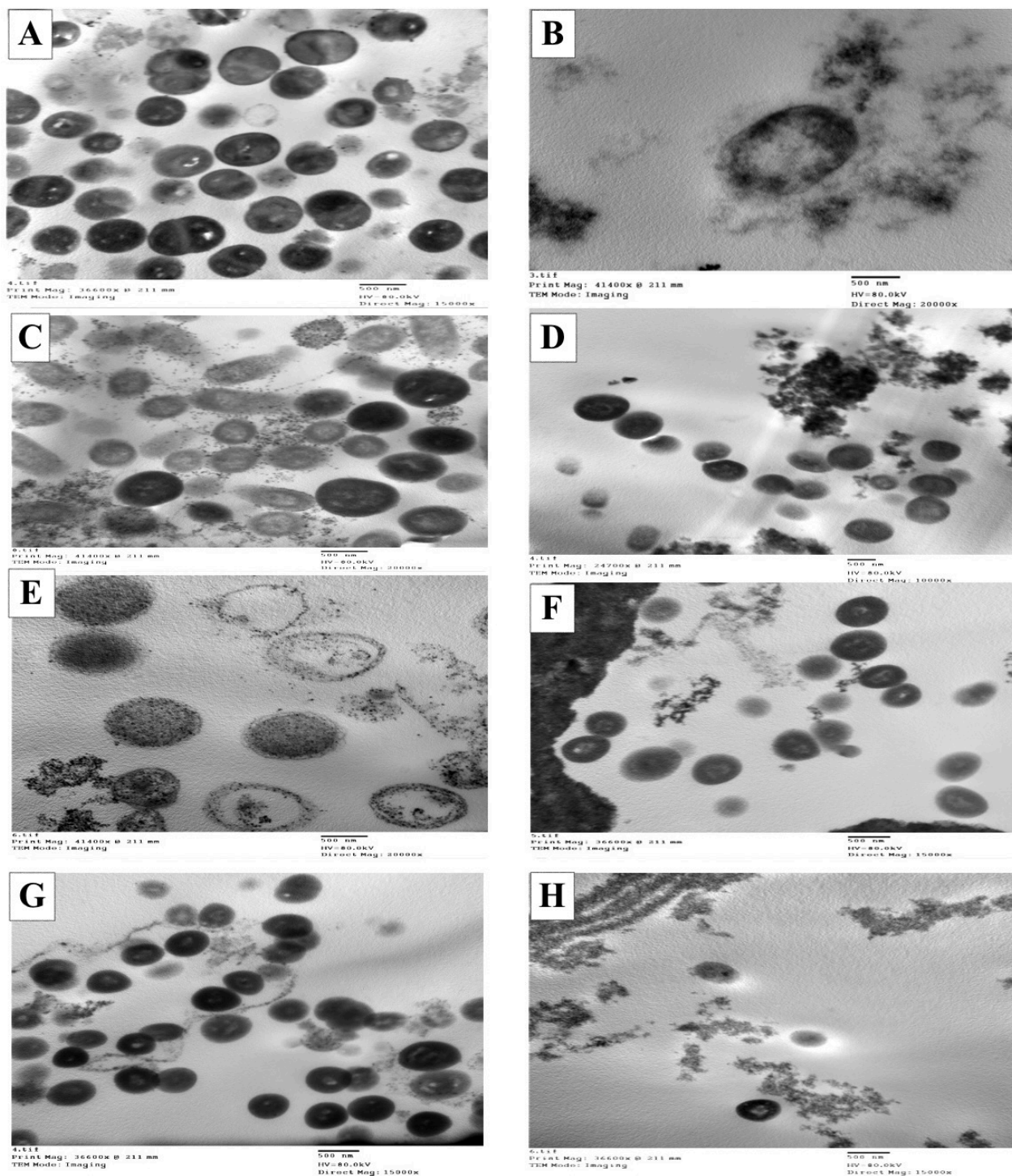
Table S1: Protein concentration of three lectins conjugated chitosan nanoparticles (PHA-CHNPs, PNA-CHNPs, and SBA-CHNPs) using three volumes (200, 300, and 400) of 0.25% glutaraldehyde after estimation by nanodrop technique.

Conjugates	Volumes of 0.25% glutaraldehyde	Concentration (mg/ml)
PHA -CHNPs	200	0.066
	300	0.146
	400	0.432
PNA -CHNPs	200	0.056
	300	0.181
	400	0.629
SBA- CHNPs	200	0.111
	300	0.254
	400	0.960

PHA-CHNPs = Phytohemagglutinin lectin conjugated chitosan nanoparticles
PNA-CHNPs = Peanut agglutinin lectin conjugated chitosan nanoparticles
SBA-CHNPs =Soybean agglutinin lectin conjugated chitosan nanoparticles

Table S2: Haemagglutination activity (HA) of three lectins conjugated chitosan nanoparticles (PHA-CHNPs, PNA-CHNPs, and SBA-CHNPs) using 400 μl of 0.25% glutaraldehyde against human blood groups A, B, AB, and O
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Conjugates	Human blood groups			
	A	B	AB	O
	Haemagglutination Activity (titer)			
PHA -CHNPs	256	128	128	256
PNA- CHNPs	8	8	16	8
SBA- CHNPs	32	32	64	16

PHA-CHNPs = Phytohemagglutinin lectin conjugated chitosan nanoparticles
PNA-CHNPs = Peanut agglutinin lectin conjugated chitosan nanoparticles
SBA-CHNPs =Soybean agglutinin lectin conjugated chitosan nanoparticles
Titer = The reciprocal of the heights dilution of protein solution showing visible hemagglutination.