Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 7920 - 7927
Received 25 April 2021; Accepted 08 May 2021.

Study of the Antioxidant Efficacy of Laboratory andcommertial Silver Nanoparticles intercalated with ZnO

[1]Hussein SubhiAlwan, [2]Abbas matroodbashi

[1]Chemistry Department ,College of Education for pure Science ,University of Kerbala, Iraq
[2]Departement of anastasi and intensive care -Altuff college _iraq
E-mail: kokototo8312@gmail.com

Abstract: The preparation of silver nanoparticles has been studied in two ways (industrial and laboratory) and the prepared silver nano composites (industrial and laboratory) have been diagnosed with XRD, FTIR and AFM techniques. As the average sizes of the nanocomposites prepared were obtained with (62.41 nm) for industrial nano silver and (45.36 nm) for laboratory silver nanoparticles, the antioxidant activity was measured by the method of scavenging free radicals DPPH by comparison with a standard solution of ascorbic acid. The experimental results indicated that the antioxidant activity To oxidize silver nanoparticles more than industrial silver,
Keywords: Nanoparticles ,silver , Antioxidant Efficacy.Ascorbic acid . DPPH

INTRODCTION

Nanochemistry [1], is a new branch of solid-state chemistry that focuses on manufacturing rather than engineering aspects of preparing pieces of nanoscale materials in one, two, or three dimensions. Nanoparticles have received much attention due to their small size, as these small things can be synthesized from inorganic, organic, or organometallic-metallic components to produce new materials with optical, electronic and magnetic properties [2]. Nanotechnology is the processing of matter on an atomic, molecular and supramolecular scale. An older and broader description of nanotechnology [3],[4] indicates. Silver is an element with the symbol Ag (from Latin Argentina: "shiny" or "white") and atomic number 47. A soft, white, lustrous transition metal that exhibits the highest electrical conductivity, thermal conductivity, and reflectivity of any metal. The mineral is found in the earth's crust in pure elemental free form ("native silver"), as an alloy with gold and other metals, and in minerals such as arginate and chlorargarite. Most of the silver is produced as a by-product of refining copper, gold, lead and zinc. [5]

Silver is a very soft and ductile transition metal, although it is less malleable than gold. Silver crystallizes in a face-centered cubic lattice with a huge harmonic number 12, in which only the only 5 s electron is removed, similar to copper and gold. Unlike minerals with incomplete d orbitals, the metallic bonds in silver lack covalent properties and are relatively weak. This observation demonstrates the low hardness and high ductility of the individual crystals of silver. [6]

The oxide is an inorganic compound with the formula ZnO in the form of a white powder, which is soluble in water. Two main forms: Wurtzite hexagonal [7] cubic zinc alloy. Fortazite structure is the most stable form under natural conditions, and this makes it more common. ZnO can be changed to rock shape at relatively high pressures around 10 GPa. [8]

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 7920 - 7927
Received 25 April 2021; Accepted 08 May 2021.

MATERIAL AND METHODS

All chemicals were used in this work of analytical grade. Phthalic acid, glycerol and other chemicals were purchased from E. Merck Limited.

Preparation of a LaboratoryNano Silver

Weighing 1.7 grams of silver nitrate, add 1.7 grams of ascorbic acid to it and dissolve it all by adding 100 ml of distilled water, then take 1 gram of zinc oxide and dissolve it in 50 ml of distilled water with shaking and stirring, add to it a silver solution with ascorbic acid, then put The mixture was kept in continuous shaking for 12 hours. A centrifuge was used for 30 minutes to isolate the precipitate from the filtrate. The precipitate was washed with distilled water four times, then dried and collected the precipitate which represented the laboratory silver nanoparticles [10].

Preparation of industrial silver nanoparticles

Weighing 1 gram of zinc oxide added on 50 ml of distilled water, then adding 0.1gm from the commercial nano silver, add 2 ml of ethylene glycol added to the mixture. Then 10 ml of ethanol was added to the solution. and the mixture was kept 12 hours stirring, the precipitate's solid was washed with equal quantities of distilled water and acetone, then dried and collected the sediment, which is Silver represents industrial nanostructures sandwiched between zinc oxide layers. [11].

Evaluation of the antioxidant efficacy of nanosilver

Prepare a solution of DPPH (mM0.135) by dissolving 1 g of DPPH in an amount of methanol. After the dissolution process, the volume is completed to 20 ml using methanol. A series of dilutions were made of industrial and laboratory nano silver in addition to the standard anti-Ascorbic Acid using the solvent methanol (silver nanoparticle concentrations were limited between 1 mg / ml to 1 µg / ml). Then, equal volumes of the DPPH solution were added to each concentration of industrial and laboratory nanoparticles in addition to the standard material used in the study. The tubes were shaken using a Vortex mixer and the mixture was incubated at room temperature for 30 minutes. Absorption was measured at wavelength of 517 nm. The rate of suppression of root DPPH was estimated according to the following equation:

Inhibition (%) = (OD control - OD sample) / OD control * 100

RESULTS AND DISCUSSION

Atomic Force Microscope (AFM)

The outer surface of the prepared, laboratory and industrially nanosilver was studied using atomic force microscopy:
Figures (2 a, b) and (3a, b) show the outer surface of the nanoparticles of silver nanoparticles. The roughness of this surface and the square root are calculated according to the treatment:

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 7920 - 7927
Received 25 April 2021; Accepted 08 May 2021.

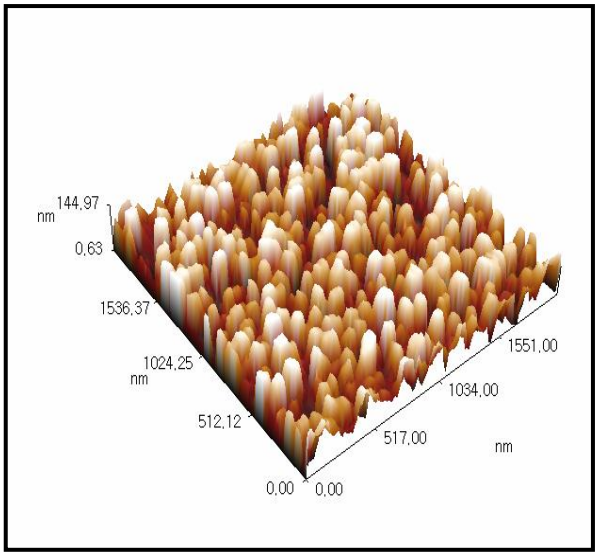
$$Rm \sqrt{\sum_{i=1}^{n} \frac{(Zi - Zav)^2}{N}}$$

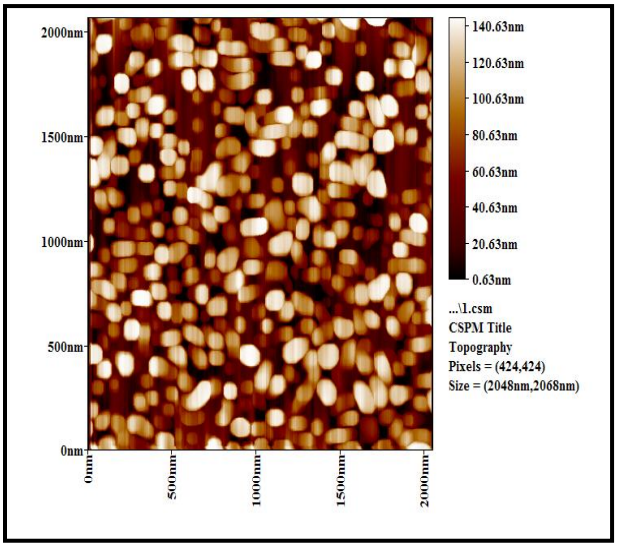
Where N, Z = number of points measured:

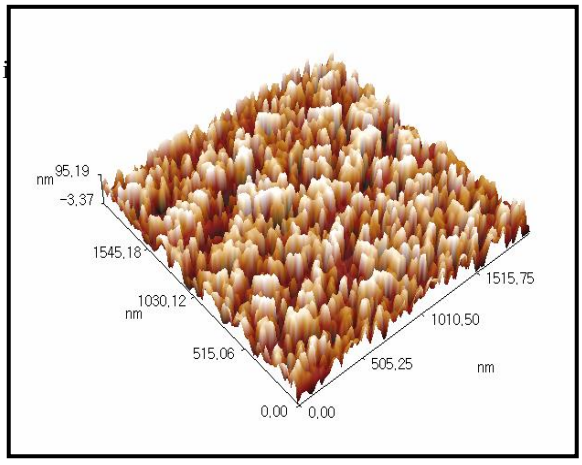
The roughness coefficient of the surface of the industrial nanoparticles was 36.2 nm, while the laboratory-prepared nanoparticles had a roughness modulus of 24.6 nm, and the difference between them is noted.

The rate of square root of industrial nanosilver to 41.8 nm while laboratory prepared nanoparticles is 28.5 nm. In the case of loading of nanoparticles, here is the difference between the square root rate of industrial and laboratory-prepared nanosilver and this difference resulting from a change in the crystal structure according to the method of preparation and laboratory conditions.

The results of Tables (1) and (2) z- coordinator of the nano silver prepared labrotary =45.36 nm. As for the height of the industrial nano silver with z-coordinator = 144.97 nm, and for the laboratory prepared nanofill the height was 95.19 nm**.**







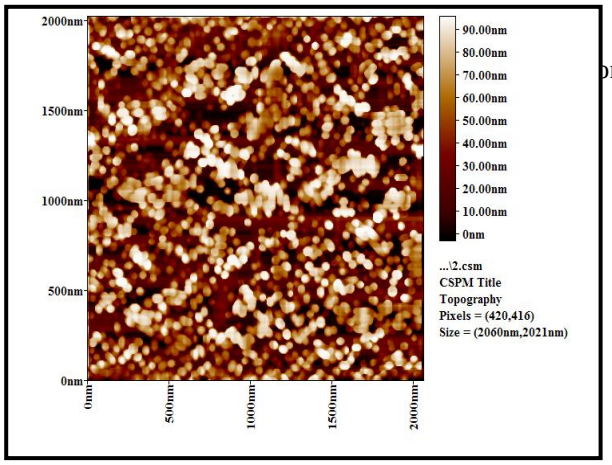


Figure 3 a: An atomic force microscope image of laboratory silver nanoparticles showing a three-dimensional (3D) image.

Figure 3 b: An atomic force microscope image of the laboratory silver nanoparticles showing a two-dimensional (D2) image.

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 7920 - 7927
Received 25 April 2021; Accepted 08 May 2021.

Table 1: The total average sizes of the industrial silver nanoparticles and the different proportions of these sizes

Avg. Diameter:62.41 nm	**<=10% Diameter:40.00 nm**
<=50% Diameter:55.00 nm	**<=90% Diameter:85.00 nm**

Diameter(nm)<	Volume(%)	Cumulation(%)	Diameter(nm)<	Volume(%)	Cumulation(%)	Diameter(nm)<	Volume(%)	Cumulation(%)
40.00	3.11	3.11	70.00	8.13	71.05	100.00	2.39	97.13
45.00	10.29	13.40	75.00	6.94	77.99	105.00	1.67	98.80
50.00	12.20	25.60	80.00	7.66	85.65	110.00	0.48	99.28
55.00	12.68	38.28	85.00	3.59	89.23	115.00	0.24	99.52
60.00	13.40	51.67	90.00	4.07	93.30	120.00	0.24	99.76
65.00	11.24	62.92	95.00	1.44	94.74	130.00	0.24	100.00

Table 2: The total average sizes of the laboratory silver nanoparticles and the different .proportions of these sizes

Avg. Diameter:45.36 nm	**<=10% Diameter:32.00 nm**
<=50% Diameter:44.00 nm	**<=90% Diameter:56.00 nm**

Diameter(nm)<	Volume(%)	Cumulation(%)	Diameter(nm)<	Volume(%)	Cumulation(%)	Diameter(nm)<	Volume(%)	Cumulation(%)
30.00	3.99	3.99	42.00	5.99	33.94	54.00	7.99	82.58
32.00	5.08	9.07	44.00	8.35	42.29	56.00	4.90	87.48
34.00	5.99	15.06	46.00	8.35	50.64	58.00	5.44	92.92
36.00	3.63	18.69	48.00	7.08	57.71	60.00	6.17	99.09
38.00	4.17	22.87	50.00	8.71	66.42	62.00	0.91	100.00
40.00	5.08	27.95	52.00	8.17	74.59			

Scanning electron microscope (SEM)

The outer surface of the industrial and laboratory-prepared nano silver was studied using a SEM scanning electron microscope. As Figures (4) and (5) show the scanning electron microscope image of the loaded nanoscale silver, as it is seen in irregular shapes and sizes.

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 7920 - 7927
Received 25 April 2021; Accepted 08 May 2021.

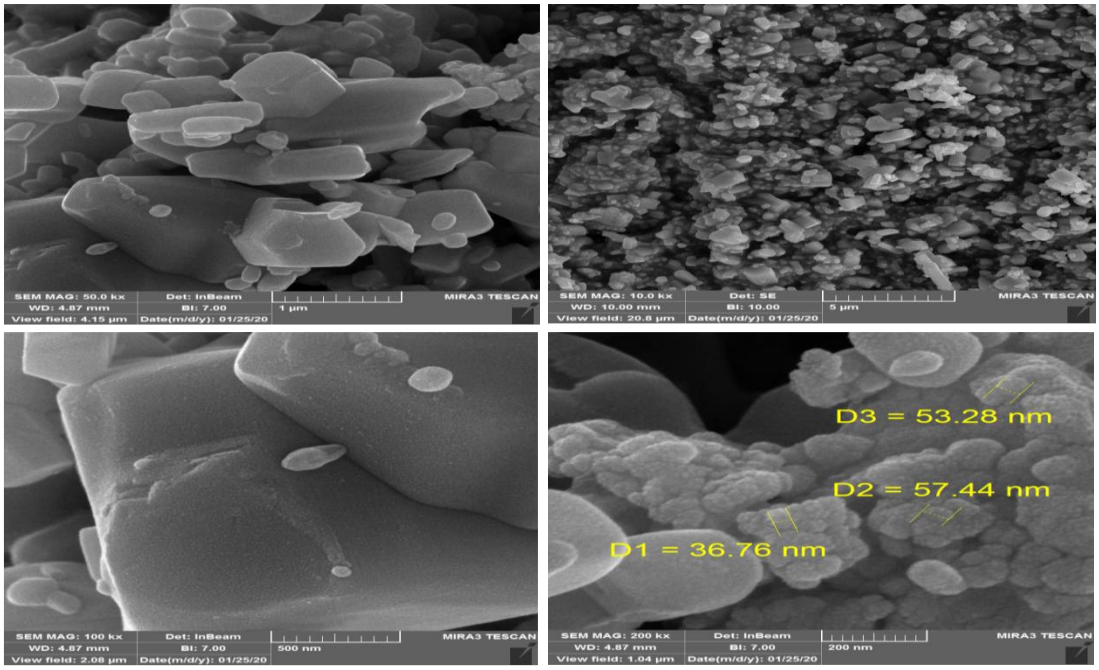


Figure 4: Scanning electron microscope (SEM) images of industrial nano silver

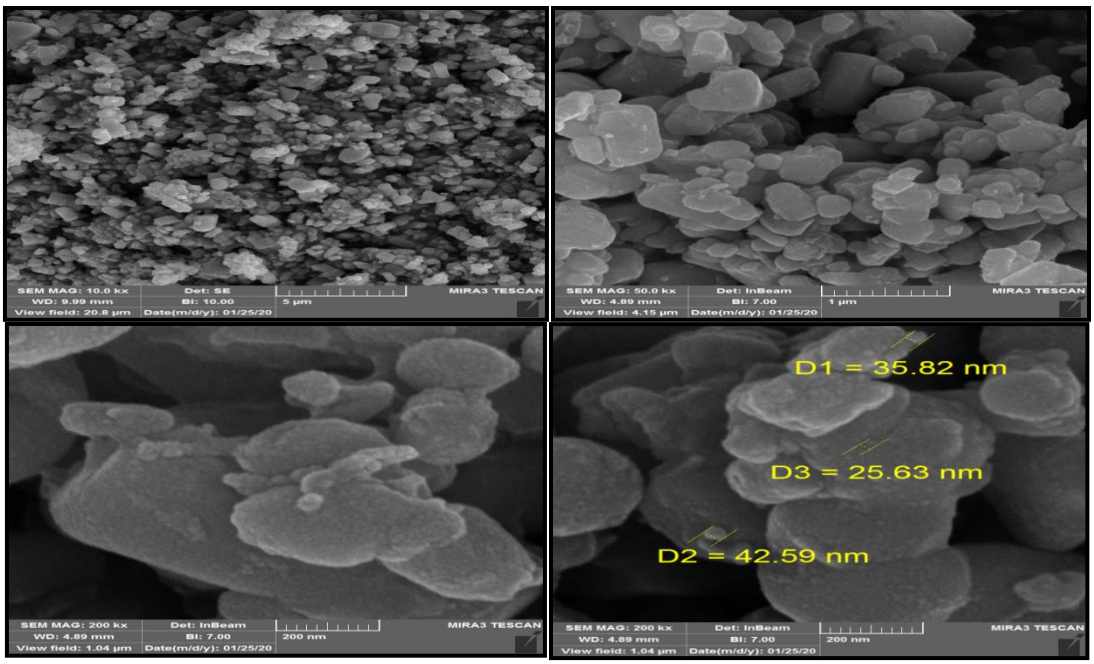


Figure 5: Scanning electron microscope (SEM) images of laboratory nano silver

X-Ray Diffraction (XRD)

The X-ray diffraction spectrum of industrial silver nanoparticles has been studied in vitro with XRD, as Figures (6) and (7) show the X-ray diffraction spectrum of the nanosilver and show the diffraction of the levels at the angles 38.5 °, 44.5 °, 63 ° returning To silver nanostructures in both forms.

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 7920 - 7927
Received 25 April 2021; Accepted 08 May 2021.

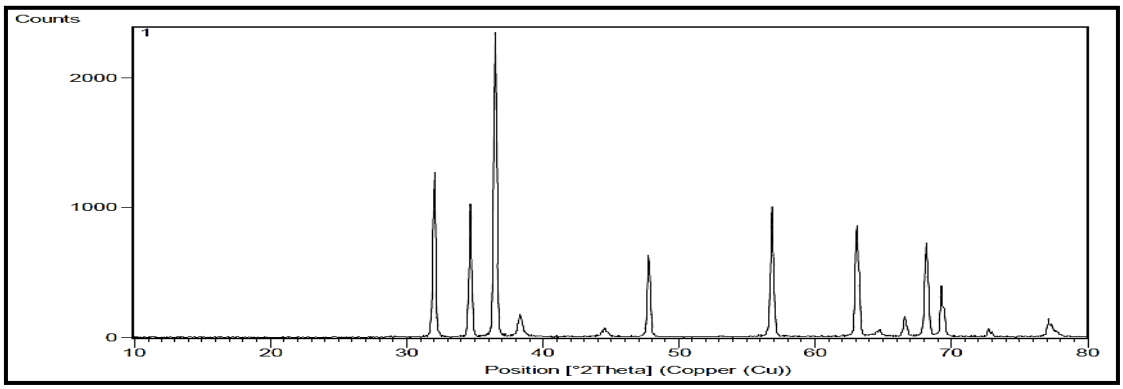


Figure 6: X-ray diffraction spectrum of industrial nano silver

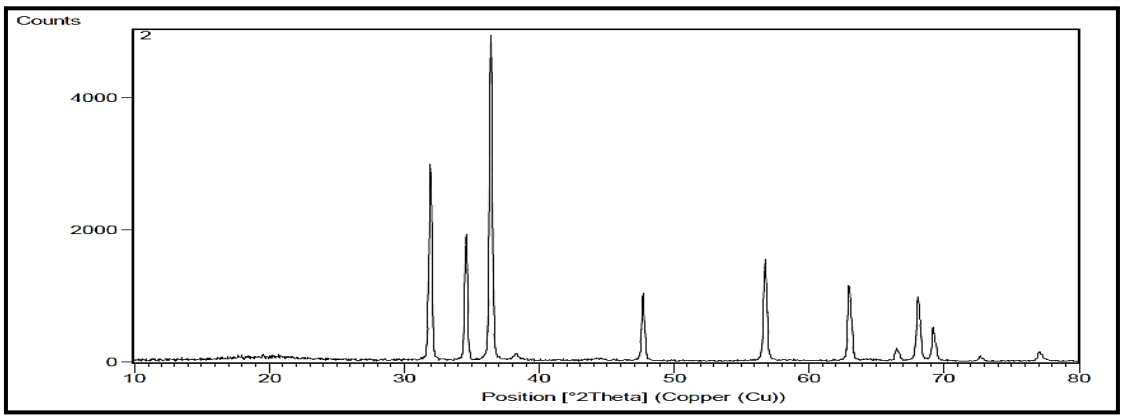


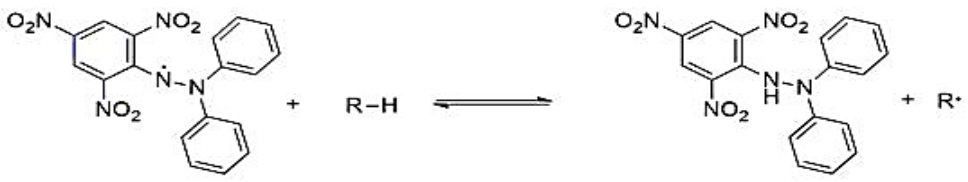
Figure 7: X-ray diffraction spectrum of laboratory nano silver

Free radical scavenging (DPPH) antioxidant efficacy of in laboratory and industrial nano silver

Among the methods most used for determining the antioxidant capacity of DPPH (2,2-diphenyl-1-picrylhydrazyl)) is a stable purple root that interacts with a hydrogen donor (Scheme 1). The presence of backup electrons not centered on the entire molecule prevents dimerization and also gives the color to the DPPH molecule with maximum absorption at a value of 520 nm in the UV / visible spectrum[12]. The root DPPH after the reaction gives hydrazine, which causes the color to change from purple to pale yellow. The level of disappearance of the purple color depends on the concentration of the antioxidant. Scavenging capacitance is usually determined in organic solvents, not in aqueous medium.

The interaction mechanism between the root DPPH and the substance can be illustrated according to the following equation:

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 7920 - 7927
Received 25 April 2021; Accepted 08 May 2021.



The free radical scavenging method was used to estimate the antioxidant efficacy of laboratory and industrial prepared nanoparticles, in addition to using ascorbic acid as a standard material. Which is expressed as inhibition (%) as in the following equation:

Inhibition (%) = OD Control - OD Sample / OD Control * 100

It is evident from Fig. (8) that the antioxidant activity in the laboratory-prepared nanoparticles is more effective than industrially nanocrystalline silver, despite their effectiveness, they did not reach the limits of 20% of the effectiveness of ascorbic acid (a standard substance).

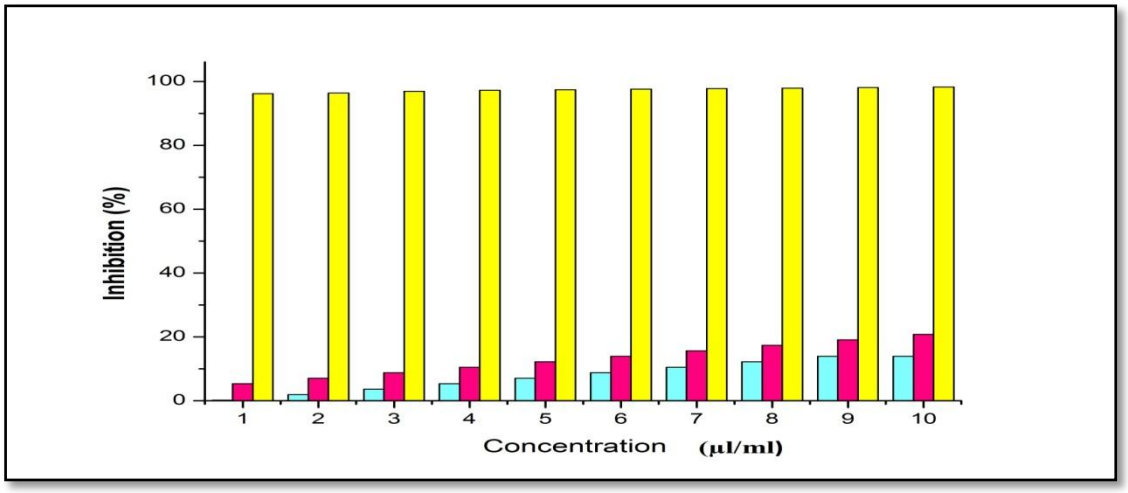


Figure 8: Antioxidant activity by suppressing free radicals DPPH for laboratory and industrial silver nanoparticles and ascorbic acid

CONCLOSION

Silver nanostructures were prepared in the laboratory can intercalated more than the nano commercial silver in between the layered of zinc oxide. New xrd peak appeared at 2theta =20. The measuring of the antioxidant activities, it was found that they have an antioxidant action, while the strength of the antioxidant action was found in laboratory-manufactured nano silver more than in artificially prepared silver.

REFERENCE

[1]. John D. (2008). Oxford Dictionary of Chemistry,6th ed. Oxford: Oxford University Press.
[2]. zin, G. A. (1992). Nanochemistry: synthesis in diminishing. Advanced Materials, 4(10), 612-649.
[3]. Drexler, K. Eric . (1986). "Engines of Creation: The Coming Era of Nanotechnology". Doubleday.

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 7920 - 7927
Received 25 April 2021; Accepted 08 May 2021.

[4]. Drexler, K. Eric. (1992). " Nanosystems: Molecular Machinery, Manufacturing, and Computation. New York": John Wiley & Sons.
[5]. Meija, Juris; et al. (2016). "Atomic weights of the elements 2013 (IUPAC Technical Report)". Pure and Applied Chemistry. 88 (3): 265–91.
[6]. Özgür, Ü.,Alivov, Y. I., Liu, C., Teke, A., Reshchikov, M., Doğan, S., ... &Morkoç, H. (2005). A comprehensive review of ZnO materials and devices. Journal of applied physics, 98(4), 11.
[7]. N. Daneshvar, S. Aber, M. Dorraji, A. Khataee and M. Rasoulifard. (2007). "Preparation and Investigation of Photocatalytic Properties of ZnONanocrystals: Effect of Operational Parameters and Kinetic Study", World Academy of Science, Engineering and Technology, vol. 29, pp.267-272, , and references there in.
[8]. Fierro J. L. G. (2006). Metal Oxides: Chemistry & Applications. CRC Press.
[9]. Rai, M., Yadav, A. and Gade, A. (2009). Silver nanoparticles as a new generation of antimicrobials. Biotechnology Advances. 27(1) 76-83.
[10]. Ahmad, Z., Pandey, R., Sharma, S. and Khuller, G.K. (2006). Alginate nanoparticles as antituberculosis drug carriers: formulation development, pharmacokinetics and therapeutic potential. Indian journal of chest diseases and allied sciences, Vol. 48, No. 3, 171-176.
[11]. Gu, H. ,Ho, P.L., Tong, E., Wang, L. and Xu, B. (2003).Presenting vancomycin on nanoparticles to enhance antimicrobial activities. Nano letters, Vol. 3, No. 9,1261-1263.