4.1. Characterization:

To identify the phytochemicals responsible for the reductionreaction and stabilization of the formed MgONPs, the magnesium oxide nanoparticles was analyzed in a **UV–Vis** absorption spectrophotometer (Uniscope SM 7504) in the wavelength between 200 and 800 nm.

Morphological study to assess the microstructure, particledistribution and elemental composition of the MgONPswas performed in a scanning electron microscope (**SEM**)equipped with an energy-dispersive X-ray analyzer (**EDX**)unit (SEM: JEOL JSM 7660F). The sample was analyzedwith an accelerating voltage of 15 kV.

Fourier transform infrared (FTIR) spectroscopy (FTIR:Nicolet iS10) with wavenumber in the range 350–4000 $cm^{-1}$was employed to assess the type of bonds present in theMgONPs so as to complement and confirm the result of theanalysis with UV.

4.2. Results and Discussion:

4.2.1. FTIRspectrum:

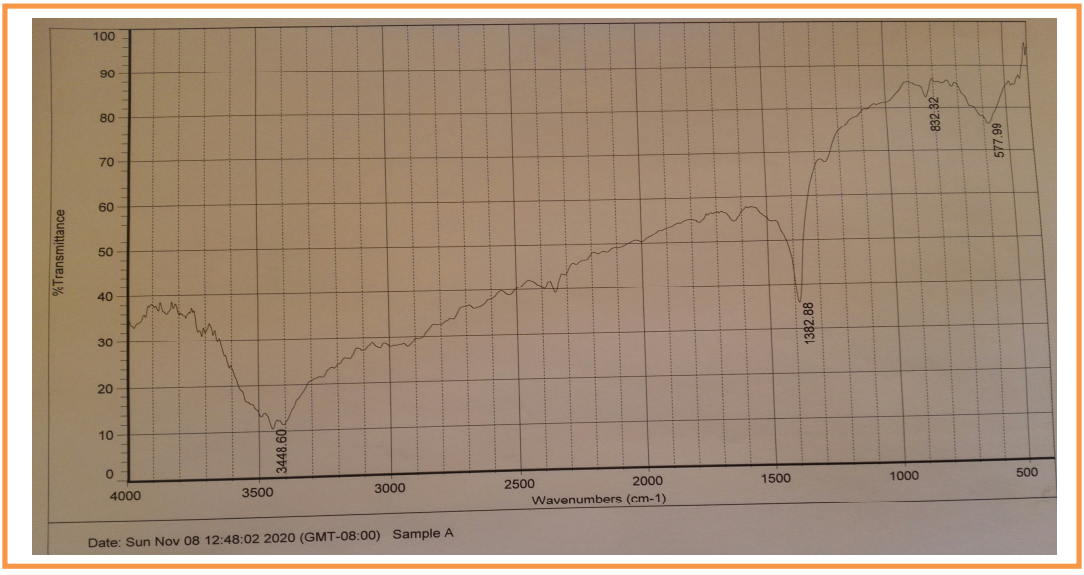


Fig. 1AFTIR spectrum of the MgONPsprepared by using sol-gel method

The FTIR spectrum of the MgONPs depicted in Fig.1A and 1B, The composition of the sample wasanalyzed by the FTIR measurement. Thepreparedpowder was mixed with KBrand the pellet of the mixture was used forinfrared (IR) spectroscopic measurement atroom temperature while the wavelength wasvaried from 400 to 4000 cm^{-1}.

Fig.1A shows the spectra of as MgONPspreparedby using sol-gel method, The broad peak spectrum at(3448.6 cm^{-1}) shows the formation ofMgO. The prominent peak at (1382 cm^{-1}) is assigned to Mg–Ovibration, The peak observed around 832.82 cm^{-1} indicatesthe formation of hexagonal MgONPs.(12)

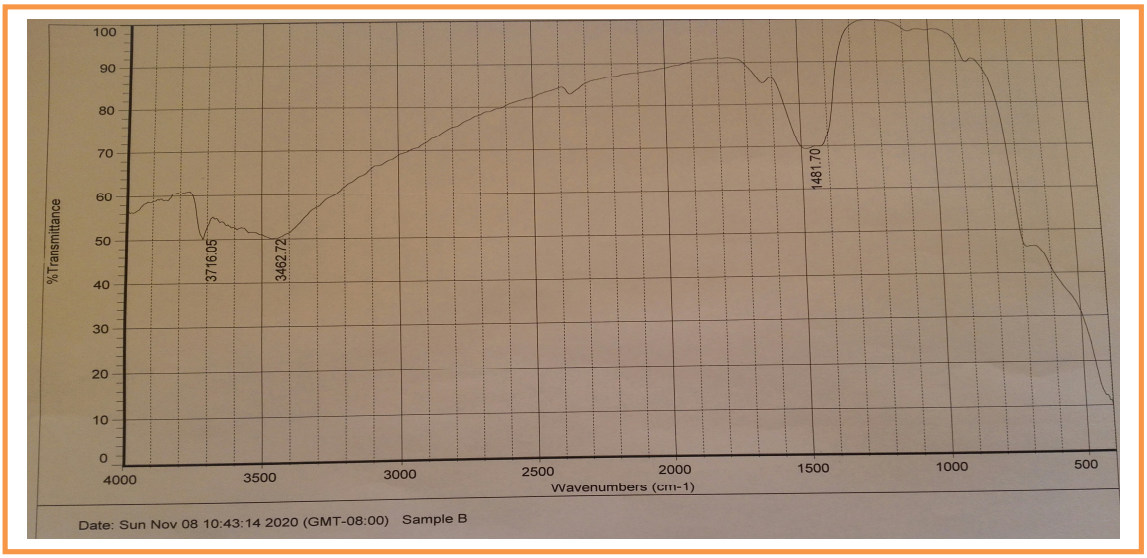
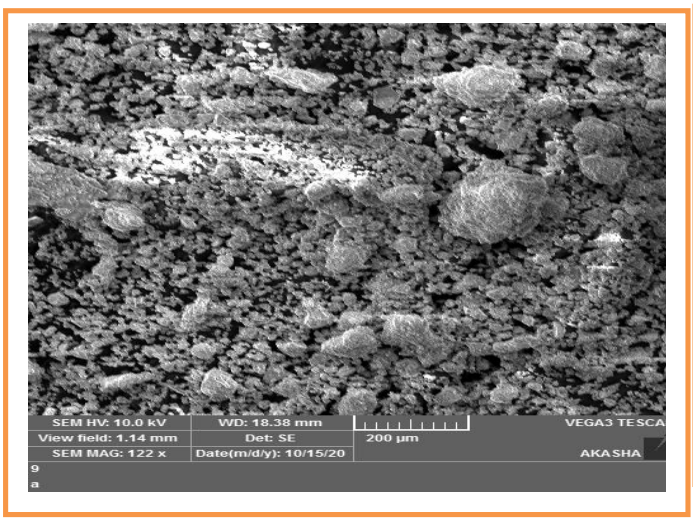


Fig. 1BFTIR spectrum of the preparedMgONPspreparedby using liquid phase method

Fig.1B shows the spectra of as MgONPspreparedby using liquid phase method, The peak at3716.05 cm^{-1} is due to the O-H vibration of brucitephase of $Mg(OH)_2$, The broad peak spectrum at 3462.72cm^{-1} shows the formation ofMgO. The prominent peak at 1481.70 cm^{-1} is assigned to Mg–Ovibration.(13)

4.2.2. Scanning Electron Microscopy (SEM)and (EDX):



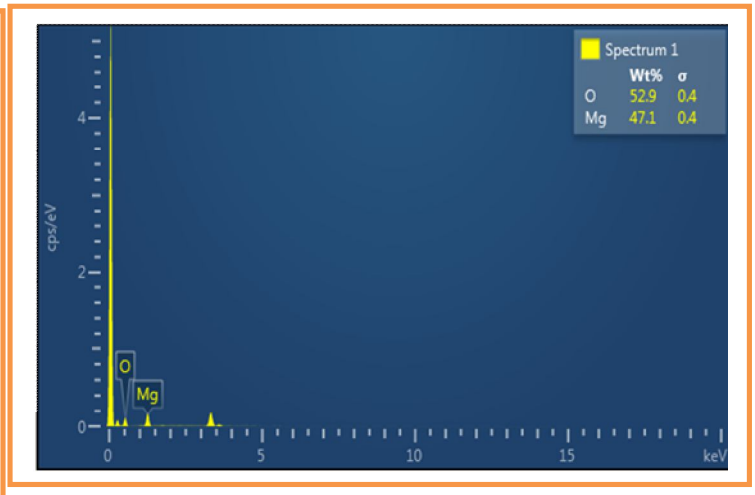
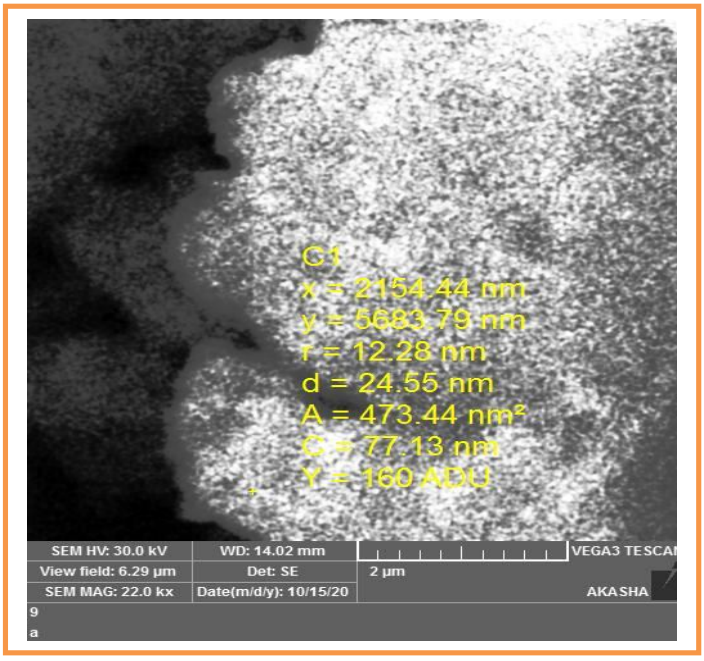


Fig. 2AaSEM image of the MgOprepared by using sol-gel method**Fig. 2Ab** EDX spectrum of the MgONPs showing the presence of Mg and O at 1:1 atomic ratio



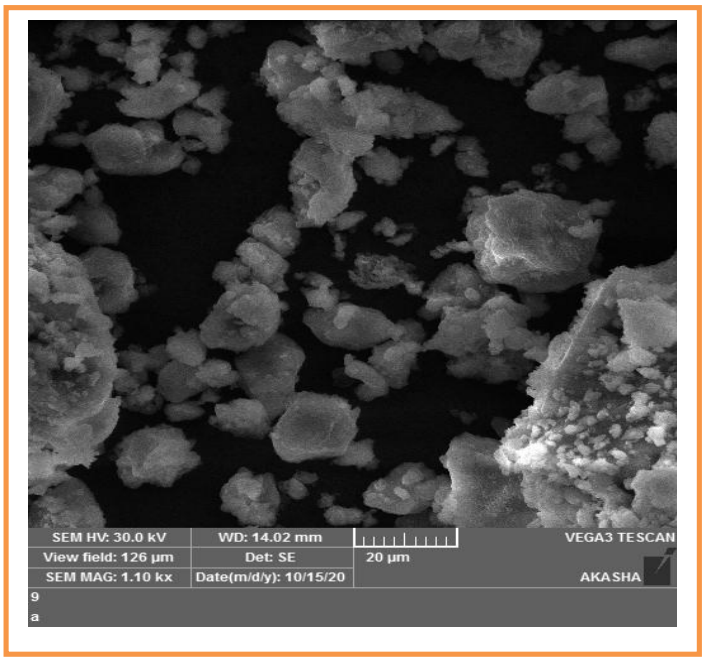


Fig. 2AaSEM image of the MgOprepared by using sol-gel method

A scanning electron microscope is used to view the nanostructures and examine surface morphology of samples. the samples checkedWith a scanning electron microscope (SEM), type (Inspect S50), with a high magnification, it is noticed that there are dense chips.

In this image the MgOpreparedby using sol-gel method,Some of the particles that appear irregular, and group to irregularly shaped particles

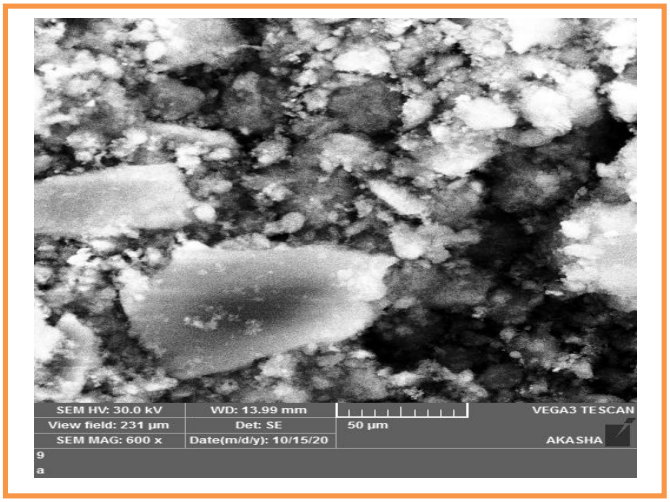
are large and there are others with much smaller onesAn irregularity in the sizes evidenced by the images that there is clumping, and due to the limitation of the device that was within the microscopic range it is not clear The shape of the nanoparticles, whether they are spherical, semi-spherical, or have other shapes, as shown in Figure 2Aa.Images measured at 200μm because images at smaller sizes were distorted and blurred.

the MgONPs is presented in Fig. 2Aa. Themicrostructure shows hexagonal particles of size between 70 - 85 nm appearing as different ensembles. The particlesshowed very little degree of agglomeration and were welldistributed over the surface of the material to present a largesurface area-to-volume ratio.

The formation of MgONPs was further confirmed by the EDX spectrum attached to the scanning electron microscope (Fig.2Ab), through which the quality and quantity of elements present in each sample was determined. The images reveal the presence of the Kα-transported MgAt energy 1.254kV and oxygen for the Kα transition at energy 0.525 kV, the graph shows a typical result of MgO.

Fig. 2Abshows the presenceof Mg and O in the sample and at 1:1atomic ratio as found in pure MgO compound. As for other peak, its appearance is related to With the test device.

The results of the SEM and EDX assay showed that the magnesium oxide particlesIt was in the field of nanoscale and of high purity.



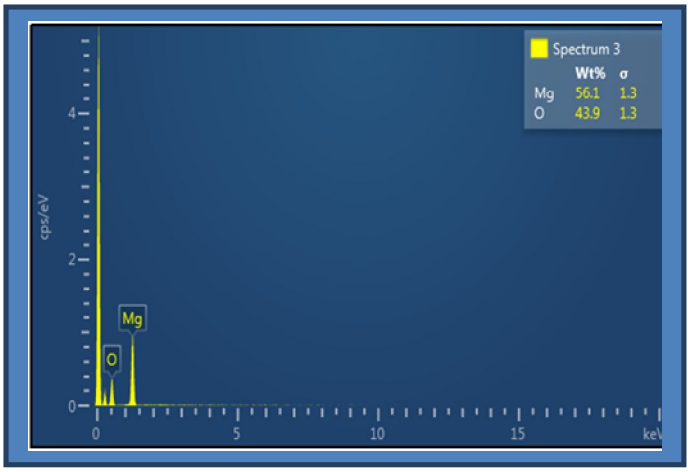


Fig. 2BaSEM image of the MgOprepared by using liquid phasemethod**Fig. 2Bb** EDX spectrum of the MgONPs showing the presence of Mgand O at 1:1 atomic ratio

In this image the MgOpreparedby using liquid phase method, Some of the particles that appear irregular, and group to irregularly shaped particles are large and there are others with much smaller onesAn irregularity in the sizes evidenced by the images that there is clumping, and due to the limitation of the device that was within the microscopic range it is not clear The shape of the nanoparticles, whether they are spherical, semi-spherical, or have other shapes, as shown in Figure 2Ba.Images measured at 50µm because images at smaller sizes were distorted and blurred.

The formation of MgONPs was further confirmed by the EDX spectrum attached to the scanning electron microscope (Fig.2Bb), through which the quality and quantity of elements present in each sample was determined. The images reveal the presence of the Kα-transported MgAt energy 1.254kV and oxygen for the Kα transition at energy 0.525 kV, the graph shows a typical result of MgO.

Fig. 2Bbshows the presenceof Mg and O in the sample and at 1:1atomic ratio as found in pure MgO compound. As for other peak, its appearance is related to With the test device.

4.2.3. Ultraviolet–visible spectroscopy (UV):

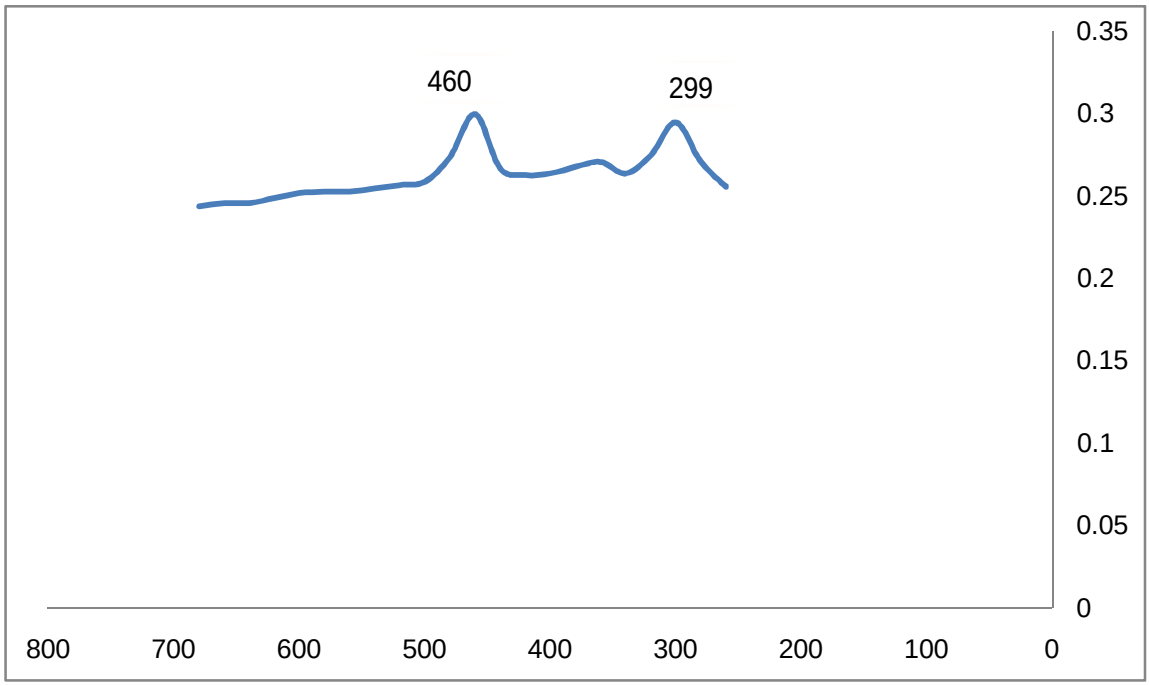


Fig. 3AUV spectrum of the MgONPsprepared by using sol-gel method

UV-vis spectrophotometer is used to record UV-visible spectra of the prepared MgOnanopowder in the absorbance mode, and in the wavelength range between 200–800 nm to determine the absorbance ofMgO NPs. We obtained the distinctive absorption bands of MgO up to 800 nm. The spectrum of MgOcontains several absorption peaks as observed in Fig 3.AMgO is reported to exhibit a broad absorption peak in between 260-330 nm. The spectrum has two absorption humps in the range of 320–400 nmcentered at 380 nm and between 440–480 nm with the peak at 460 nm.

4.3. Conclusions:

The major conclusions of this work can be summarized as follows:

Magnesium oxide nanoparticles were prepared by green synthesis using lemon juice extract. The preparation method is environmentally friendly and depends on plant materials and chemicals at low temperatures. It also gives an abundant product of magnesium oxide particles with homogeneous nuclear dimensions, so it can be used for commercial purposes. The result was analyzed with (FTIR ,UV, SEM and EDX). The results of the SEM and EDX assay showed that the magnesium oxide particlesIt was in the field of nanoscale and of high purity

Nano-crystalline size MgO via liquid phase method was prepared successfully i.e. sol-gel technique so as this technique is simple, fast and effective.

magnesium oxide nanoparticles were Preparedby the sol-gel method using magnesium nitrate($MgNO_3.6H_2O$) as a source material with sodium hydroxide.

(SEM) observations clearly show the cubic form of separated magnesium oxide nanoparticles of about 70-85 nm in size.

4.4. Recommendation:

Expanding the fields of nanotechnology to include the medical and environmental applications that the country currently needs.

Establishing a specialized conference on nanotechnology issues with the participation of research papers on the use of nanotechnology in industry and medicine, and preparing curricula for summaries of these researches.

Increasing cooperation between Sudanese universities.

Urging researchers in the field of nanoparticles to diagnose and apply the prepared nanoparticles.

Establishing a specialized center for the production of nanomagnesium oxide in large quantities and by simple methods locally.

Encouraging the use of nanomagnesium oxide in leather tanning because it helps reduce chromium pollution as well as the use of chromium.

The necessity of assessing and avoiding any risks resulting from the use of nanomaterials in the manufacture of nanomaterials by preparing technical specifications for dealing with these materials.