

ž ž ž ž

## ü TiO<sub>2</sub>/UV

naserise@tums.ac.ir

ly /y : y / / :

(Ag-TiO<sub>2</sub>)

y y mg/L

i pH

/ y i y g/L

Ag-TiO<sub>2</sub>

Ag-TiO<sub>2</sub>

y g/L Ag-TiO<sub>2</sub>

pH:

y mg/L

f / E

/ g/L

y g/L

n /

n

Ag-TiO<sub>2</sub>

f E

! ! ! ! !

UV-E  
 (ZnO-E TiO<sub>2</sub>-E  
 ) ( E " "

"fl E "fl E

TiO<sub>2</sub> " "

- mg/L  
 " flÿnm E ) ( E  
 TiO<sub>2</sub> "

Ô  
 "flDopingE " "  
 ) ( E  
 "flE

P25 TiO<sub>2</sub> " "  
 Hombikat ) ( E  
 "flE  
 Ô  
 " TiO<sub>2</sub>

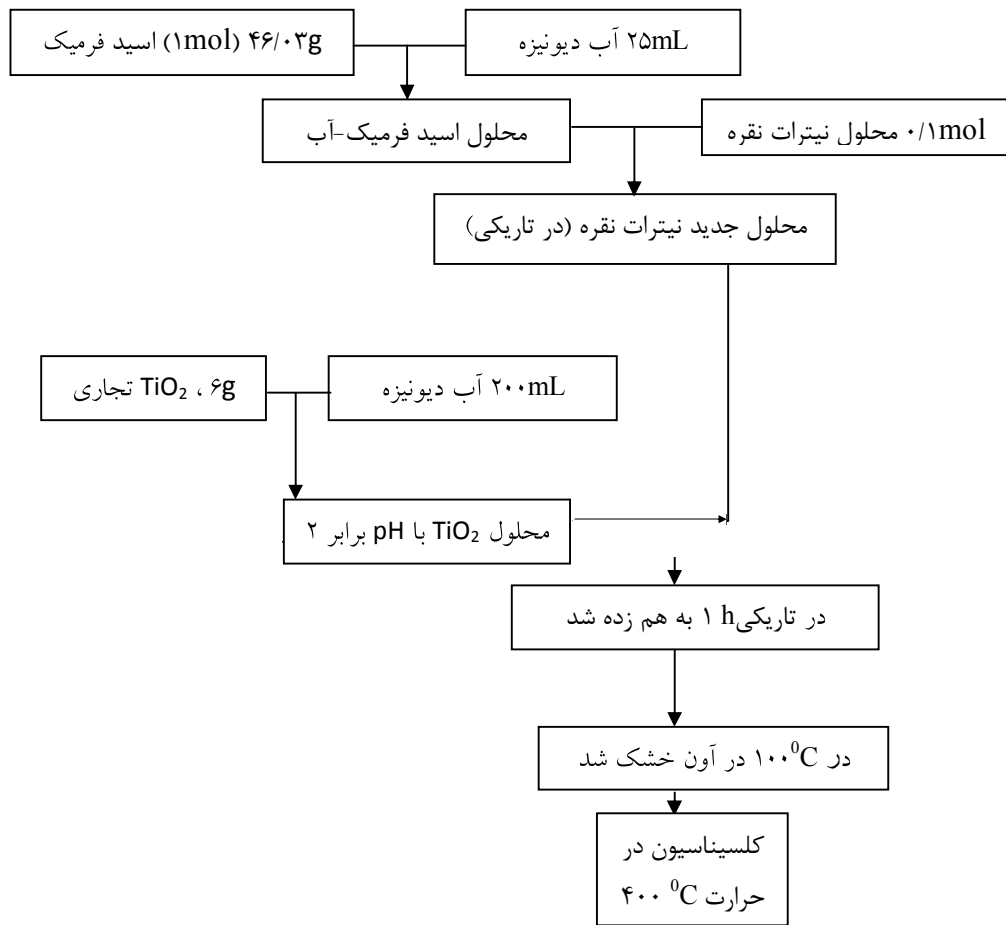
( yE " "

fl E fl E (Photocatalytic DegradationE  
 " "

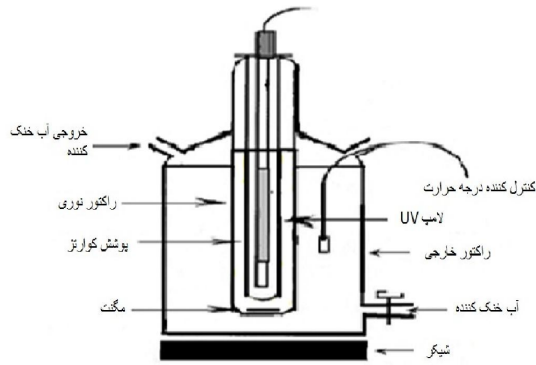
Ag-TiO<sub>2</sub> UV  
 pH  
 TiO<sub>2</sub> Ag-TiO<sub>2</sub> Degussa ,25  
 TiO<sub>2</sub>- Ag  
 (Ag/Ti)  
 Scanning Electron Microscope-Energy Dispersive)  
 'Seron Technology AIS-2100' (X Ray (SEM-EDX  
 'X' Pert MPD  
 (Transmission  
 'ZEISS-EM10C' Electron Microscopy (TEM)  
 " KV (Accelerating voltage)  
 Brunauer- Emmett- 'Ag-TiO<sub>2</sub>'  
 Autosorb 1 Quantachrome Teller (BET  
 nm  
 fl

HCOOH  
 Hole Scavenger  
 Ag-TiO<sub>2</sub>  
 ( Photodeposition  
 Hydrothermal Sol-gel !  
 Chemical Photoreduction  
 " Vapor Deposition  
 Swamiathan  
 Tryba ( DB53 DR23  
 ec y  
 ( Shirzad Siboni  
 y y  
 UV/TiO<sub>2</sub>  
 pH  
 pH= y min  
 i mg/L g/L  
 ( n / n /  
 Ghanbarian y  
 UV TiO<sub>2</sub>  
 ( n / LAS

NaOH pH  
 / L L  
 mg/L cm fl WL  
 cm ycm  
 min  
 y y  
 mL  
 min rpm mg/L  
 μ  
 Perkin-Elmer Lambda  
 nm 15-UV/Vis Spectrometer pH= i / i i i



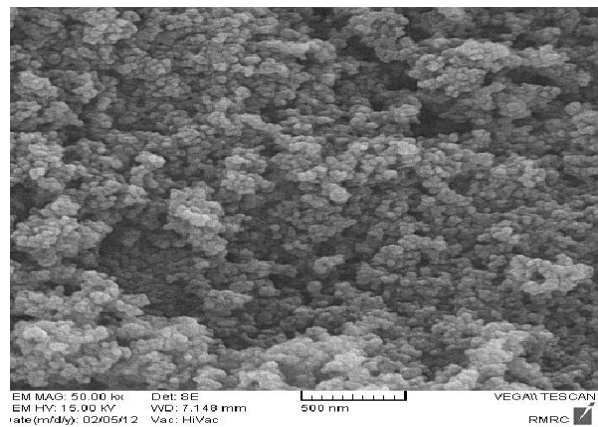
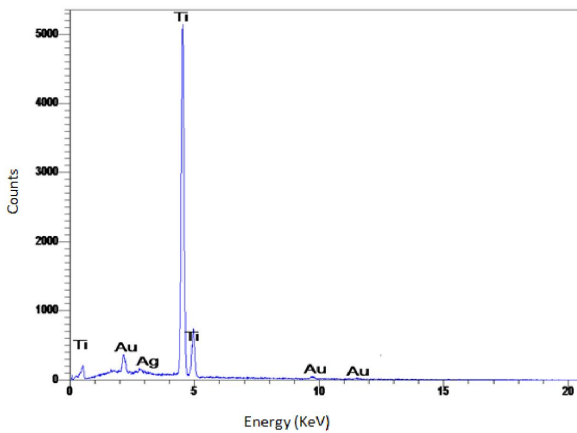
Ag-TiO<sub>2</sub>



SEM-EDX  
 Ti Ag (at%)  
 (Ag/TiO<sub>2</sub>)  
 Au  
 TEM SEM  
 (nm)  
 EXRD  
 (Ag-TiO<sub>2</sub>)  
 P25)  
 BET (TiO<sub>2</sub> Degussa)  
 Ag-TiO<sub>2</sub>  
 TiO<sub>2</sub>-P25 doped TiO<sub>2</sub>  
 Ag-TiO<sub>2</sub> (m<sup>2</sup>/g) TiO<sub>2</sub>-P25  
 / m<sup>2</sup>/g  
 pH pH

Perkin-Elmer  
 Lambda 25-UV/Vis Spectrometer Elmer  
 (DR5000) nm  
 Ag-TiO<sub>2</sub> UV  
 UV  
 pH  
 Ag-TiO<sub>2</sub>/UV  
 UV  
 SPSS16

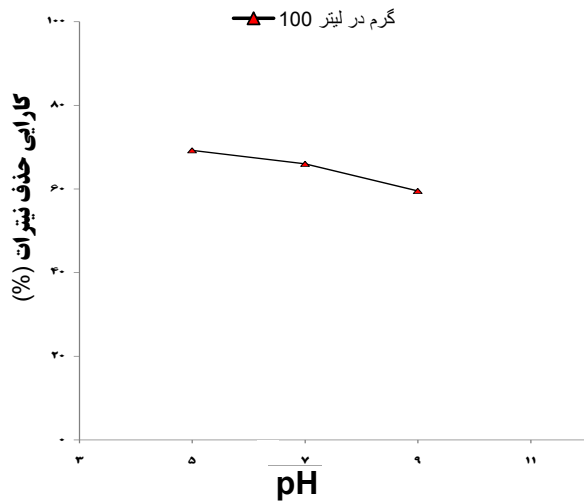
Ag-doped TiO<sub>2</sub> SEM-EDX



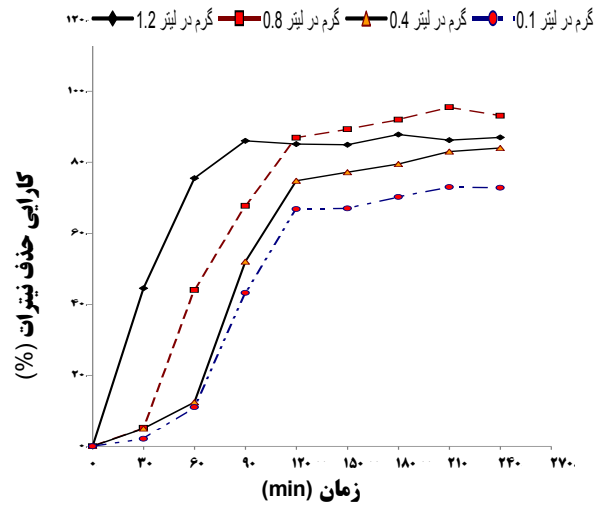
SEM

SEM-EDX





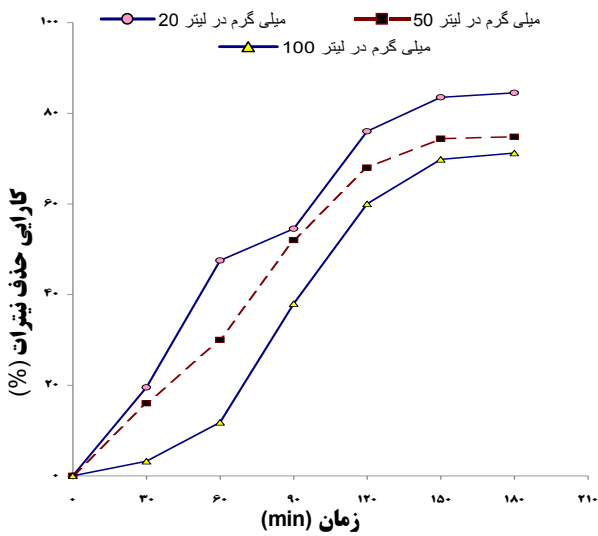
$C_0 = 100 \text{ mg/L}$        $\text{pH}$   
 $t = 60 \text{ min}$        $\text{Ag-TiO}_2 = 1 \text{ g/L}$        $\text{Ag-TiO}_2/\text{UV}$



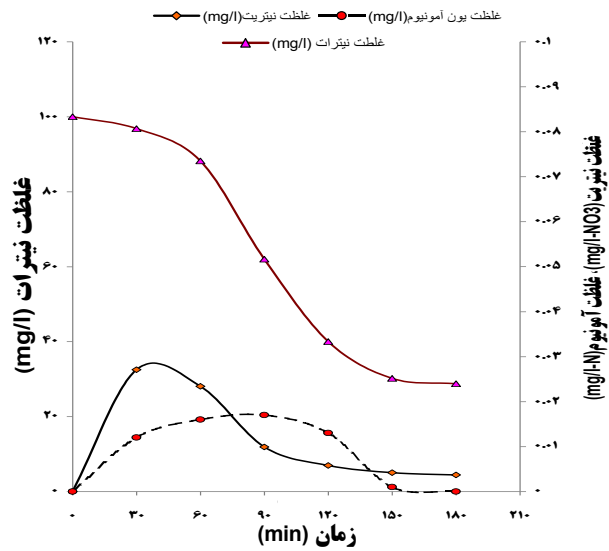
$\text{Ag-TiO}_2/\text{UV}$        $\text{pH} = 7$        $C_0 = 100 \text{ mg/L}$

Ag-doped  $\text{TiO}_2$        $\text{Ti}$        $\text{Ag}$       "      "

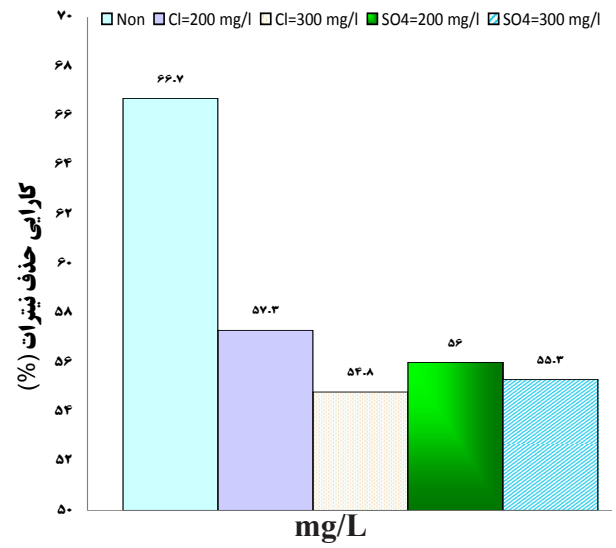
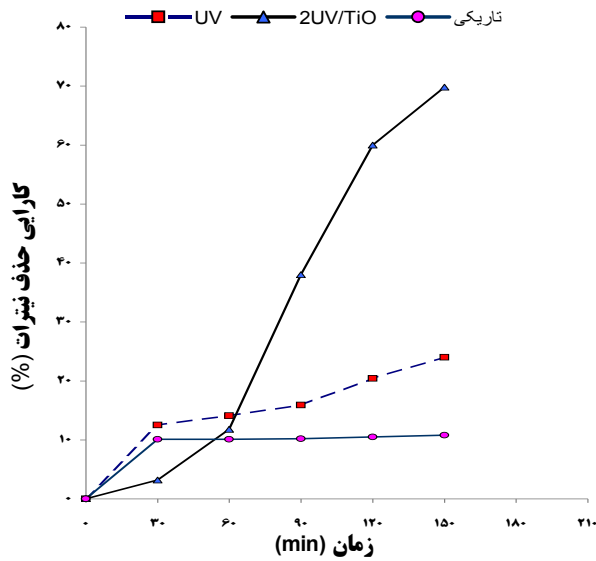
"BET" XRD "TEM" "SEM-EDX"  
 Ag-doped  $\text{TiO}_2$       TEM  
 / nm      Ag-doped  $\text{TiO}_2$   
 $\text{TiO}_2$   
 SEM-EDX      / nm      nm  
 Ti      Ag (at%)      %  
 "      "      "



$\text{Ag-TiO}_2 = 1 \text{ g/L}$        $\text{pH} = 7$        $\text{Ag-TiO}_2/\text{UV}$



$\text{Ag-TiO}_2 = 1 \text{ g/L}$ ,  $\text{pH} = 7$        $C_0 = 100 \text{ mg/L}$        $\text{Ag-TiO}_2/\text{UV}$

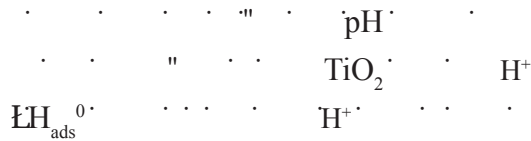


UV Ag-TiO<sub>2</sub>/UV

t = 60 min

Ag-TiO<sub>2</sub> = 0.5 g/L, pH = 6.25, C<sub>0</sub> = 50 mg/L

Ag-TiO<sub>2</sub> = 0.5 g/L, pH = 6.25, C<sub>0</sub> = 50 mg/L



pH

pH

Ranjit "

0.5M-TiO<sub>2</sub>

(0.5 g/L

Ag-TiO<sub>2</sub>

pH

TiO<sub>2</sub> P25

XRD

flL

Ag-TiO<sub>2</sub> BET

TiO<sub>2</sub> / m<sup>2</sup>/g

" fl ± m<sup>2</sup>/g P25

Ag-TiO<sub>2</sub>/UV pH

t =

pH

pH =

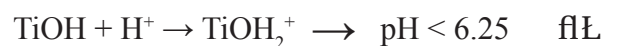
pH

pH

pH fl L2 pH fl #L2 pH fl yL

pH

flTiOH TiO<sub>2</sub>





pH / g/L "fl - E  
" " y/ g/L  
" "  
- E  
Ag-TiO<sub>2</sub> fl  
fl E " y  
Yang "  
Paracetamol  
TiO<sub>2</sub>  
E  
"fl  
" "fl E  
y Guo  
TiO<sub>2</sub>  
TiO<sub>2</sub>  
nm  
fl Ranjit " fl E  
" y/ g/L  
n  
" "  
w pH E  
fl E " fl  
nm  
E y Damodar .( y)  
fl  
" "  
Ag-TiO<sub>2</sub>  
i ymin  
" " ymin fl E  
" "  
" "  
( E " "



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## **Photocatalytic Reduction of Nitrate in Aqueous Solutions using Ag-doped TiO<sub>2</sub>/UV Process**

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### **ABSTRACT**

**Background and Objectives:** Pollution of water resources to nitrate is an environmental problem in many parts of the world. This problem possibly causes diseases such as methemoglobinemia, lymphatic system cancer and Leukemia. Hence, nitrate control and removal from water resources is necessary. Considering that application of nanomaterials in treatment of environmental pollutants has become an interesting method, in this research use of Ag-doped TiO<sub>2</sub> nanoparticles synthesized through photodeposition produced under UV irradiation was studied for removal of nitrate from aqueous solutions.

**Materials and Methods:** Three nitrate concentrations of 20, 50, and 100 mg/L were considered. In order to determine the effect of Ag-doped TiO<sub>2</sub> nanoparticles on nitrate removal, dosages of 0.1, 0.4, 0.8 and 1.2 g/L nanoparticles were used; pH range of 5-9 was also considered. The effect of Ag-doped TiO<sub>2</sub> nanoparticles both in darkness and under UV irradiation was studied. Moreover, the presence of chloride and sulfate anions on the system removal efficiency was investigated.

**Results:** The optimum performance of nitrate removal (95.5%) was obtained using nitrate concentration of 100 mg/L, in acidic pH and 0.8 g/L Ag-TiO<sub>2</sub>. Increase of nanoparticle dosage up to 0.8 g/L, increased the removal efficiency, but for 1.2 g/L dosage of nanoparticles, the removal efficiency decreased. Maximum reduction performance without nanoparticles, under UV irradiation and under darkness conditions were 32% and 23.3% , respectively. In addition, we found that presence of sulfate and chloride anions in aqueous solution reduced efficiency of nitrate removal.

**Conclusion:** Results of this study showed that Ag-doped TiO<sub>2</sub> nanoparticles may be efficiently used for nitrate removal from aqueous solutions.

**Keywords:** Photocatalytic reduction, Ag-doped TiO<sub>2</sub>, Nitrate, Aqueous solutions

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