EURACHEM WEEK 2022 – TBILISI, GEORGIA

16 MAY 2022 - 20 MAY 2022

Sampling technique of graphene oxide-based nano metal composites and their influence on pathogenic microorganisms

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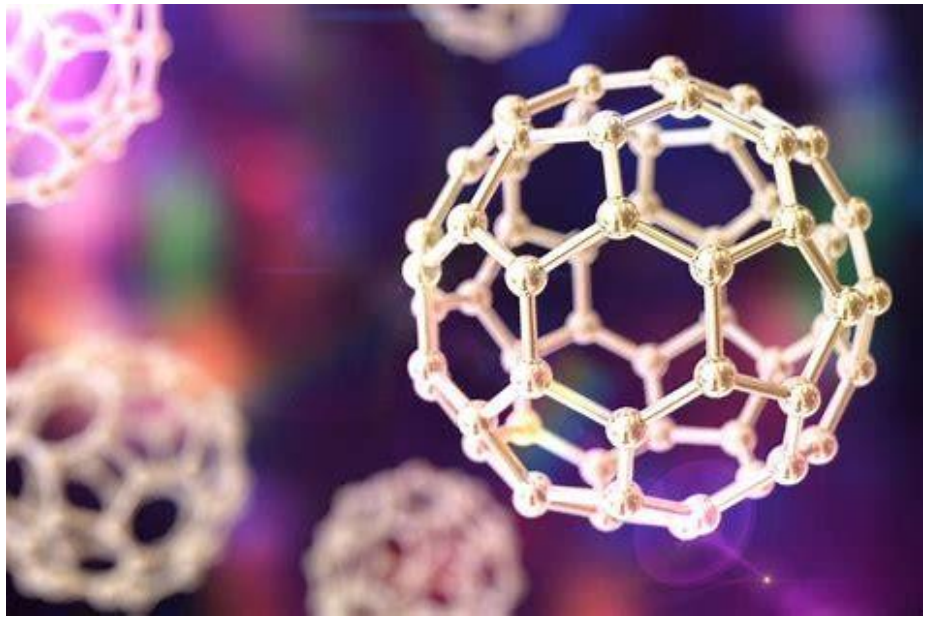
Presentation content

- INTRODUCTION
- SYNTHESIS OF RGO-AG , RGO-CU AND RGO-TIO2 COMPOSITES
- SAMPLE PREPARATION METHODS
- DETERMINATION OF ANTIMICROBIAL ACTIVITY
- RESULTS



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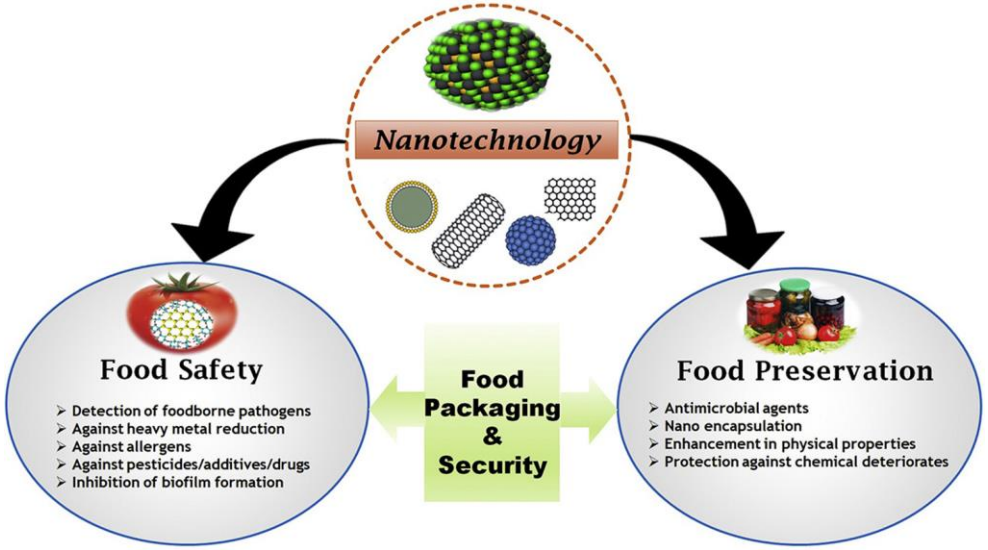
Introduction

Nanomaterials for food Industry



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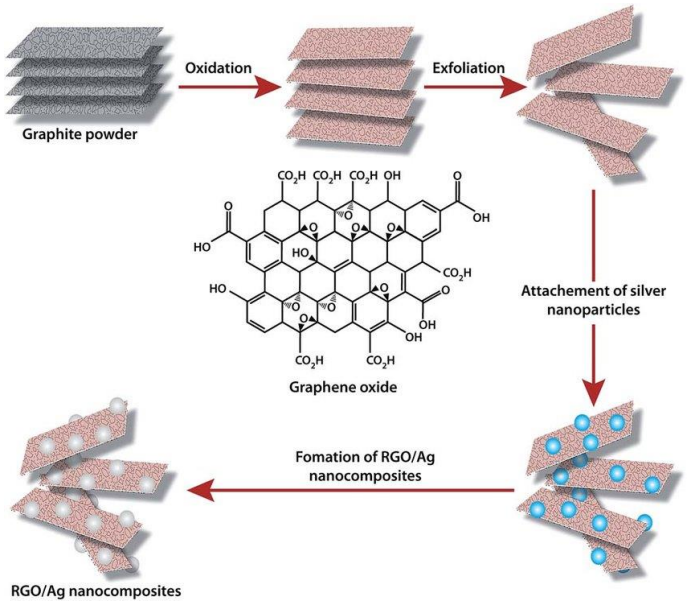
Synthesis of nanoparticles

Synthesis of rGO-Ag , rGO-Cu and rGO-Tio2 composites

- Dry method (Vacuum exfoliation)



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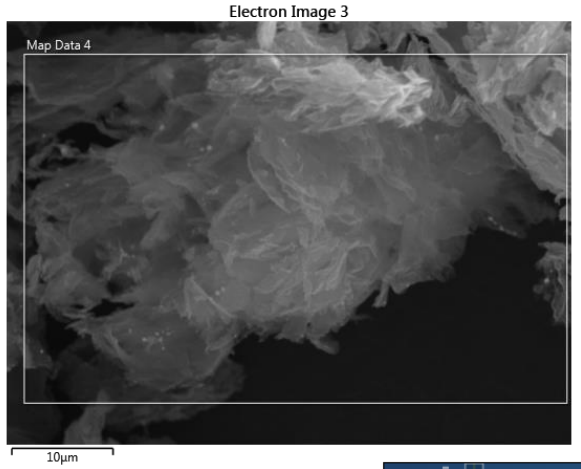


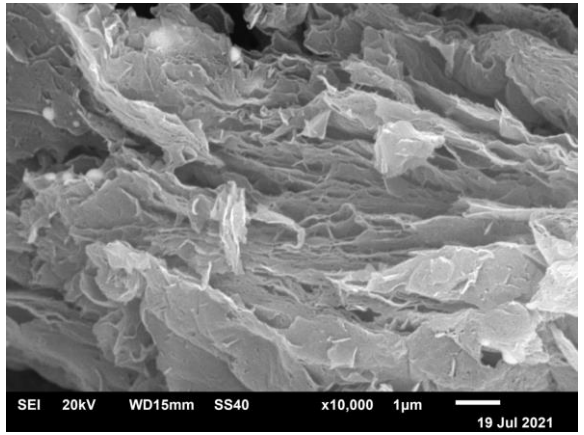
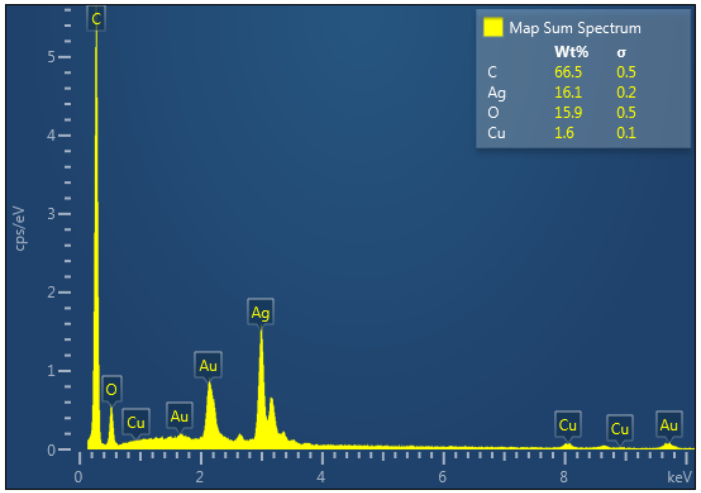


Figure 1, 2, 3. SEM micrographs of rGO-Ag composite



Statistics	C	O	Cu	Ag
Max	66.46	15.86	1.56	16.11
Min	66.46	15.86	1.56	16.11
Average	66.46	15.86	1.56	16.11
Standard Deviation	0.00	0.00	0.00	0.00

Result Type	Weight %
Spectrum Label	Map Sum Spectrum
C	66.46
O	15.86
Cu	1.56
Ag	16.11
Total	100.00

Table 1, 2. EDX analysis of rGO-Ag composite

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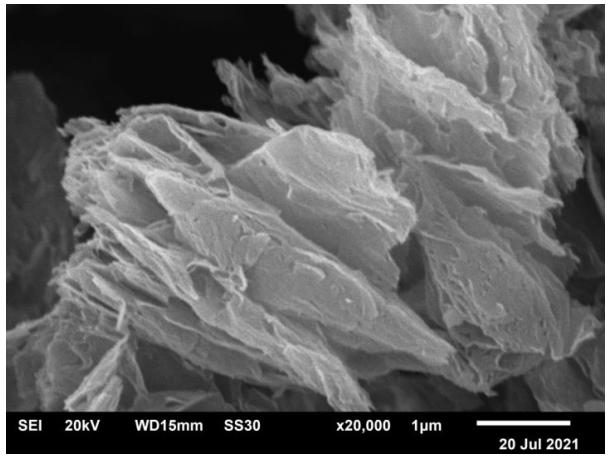
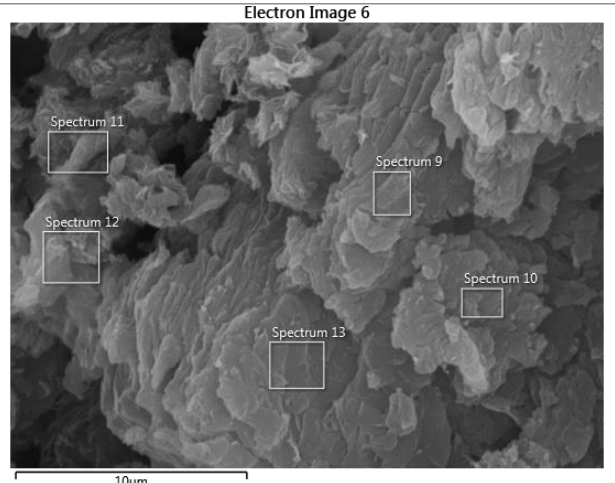




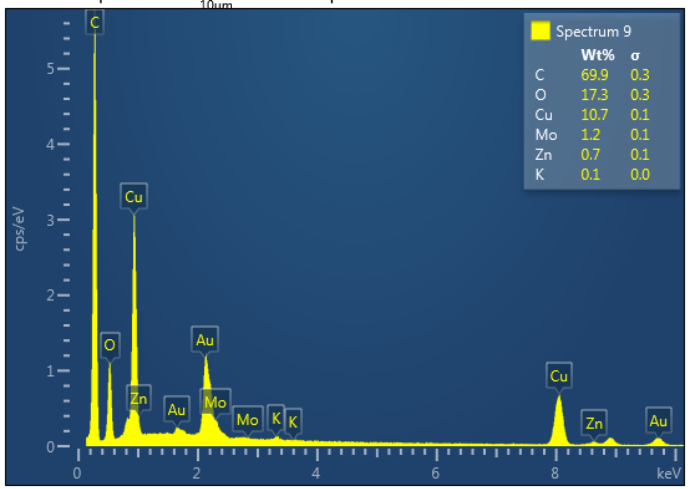
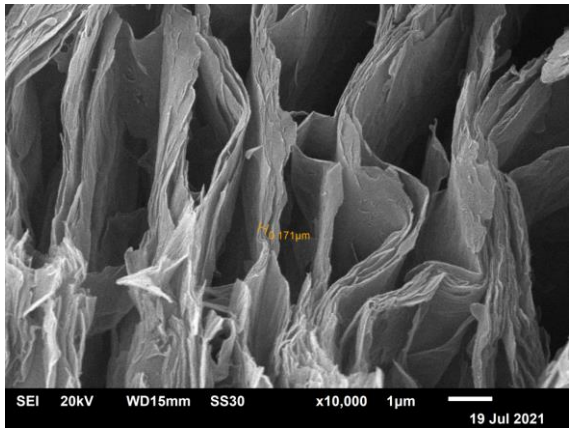


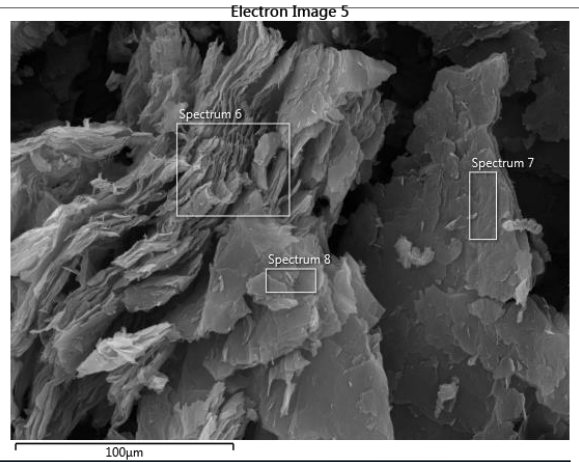
Figure 4,5,6. SEM micrographs of rGO-Cu composite

Result Type	Weight %				
Spectrum Label	Spectrum 9	Spectrum 10	Spectrum 11	Spectrum 12	Spectrum 13
C	69.92	68.30	70.91	70.85	69.29
O	17.32	14.31	16.60	16.51	15.24
K	0.11	0.16	0.28	0.25	0.17
Cu	10.68	15.10	10.44	10.76	13.38
Zn	0.73	0.66	0.88	0.71	0.54
Mo	1.24	1.48	0.89	0.92	1.39
Total	100.00	100.00	100.00	100.00	100.00

Statistics	C	O	K	Cu	Zn	Mo
Max	70.91	17.32	0.28	15.10	0.88	1.48
Min	68.30	14.31	0.11	10.44	0.54	0.89
Average	69.85	16.00	0.19	12.07	0.70	1.18
Standard Deviation	1.10	1.21	0.07	2.07	0.12	0.27

Table 3, 4. EDX analysis of rGO-Cu composite





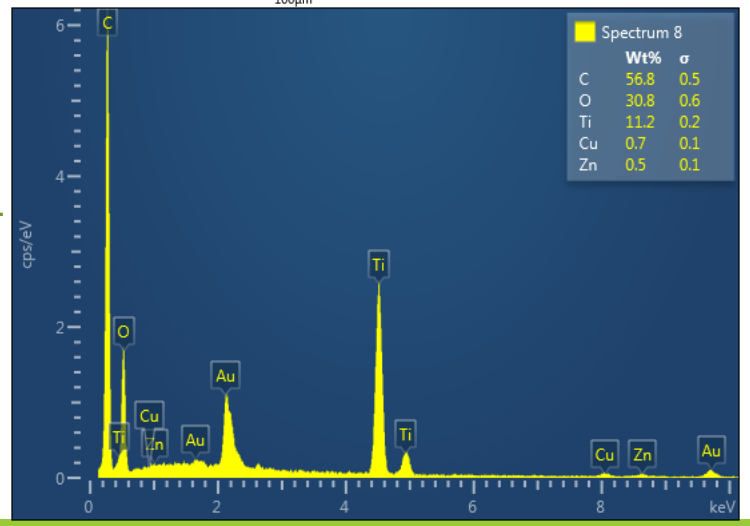


Figure 7,8,9. SEM micrographs of rGO-composite TiO2

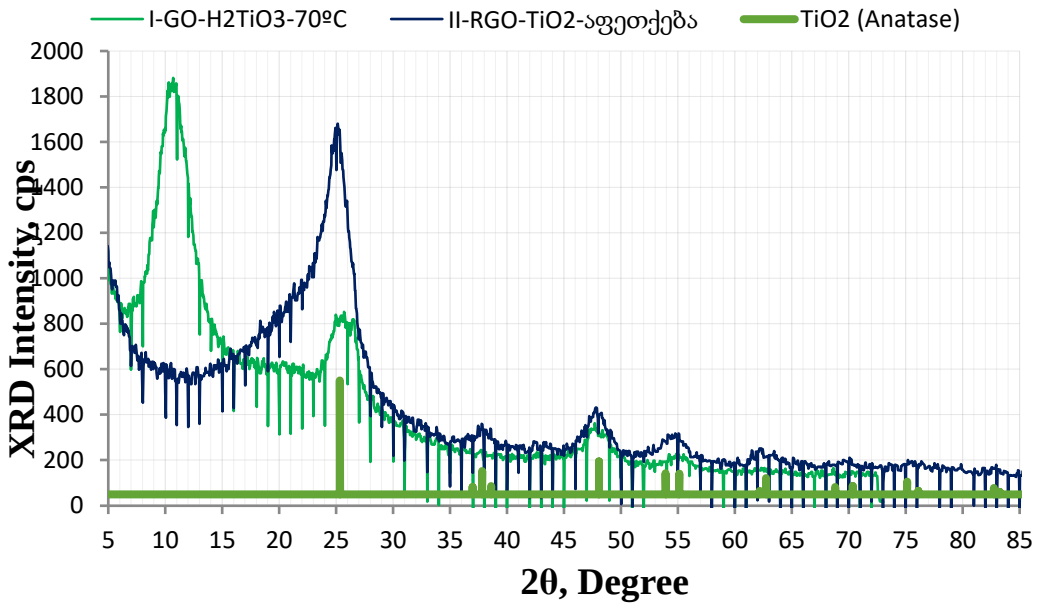


Figure 10. XRD patterns of composite CO-H2TiO3(green), rGO-TiO2 (anatase, blue) and anatase (TiO2).

Sampling Preparation Methods

- Sample taking
- The ultrasound treatment and homogenization of suspensions by Ultrasonic cleaner (45 KHz) and JY92-IIDN Touch Screen Ultrasonic Homogenizer (20-25 KHz, 900 W).
- Pathogen input to the sample
- Place prepared sample on a shaker incubator

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Common Sampling Problems

- Sample size (They occur at low levels)and structure
- Sample homogenization impacts on pathogen activity (They are typically not evenly distributed)

Fig. 11. Homogenized nanoparticles of TiO2, Ag, Cu

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Microbial cultures

- *Ps. aeruginosa*
- *B. subtillis*
- *E. faecalis*

Isolates were incubated with 20,40 µg/mL of nanoparticles

The antibacterial properties were studied against indicator bacterial strains by viable cell count and agar diffusion method.

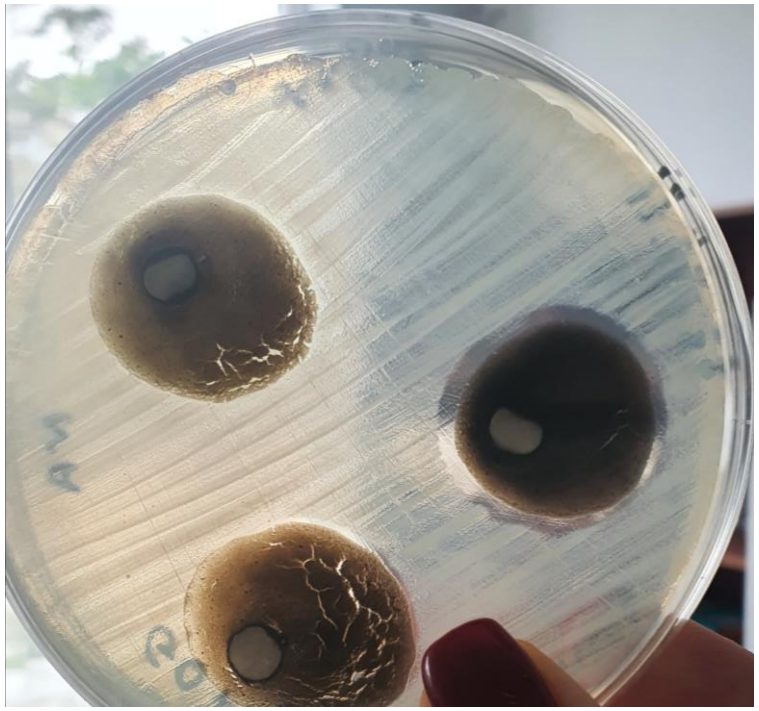

Fig. 11. inhibition zone of a test culture on rGO-AgNps

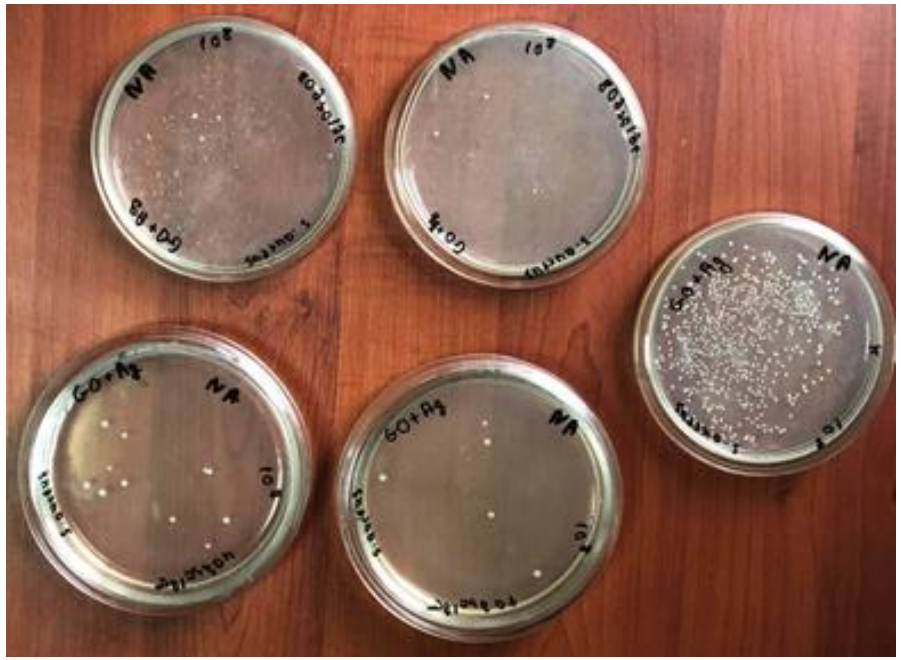

Fig. 12. viable cell count

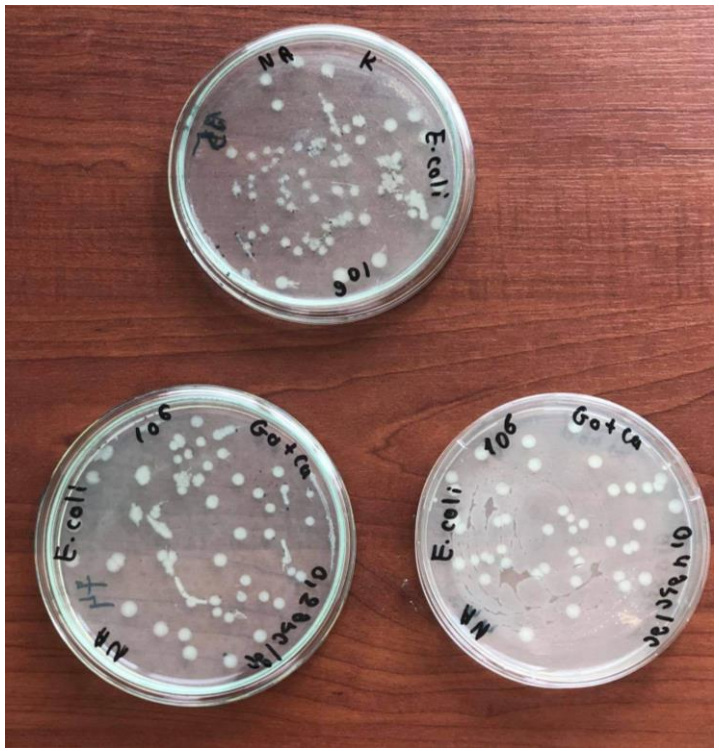

Fig. 13. viable cell count of *test culture* on rGO-Cu

Fig. 14. viable cell count of *test culture* on rGO-Cu

Fig. 15. viable cell count of *test culture* on rGO-TiO_2

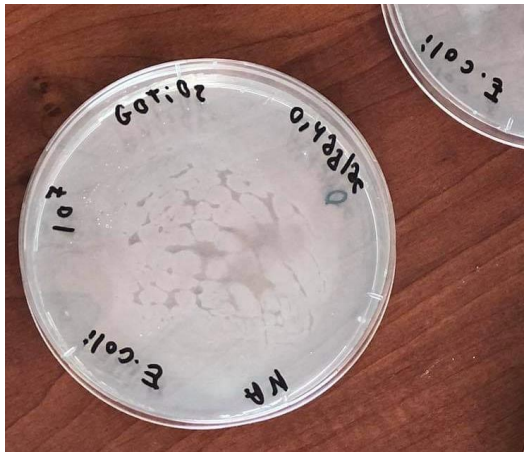

Fig. 16. viable cell count of *test culture* on rGO-TiO_2

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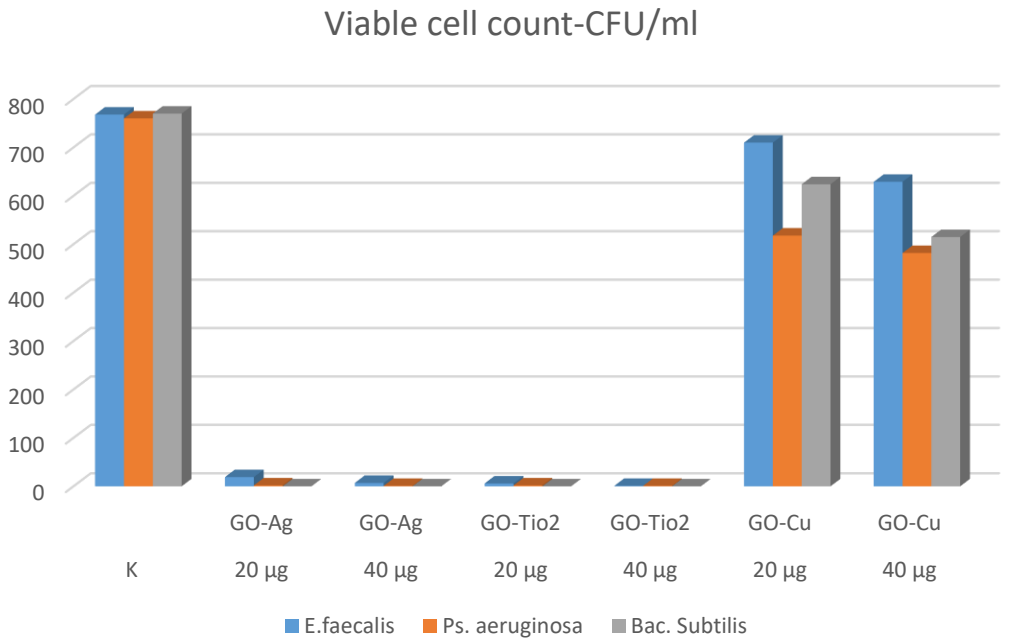

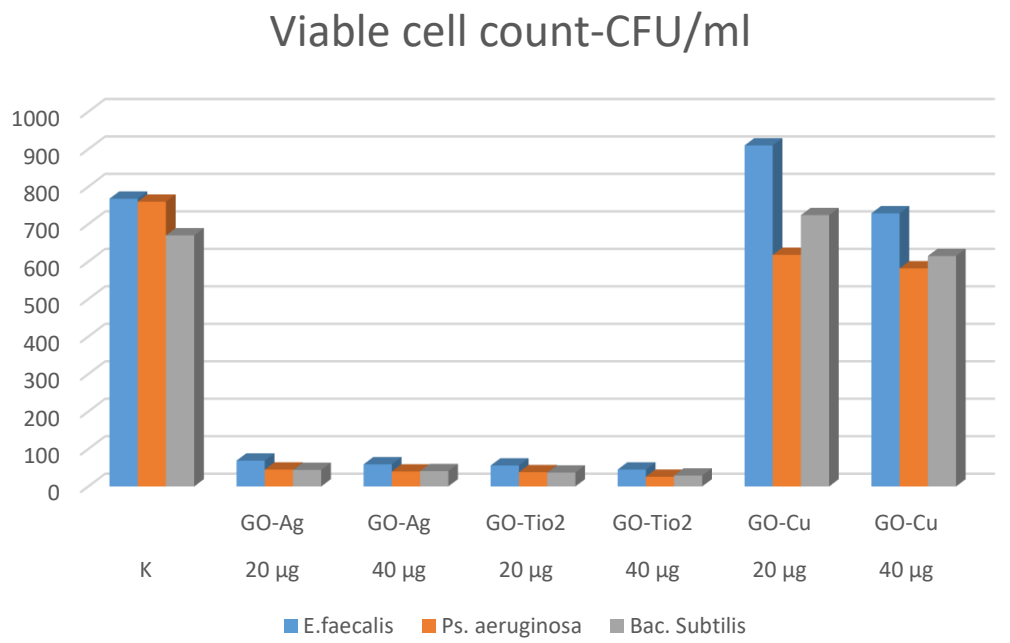

Conclusion

- The results demonstrated that, depending on the homogenization of the sample of rGO-AgNP, rGO-Cu, and rGO-TiO2 exhibited significant antibacterial activity compared to not homogenized.
- All nanocomposites fully inhibited the growth of *P.aeruginosa, Bacillus subtillis* and significantly reduced *Enterococcus faecalis* growth at 2 and 24 h in a time-dependent way compared to the respective time controls.

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