TiO$_2$/UV

naserise@tums.ac.ir

(Ag-TiO$_2$) ... mg/L ... Ag-TiO$_2$ ... g/L ... pH ... Ag-TiO$_2$ ... Ag-TiO$_2$ ...

(HCOOH) ... (Hole Scavenger) ...

... Ag-TiO$_2$ ...

(Photodeposition) ... (Hydrothermal) ... (Sol-gel) ... Chemical) ... (Photoreduction) ... (Vapor Deposition.

... Swamiathan ... DB53 ... DR23 ... Tryba ...

... Shirzad Siboni ... UV/TiO$_2$ ... pH ... pH= ... min ... mg/L ... g/L ...

Ghanbarian ... UV ... TiO$_2$ ... LAS ...

... Ag-TiO$_2$ ... UV ... pH ...

... TiO$_2$ ... Ag-TiO$_2$ ... Degussa ,25 ...

... TiO$_2$- Ag ...

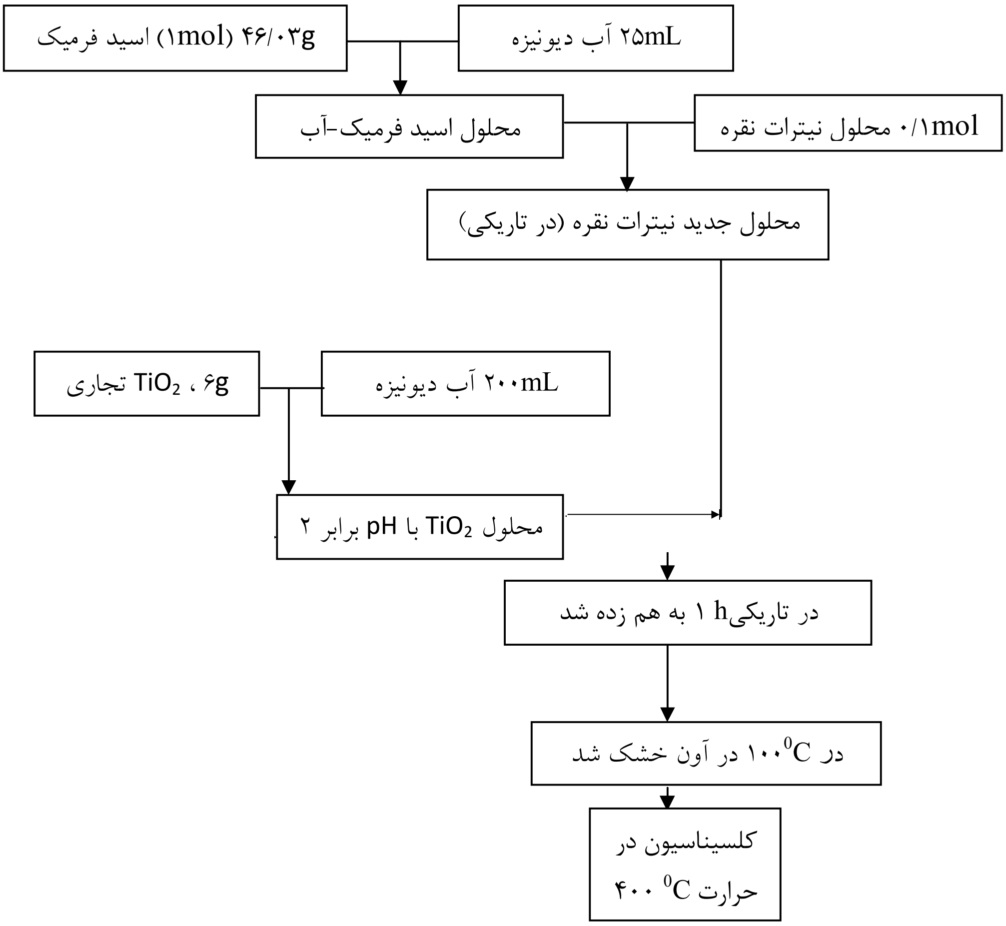
... (at%) ... (Ag/Ti) ... Scanning Electron Microscope-Energy Dispersive)) ... Seron Technology AIS-2100 ... (X Ray (SEM-EDX ... X' Pert MPD ... (Transmission ... ZEISS-EM10C ... Electron Microscopy (TEM)) ... KV (Accelerating voltage) ... Brunauer- Emmett- ... Ag-TiO$_2$ ... Autosorb 1 Quantachrome ... Teller (BET) ...

... nm ...

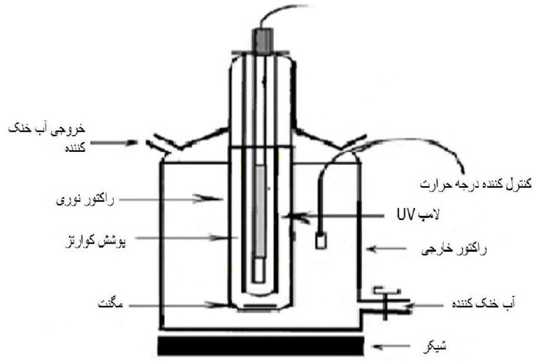
Ǫ ʅ ƒ Ǵ ǨǕ ǁ ǻǂǴǁǸǀǝǂ ǻǂǴ ǂ ǿ ǁ ǮǸǀǂǮ Ŧǣ ǮǓ ǼǀʂǿǨǨǂǸǀǝ
Ơ ǁ ǂɣ ǁ ȡ Ƿ ƩƱ Ǽ ǯ ǿ ǁ ȡ Ǖ ǂ ǣ Ǫ ƩƋ ǮǓ Ƿ ǴǁǸ ǯ Ĥ/Ĩ L ǻ ƿ ƒ ĥ L
Ŧǣ Û l ǁ ǔ ǁǁ ǫ .ɣ ǁ Ǫ ʅ ǁ ǯǂƩ ǁ ƜǕǁ ǯ ȓ ǪǸǪǕ ǁ ǕǂǁǓ ǌ ǿ Ƭ Ǫ
ǨƠǓ ǮǓ Ǵ ǂ ǓǸ Ī cm ǧǸǍ Ǵ (ĤĥĨ W) l ǍǁǂƩ ǩǪè
.ɣ ǁ Ǽ ǫ Ơ ǒǨ Ƭ ǪĨcm Ʃǎǎ Ƿ Ħ ǵ cm ǓǨ ǁǮ Ǵ ȥǁǮǸǂ ǓÊǓ
ǯǨ ǂ ǁ ǂǮ Ǎǿ ǂ Ƭ Ǫ ǯ ǂ ǮǓ ǁɣ ǁ Ǩǁǝǂ ǓǮǸǫ ǮǸǀǂǮ Ʃǂ ǼǂǨǯ ĥ ǨǕ ǁ
ǮǸ ǁ Ƿ ǓƩǿ Ǖ ǮǂƩ ǎ l ǁ ǓǮǸǫ ƩǁǁǸ ǴǁǸǯ Ǵǂ ǯ ǂ ǻǂƩ .ɣǧǓǼ ǫ
ǁǓǓ ǮǂƩ ǎ ǧǸǪ Ƭ Ǫ ǮǓ ǓƩ Ǒ ǯǂƩǫ ǮǓ ǩǪè ǓǸ ǂ ǁ ǔ ǁ ɣ ǁ ǁɣ ǿ ǁ
.ɣ ǁ ǁɣ ǿ Ƭ ǂ Ǽ ǫǸǁǿǸ ǁ ȥǓǂ ǨƠǓ ǮǓ ǻǂǴ ǂ ǿ ǁ ǮǸǀǂǮ Ƿ ɣ ǁ
ǻǨǵ Ơ ǒǪǓ ǮǸ ǂ ǂ Ǽ ǁ ǔǨǁǫ Ʃǂ ǼƠƩ ǁ ǁ ǻǨǵǴǁǸǯ Ǵ ǴƩǸǁ Ǩ
mg/L Ơ ǒǪǓ Ǵǝ Ǩǫ ǁ Ǎǿ ǂ Ƭ Ǫ ǯ ǂ ǮǓ ǾǂƩǁǿ ǼǝǮƩǁ ǓǮǸǫ
Ǯǂɣǫ ǯ ǿǿ ǔ ǮǸǒǸǫ Ǵ .ɣ ǁɣ ǁ ǴǁǝƩ ǔ Ʃǒ ǮǓ Ĥ ǵ ǵ Ƿ Ĩ ǵ ¡ ǵ
g/L ǻǨǵ Ơ ǒǪǓ Ʃǂ ǾǂƩǁǿ ǻǨ ǿ ƒ ǂ ǮǓ Ag-TiO$_2$ ǁǮƵ ǸǁǁǓ Ǵǁǿ ǁ
pH=Ĩ¡ Ī Ƿ Ĭ ȥǿ Ƿ .ɣ ǁ ǁɣ ǨǍ ǁ ǝ ǁ ǁǮƵǸǁǁ Ĥ/ĥ Ƿ ǵ/ī ¡ ǵ/ħ ¡ǵ/Ĥ

NaOH Ʃǂ Ǩǵ ǴǁǸǯ pH Ǫǿ ǒ ǁ ǮǓ .Ơ ǝ ƩǓ ǮǂƩǎ ǼǝǮƩǁ ǓǮǸǫ
.ɣǂǓƩǓ ǁɣǓǨǍǁ ǝǂ ǵ/Ĥ Ƿ ǵ/ǵĤ N ،HCl Ƿ Ĥ Ƿ ǵ/Ĥ ¡ǵ/ǵĤ N
ǻǨǵ Ơ ǒǪǓ ǮǓ ɣǂǂƩǪǂ Ƿ ǾǨǍǸǝ ǻǨǵ ƩǓǴǪƠǂɣǫ ƩǿǨǁ ǯ ǿǂǫǵ
Ǵǯǵ .Ơ ǝ ƩǓ ǮǂƩǎ ǴǓǨǎǫ ǓǮǸǫ ɣǁǂƩǝ ǼǝǮǨǂ ǮǓ Ħǵǵ Ƿ ĥǵǵ mg/L
ǣƩǫ Ơ ǂƩ ǁ Ʃǂ ǴǓǨǎǫ ǯ ǂ ǮǓ ǁɣ ǁ ǁɣǓǨǍǁ ǝǂ ǼǵǨǕ ǂ ǣǨǫƩǎ ǓǂǸǫ
.ɣ ǁɣ ǁ ǻǮǂɣǂƩƠ

¡Ĥĥ ǵ ¡Ĩ ǵ ¡ī ǵ ¡Ħ ǵ min Ǎǿ ǂ Ƭ Ǫ ǯ ǂ ǮǓ ǼǁǨǪǸǪƩȓ ǻǨǵǯǨǫƩ
Ǩǵ ǯ Ǩǫ Ʃ ǯ ǂ Ʃǂ Ǫǂɣǂ Ʃǵ ǮǓ Ǵǂ ɣ ǁɣ ǁ ǴǁǝƩǓ Ʃǒ ǁ ǮǓ Ĥīǵ Ƿ ĤĨǵ
ǌǝǸǁ ǮǸǀǂǮ Ʃǂ ǻǮǂɣƩǁǴǁǸǯ ǁ .ƠǝƩǓǼ ǫ ǾǮǸǪǏ ǻǮǂɣƩǁǴǁǸǯ ǁ
Ơ ʂǿǨǨǂ ǾǂǮƵ ǻƩǨǝǂɣ Σ ǮǸǒǸǫ Ǵ .ɣ ǁ Ǫ ʅ ǁ Ĥ ǵ mL Ơ ǿ ǿ Ŧǣ
ĥ ǵ min Ǿ ɣ ǫ Ǵ Ĩ ǵǵǵ rpm ǮǷ Ǩ ǂ ƫǸǍǂƩǁǁǨǝ Ʃǂ ǧǸǪ Ƭ Ǫ Ʃǂ
ǮǓ ǁɣ ǁǨǫ ǼǎǨ ǁ ǾǂƩǁǿ ǁ Ƿ ɣ ǁ ǁɣǓǨǍǁ ǝǂ ǵ/ĥ µ Ʃǁǁǿ ǝ Ʃǂ 5 ś ǝ Ƿ
Perkin-Elmer Lambda) ǻƩ ǁ ǫ Ƿ Ʃ ǁ Ǖ ś ǝǂ Ƿ Ƿ Ǯ Ǩ ǧǸǪ Ƭ Ǫ
ĥ ĥ ǵ nm ǻǨǵƧǸǫ ǧǸǍ ǮǓ (25-UV/Vis Spectrometer



Ag-TiO$_2$ ȥǁǝ Ƿ ǷǮ Ǩ ƒ ǂ Ʃǫ :Ĥ ǨǕ ǁ



ĠüĶăŏ ǰǽǂ ƺƳ ǻƴƳƵǐƦǂ ƳƺǸŏ ƓǐƮǼƿƵǀǸưǸǑǀ ƺǸǑƮƺ ƽǂ ƓǛǼƿƺ :ĥ ǦǛǋ

njƦǂƿ ƟèǸǆǕŏ ǻƽǾƞǽǀƙ ƠǾƩ .ƴƙ ǻƽǾƞǽǀƙ ĥĪĬ ƿ Perkin-) ǻƽǑŏƿƽǕƦǂ ƿ ƿƺ ƽǂ ǂǀƾƽǀ Ġǃ ǫǸǾǀǸŏǂ ƿ ƠǀƽǑǀ ƧǸŏ ǧǸĂ ƺƳ (Lambda 25-UV/Vis Spectrometer Elmer .(ĤĪ) ƴƙ ǻƴƳƵǐƦǂ DR5000 ǻƵǑƦƳ ƿ Ĭħĭ nm

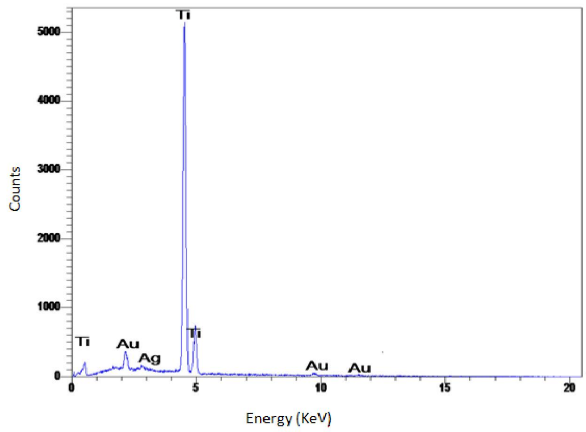
ƺƳ ƵǵǦǸǼǋ ǘ ü ǏǕŏ njǽǂƙ ƺƳ ƴǾǂƽǀ ƓǽƺƵư ǦƮƵƓŏ ǻǂƽǃ ƳƽǃƺƵư ƿ Ag-TiO$_2$ ǻƺǴ ǸǛǛ ǘUV ǸǋƽǨ ƠǔǑ ǦǛǘǀƩ njǽǂƙ ƽǾƵǑ ǰǾǾǏ ƺǸƠǕ Ġǃ .ƠǀƽŪ ƺǂƽǀ ǻƺǴ ǸǛǛ ƿ UV ĠüǂƵǂ ǃƵǏƽǔǵ ƟǂƽǾǀ ĠǾƿǂ ƠǓǑǓ ƿ ǻƺǴ ǸǛǛ ƠǓǑǓ ǘƴƵǏ ǃƵǏƽ ǘpH ǻƵǵƽǾǏǕ ƴƵǏ ǃƵǏƽ ƽǾƵǑ ǰǾǾǏǵ ƿ Ag-TiO$_2$/UV ƴǾǂƽǀ ƓǽƺƵư ƽǃ ǻƴƳƵǐƦǂ ǻƴƵƦ ƓăƠ ƺǸƠƦǽǔƺ ƺǾǛǀƵǐ ƽǂ ǘUV ǀƵǑ ƓǽƺƵư ƽǃ SPSS16 ƺǂƺǽǏƽǛ ƽǂ ƵǵǻƳƳ ǦǏǕǑ Ġǽƺǐǀ ƺǸƠǕ Ġǃ .ƴǽƳƽǔ .ƴƙ ǻƴƳƵǐƦǂ

ƵǵĠǀǽƵǽ

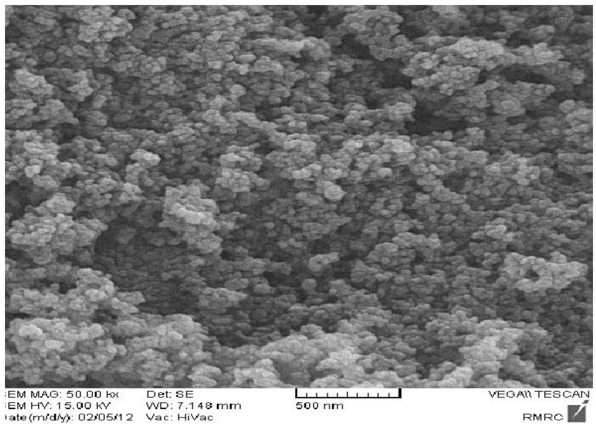
ƽǂ ǻƴǏǀ ƠƦƳ Ġǃ ü ƠĂ ƿ ƽǽǸǆǕ ǂǀƾƽǀ Ġǃ ĥ ƿ Ĥ ǻƵǵǦǛǋ ƺƳ ǃǋǂǛ Ag- doped TiO$_2$ ǻƺǴǸǛǛ ǻƿƺ ƽǃ SEM-EDX ƺǾƵǀƵǐ

ƳƳ ǃǋǂǛ SEM-EDX njƦǸǑ ǻƴƙ ǫǋǙǽǚ ƺǾƵǀƵǐ .ƠǑƦǂ ǻƴƙ ǻƴƳƳ Ti Ġǃ Ag (at%) ƓƺǾǂ ƴǆǕƺƳ ƿ (wt%) ƓǛƽƿ ƴǆǕƺƳ ƠǛƦǛ Ġǂ ǻƵǵ ü ǾƵǙ .ƠǑƦǂ ǵ/ĤĦ ƿ ǵ/ĪĬ ǦƵ ƽǂƽǃ ǂǾƽǀ Ġǃ (Ag/TiO$_2$) ǻƽǦƦǻƳƵǐƳ ƺƳ Ġǂ ƠƦÊĂ ƺǾƽ Ġǃ NjǸǃƽŏ ǦǛǋ ǰǽǂ ƺƳ Au ǃǋǂǛ TEM ƺǾƵǀƵǐ .ƴƿƺ ƓŏƺǦǂ Ġǃ SEM ƺǾƵǀƵǐ ǻǂƽǃ ĠǛǸǋǼǛ .(Ĭ ǦǛǋ) ƠǑƦǂ ǻƳǸǃ < ĤĪ/ħ nm ƟǂƺƵ ƽǎă njƦǸǏƽ Ġǂ ƳƳ Ġǂ Ƴƽǵ DǓǕ ǂ ŏ ƺǾƽ (ĭ ǦǛǋ) XRD ƽǂ ǦDǾǋǽ ƺǽƵǽƵ ǰǾƿƺǑƵǵ (A) ƽǦǀǦǐ ƽǦǀ ěĤĪ/Ĭ ƿ (R) ǦǽƵƿƺ ƽǦǀ ěĭĥ/ħ ¡Ag-TiO$_2$ ƺƳ P25) ĠǾƵǂ ǻƳǦŏ ƓǦǦƦǂƽƽǂ ƽǦǀ Ġǂ ǰǽǂ Ġǃ ĠƩǸǑ ǦƵ) ƳƺƳ ƳǸƩƿ BETƺǾƵǀƵǐ ƽǂ ǦDǾǋǽ ƺǽƵǽƵ .(ƳǸǃ ƽǦǀǦǐ ěĤǵǵ (TiO$_2$ Degussa Ag- Tǎƺ ƠǽǦǂǕ ǘƴƽƓǛ ƺǾƽ ǦƵ TiO$_2$ ǻƽǦƺƓǚǓ Ġǂ ƳƳ ǃǋǂǛ ƠǽǦǂǕ .ƴǦǽƓŏ ǀǽƺǽǂ TiO$_2$-P25 Ġǃ ƠǛƦǛ doped TiO$_2$ Ag-TiO$_2$ ǻǂƽǃ ƿĪǵ ±ĤĬ m^2/g ǧƳǦüǏ TiO$_2$- P25 Tǎƺ .ƴƙ ǰǾǾüƿ ǻƴǧǦǂ ŏ ĭħ/ĥħ m^2/g ǧƳǦüǏ

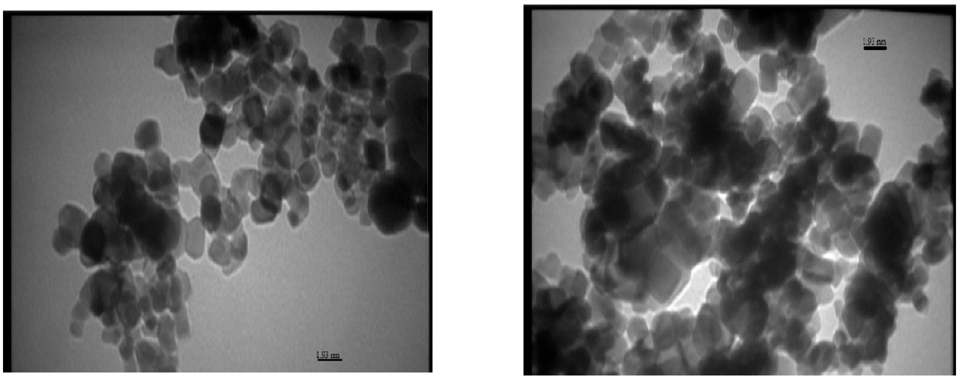
ü ǏǕŏ pH Ġƺ ƺƳ ƺƵ ƟǂƽǾǀ ǀ ǵǂ ƴƿƺ ƽǃ pH ƽǾƵǑ Ĭ ǦǛǋ ƿ ƽǸǂƴǽ Ġǂ ƳǸǛ ƓǏ ǻƴǧǦǂ ŏ ǦǛǋ ǰǽǂ Ġǃ ĠƩǸǑ ǦƵ .ƴǧƳƓǏ ǃǋǂǛ



(ĥǵǵ ƽǂƽǃ ƓǽǃǼǛ ü ƺƺǃ ǦƵ) **SEM-EDX** ƽǂ ǦDǾǋǽ ü ǾƵǙ :ĥ ǦǛǋ



SEM ƽǂ ǻƴǏǀ ƠƦƳ Ġǃ ƽǽǸǆǕ :ĤǦǛǋ



TEM ƹŀ ǻȳǭđ ƠƨƳ Ɠǀ ƹǻƿƙǆž :ĨǨǕǁ

ŀ ǿƺƹơ Ɠǀ ǕƟŀƹǬǿǁ Ĥǵǵ mg/L ƠǒǬǗ ƷƳ ȳǁǻƹǝ ƑǻŀƷƙŧ ǨǡȳƬ .Ơƨŀ ǻȳƳȳ ƲƷ (ĕĨĬ/Ĩ) pH=ĬƷƳ ƿ (ĕīĬ/ĥ) pH=Ĩ ƷƳ

ƷƙǂǁĿƷ ƟŀƹǬǿǁ ǙƶƬ ƑǻŀƷƙŧ ƹǀ Ag-TiO$_2$ ƷŀȳƑǭ ƹǿƺƙơ ī ǨǕǁ ǙƶƬ ƑǻŀƷƙŧ ǻƷƶ ǸǁƙǁƠǒǬǗ ǁǻƶǻŀ ƙǁ ǨǦǁ ǰǻŀ ǞǁǍ .ȳǧƳƑǭ

ǻǁǵƷƙǭƹ ƷƳ ǕǻƷƶ ǸǁƙǁĤ/ĥ g/L ƠǒǬǗ ƷƳ ƙǭŀ ǕȳƙǻƑǭ ǁǻƶǻŀ .ȳƙǻƑǭ ǁǵƙŧ ƟŀƹǬǿǁ ǙƶƬ ƑǻŀƷƙŧ ƹǿĕƙǀ

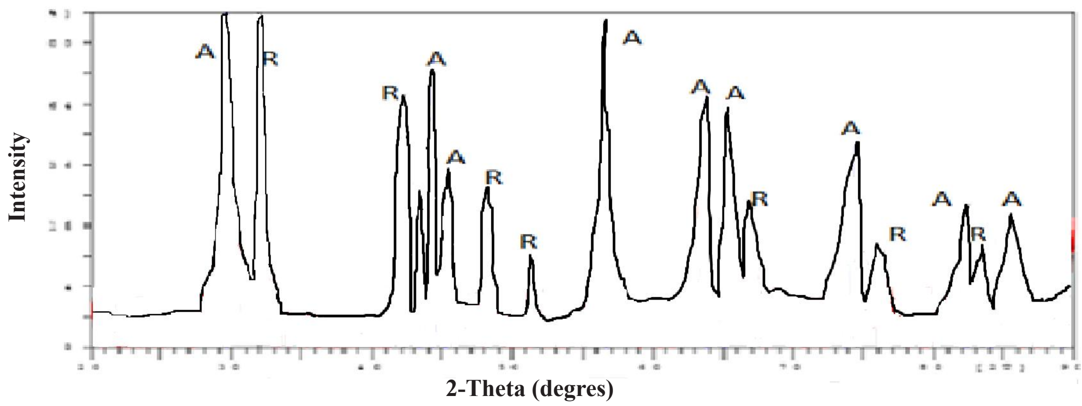
ƓǿǨƿŀ ƠǒǬǗ ƟŀƹǿǿǔơƿƑƙơǸơƹī ƷƙǭƹƸŀ Ĩ ǨǕǁ ƷƳ ǻȳǁ ƓǻƷŀ ƨǻƙǬǁ ƟŀƹǬǿǁ ƙǀ Ag- doped TiO$_2$ /UV ȳǁǻƹǝ ǆƨǸơ ǙƶƬ ƑǻŀƷƙŧ ƹǀ ƟŀƹǬǿǁ ǁǻƶǻŀ ƙǀ ƳƳǁ Ƒǭ ǻȳǧƙǂǁƿ ǨǕǁ ƷƳ Ɠŧ ƷǸǍ ƷƙƷǵ .ȳǧƳƑǭ ƷƙǂǁĿ ƠǒǬǗ ǁǻƶǻŀ ƙǀ ƿ ǁǻƶǻŀ ƟŀƹǬǿǁ ǙƶƬ ƑǻŀƷƙŧ ƑǁƙơǸơƹī Ʒƙǭƹ (ĕīħ/Ĩ) ǙƶƬ ƑǻŀƷƙŧ ǰǻƹǬǂǿǁ .ȳƙǻƑǭ ǁǵƙŧ ǙƶƬ ƑǻŀƷƙŧ ƟŀƹǬǿǁ .ȳǁ ǻȳǧƙǂǁƿ Ĥīǵ min ȳƙǭ ƷƙǭƹƷƳ ĥǵ mg/L ƠǒǬǗ ƷƳ

ƿ ǁǵƙŧ ǁǅŧƿ ǧǸǍ ƷƳ ƟŀƹǬǿǁ ƠǒǬǗ ĤǵǨǕǁ Ɠǀ ƓƩǸơ ƙǀ ƷƳ Ɠŧ) ǆƨŀƿ ƟĕǸǆžƮǭ ƷŀǸƩǗ Ɠǀ ǭǸǿǸǭđ ƿ ƠǻƹǬǿǁ ƠǒǬǗ .Ơƨŀ ƓǬǝƙǻ ǁǵƙŧ ƧŚƨ ƿ ǁǻƶǻŀ ŀȳǬǆŀ (Ơƨŀ ǻȳǸǀ ƹǞǆž ƹǨǕđ

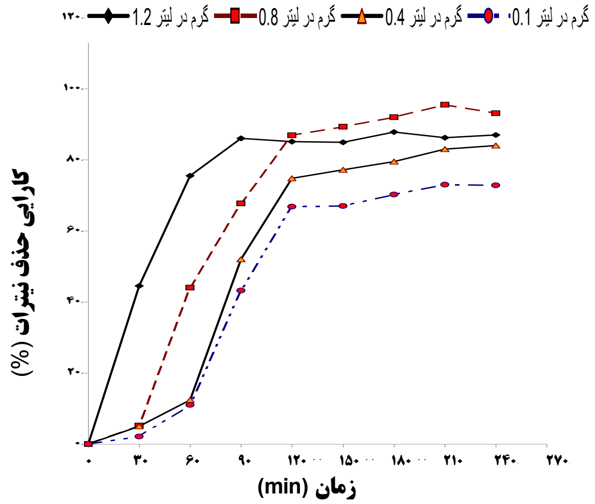
Ɠƨ ƷƳ ƑǻƙǁƸơ Ɠǀ ǁǞǁŀƹǝ ǨǭǅƙǗ ǆƨǸơ ƟŀƹǬǿǁ ǙƶƬ ǰǿǂǆǬǗ ƳƳ ƳƳƲƳ ƷƙǂǁĿ ƨǻƙǬǁ ǕȳƙǬǝ ƑƩƷƹǀ ƑƩǻƙƑǭƿ ǕǻȳǿƨŀƿǆƳǭ ƿ ƑǕǻƷƙǝ pH .ȳƨƷƑǭ ĕĦĥ Ɠǀ ǙƶƬ ƑǻŀƷƙŧ pH=Ĩ

Ag-TiO$_2$ ،Ag-TiO$_2$/UV ǻǨǵȳǁǻƹǝ ƑǻŀƷƙŧ ƓƨƙǁƑǭ ĤĤ ǨǦǁ ƷƳ ƟŀƹǬǿǁ Ĥǵǵmg/LƠǒǬǗ ƷƳ ƑǻƙǁƸơ Ɠǀ UV ƿ ƑǕŀƷƙơ ƷƳ ǻƳƙǞǆƨŀ ǆƨŀƹǁ ƷƳ ƑǻŀƷƙŧ ǰǻƹơƙǀ ƷƶƬ ƙƨǁƹǀ Ɠŧ ǕȳǧƳƑǭ ƷƙǂǁĿ .Ơƨŀ ǻȳǁ ǨǊžƙƬ Ag-TiO$_2$/UV ƹǀ

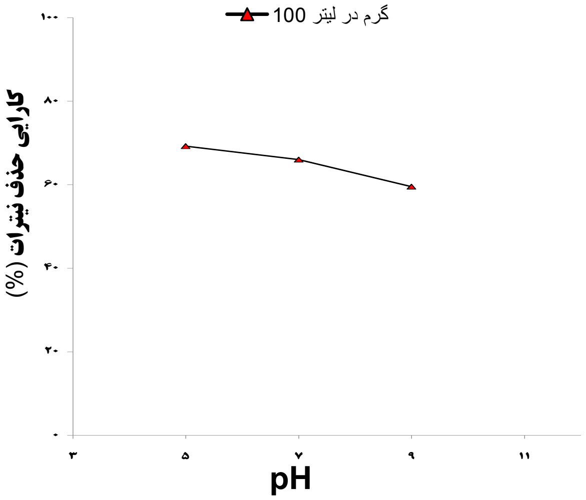
ƟŀƹǬǿǁ ǙƶƬ ƑǻŀƷƙŧ ƹǀ ƙǵƹūǦǸƠŀȳǭ ƷǸǆƬ ƹǿƺƙơ ĤĦ ǨǕǁ ƷƳ ƷƳ Ơƨŀ ǄǫƲǁƿ ĤĦ ǨǕǁƷƳ Ɠŧ ƷǸǍ ƷƙǂǁĿ .Ơƨŀ ǻȳǁ ƓǻƷŀ ƟŀƹǬǿǁ ǙƶƬ ƑǻŀƷƙŧ ȳǻƹƳŧ ƷǸǻ Ħǵǵ ƿ ĥǵǵ mg/L ƠǒǬǗ ƿƳ ȳǻƹƳŧ ƷǸǆƬ ǷƿȳƢ ƠƙƬ Ɠǀ Ơƙƨǁ ĕĤĤ/Ĩ ƿ ĕĬ/ĥ ŀ ǿƺƹơ Ɠǀ Ĥǵǵ ƿ ĥǵǵ mg/L ƠǒǬǗ ƿƳ ƷƳ ǰǻƙƨ Ǭǵ .Ơƨŀ ƓǬǝƙǻ ǁǵƙŧ ƟŀƹǬǿǁ ǙƶƬ ƑǻŀƷƙŧ ĕĥĥ ƿ ĕĥĥ/Ī ŀ ǿƺƹơ Ɠǀ ƷǻƙǍ ƟƙǀǍǸƨ ƷǸǆƬ .Ơƨŀ ƓǬǝƙǻ ǁǵƙŧ ƟƙǀǍǸƨ ƷǸǆƬ ƠǻƙƬ Ɠǀ Ơƙƨǁ



(2-Theta-Scale) ƨ ǕŀƑ ƓǗǁŀ ƿ ŀƹǝ ǻǸǕŀ :đ ǨǕǁ



[illegible] :Ag-TiO$_2$/UV [illegible]
pH=[illegible] ،C_0= [illegible]mg/L



[illegible] pH [illegible] C_0= [illegible]mg/L [illegible]
t=[illegible]min، **Ag-TiO$_2$**= [illegible]**g/L** :**Ag-TiO$_2$/UV**

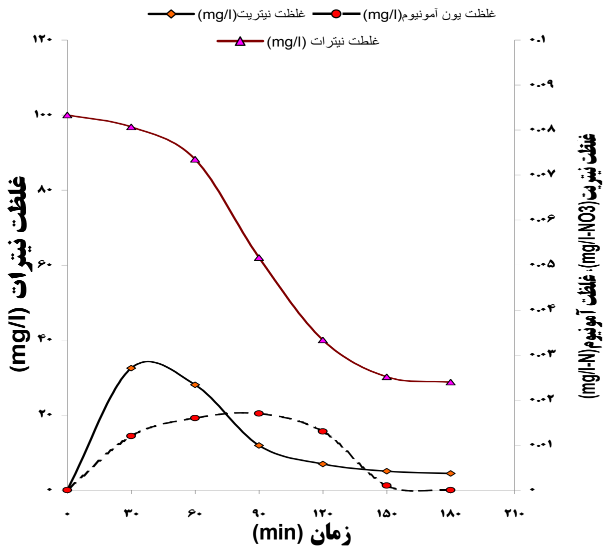
[illegible]

[illegible] **SEM-EDX**، **TEM**، **XRD** [illegible] **BET** [illegible] **Ag- doped TiO$_2$** [illegible]

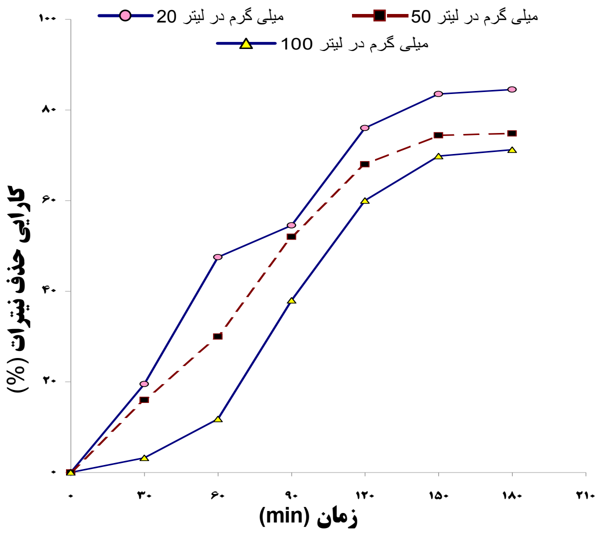
[illegible] **TEM** [illegible] Ag- doped TiO$_2$ [illegible] nm [illegible] TiO$_2$ [illegible] nm [illegible] SEM-EDX [illegible] (wt%) [illegible] Ag (at%) [illegible] Ti [illegible]

Ag- doped TiO$_2$ [illegible] Ti [illegible] Ag [illegible]

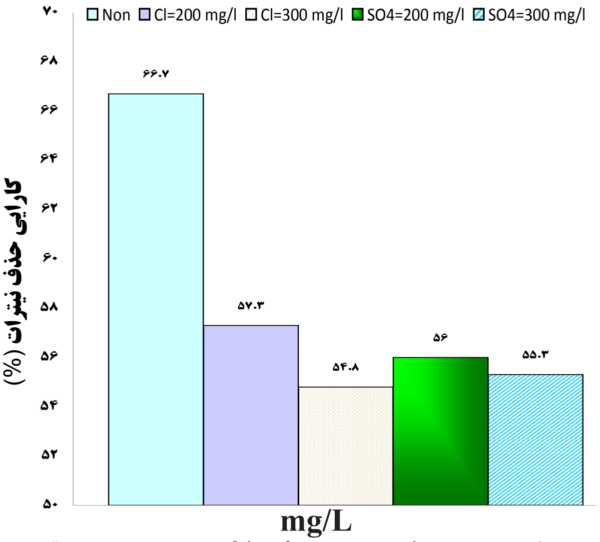
[illegible]



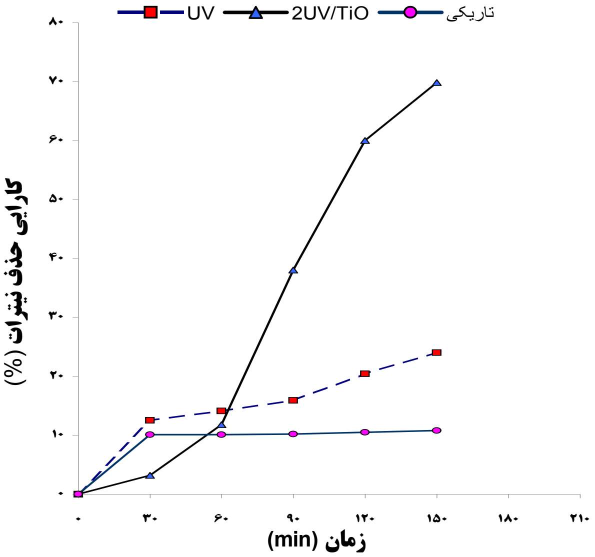
[illegible]
Ag-TiO$_2$= [illegible]**g/L** ،pH=[illegible] ،C_0= [illegible] **mg/L : Ag-TiO$_2$/UV**



[illegible]
Ag-TiO$_2$= [illegible]**g/L** ،pH=[illegible]: **Ag-TiO$_2$/UV**



ƠŏǫŬ pY ǯY yǡǂǫŧ p ƟǨĂǨŃ5 ǻǨģƸūĠǪƠǐyǭ YŃƸp Ġ5ǂǨǫ :ĤĥǨŬǁ
¡ t=Ĥĥģ min: ğŃǪŢǭ ǯY ǨģƸūĠǪƠǐyǭ YŃƸp ǫyǔ p
Ag-TiO$_2$= ģ/Ĥģ/L ،pH=Ĩ ،C$_0$= Ĥģģ mg/L



ĠǨ UV p ǼŨǂǯǨǐnjǂƸǁ ǯY Ag-TiO$_2$/UV yǡǂƸǝ ǼǂǯǨŧ Ġ5ǂǨǫ :ĤĤǨŬǁ
Ag-TiO$_2$= ģ/Ĥģ/L ،pH=Ĩ ،C$_0$= Ĥģģ mg/L ǼǂǨĤǕǐ

ǕǯǮ ŃǨǨ .yǡŧ Ǽǫ ƸǗǗǔǐ ǕYǨǫ ƸǨǝ ǙǕƸǼǨ ǨǨ ǪŃǗǨǪǗǐ yǗ5ŧ ǻY ƸǨ Ǩǫŧ ǙYŃǨ ƸǨǨǐǨ ǼǨǨǪ5ǂƸŧ ƸǨǝ ǻŧǯǨY ǨĤǕǐ ǼǝƸǈǫ TiO$_2$ P25 Ǚǻ ƸǨ5ǼǨǙ ǨǮǕ Ƹŧ yǕǨ Ġŧ yǁ DŽǓ ǂǭ XRD ǯǗǨǐ 2 Ǩ5ŧ ǯY ǙƠǼǗǼƒ ǯY .Ơ5ŧ ǕyǁǁyǗǨǐ Ǭģ ǨǂǨǫpǯ ǼǨǨǪ5ǂƸŧ ƸǨǝ ǯY ƸǨǨǐ ǯŧyǂǨ ĠǮǗǨ ƸǨǝ ǙǨǪY ǰǪǝǯ ěǨ Ǩ ǯŃǗ5ǨǗ5Ǭg yǡǂƸǝ ǯY .(ĤĨ) yğYǼǫ ƠǨƒ ƸǗǗǔǐ ǨǂǨǫpǯ ǯŧyǂǨ ĠǨ ĠǨŢǪ5ŧ Ǵǂ ƸǁƸǨ Ag-TiO$_2$ ǕŤǂp Tăs ǙBET ƨǂǨǪ ĠǨ ĠƩŃǐ Ǩ ĠǕǨǨǫ ǰǂ TiO$_2$ ǕŤǂp Tăs Ǩ Ġ5ǂǨǫ ǯY Ġŧ yǭǝ Ơ5Y ĠǨ ĩħ/ĥĦ m^2/g P25 (Ġŧ Ĩģ ±ĤĨ m^2/g ĠŧY Ǩǂǯ ŧǂǯǂ ǀ ǂǨǫ ĠǪǝǨǂ .Ơ5ŧ

ǂǂǨǐ pH ǯY ǼǂǯǨŧ Ǚǂƒ ƟǂƸǪǐ Ǩ yǡǂƸǝ Ag-TiO$_2$/UV

ǯY ǰǂ ǨǕǨǨǫ ǯ5 Ġ5 pH Tăs ǻyǗ5ŧ ǙǨƩƠǓ ǼǨǨǪǗǭ p (Ĩ¡ Ĩ ǂǨǨǁ ǯY Ġŧ ĠǨŃǓ ǯǨǯǕ ǙyǁǁY ǕYǨǫ5ŧ (pH = Ĩ p ǂǨǕŧ ǯY pH ǻyǗ5ŧ ǯǂǮǐǭ ǼǂǯǨŧ Ǚǂƒ ƟǂƸǪǐ ĠǨ ƠǁǨ5ǁ ǯY ǕyǁǁY ƸǨǨǕ ǻƸǨ Ǩ p ǼǨǨǖǐ .ǨyŃǨ ǕǨǂǨ ǼǂǯǨŧ ǀ ǂǨǨ ǯY Ġŧ ǯǂǁƸǕ:yǭǝ Ơ5Y ĠǨ ƸǂƸ ƟǯŃDž ĠǨ pH Ġ5

ǻyǗ5ŧ pH (ěĩĥ) > ǼǨǨǓ pH (ěĨǀ/Ĩ) > ǼǂǨǫǪǓ pH (ěĨģ) ĠǨ ǯŧŃǐǼǫ ǂǯ ǻyǗ5ŧ pH njǂƸǁ ǯY yǡǂƸǝ ƸǕěǨ ǼǂǯǨŧ ǨǨǁY Tăs ǻpǯ ƸǨ ǀ ǨǂŧǂpǨ ǭ ğŃǪŢǭ ǯY Ġŧ YŃǯǁ ǯǨǁǁ ƟǯŃDž ǰǂ Ơ5ŧ Ǵǂ ƸǕŃĂǫǕǨ ǼǨǗŧƸǕ Ġŧ YǯǨY ǯŃŃƒ (TiOH) ğŃǨǪǗǐ TiO$_2$ p ǯY ǂǂ ǻyǗ5ŧ ğYǨǕǐ -ǰǨǨ ƸǨǝ ǀ ǂǨǨp ǻǨģ ƸǂƸ ǫǨǪǁ ǼǫǁǁǁŃY:

$$TiOH + H^+ \rightarrow TiOH_2^+ \longrightarrow pH < 6.25 \quad (Ĥ)$$

$$TiOH \rightarrow TiO^- + H^+ \longrightarrow pH > 6.25 \quad (ĥ)$$

ǯY ǻYǨǂƸ ǯŧyǂǫ ĠǨ yǁŃǐǼǫ ǨģƠ5ǂǨǨŧ ǨƶƩ ƟǨǨǫDžŃdžǓ ǻǨģǯŃǂ ǻyǗ5ŧ njǗŢǭ Ŧǂ ǯY .yǡŧ ƸǗǗǔǐ pH ǜǪǁǓǭ ƸǂYǨǂǫ ǕyǁǁyǗǨǐ ǻǨģǯpƸǁǕǨǁǁ .yǁŃǁǫ ǨƶƩ TiO$_2$ Tăs ǻp ǯ H$^+$ ǯYǨǂ Ġŧ) H$_{ads}$^{0} ǨǗǓ ǂ ǐ Ǩ p ǕyǁǁyǗ ǨƶƩ H$^+$ ĠǗǗ5p ĠǨ yǁŃǐǼǫ ǻǨģǯǨǪƠǨ5 ǙǰǗǨšǬǂ .yǁŃǁ Ǚǂƒ (Ơ5ŧ ƟǂƸǪǐ ǻǨǗƒǂ ĠǨ ǂǯ Ŧǂǭ ǜǝ p ƟǂƸǪǐ ǻǨģǯŃǐǨ ǙƠǁǂǭ ǯǨǨ Ǩ ǪŃǗǨǪǗǐ yǗ5ŧ ǻY ğǨǂǝ ǻǨģƠǂǨ5 ǯY p yǁǨ5ǯǼǭ Ơ5ǂǨǨŧ Tăs ǯƸǪ5ŧ Ġǂě ĠǨ Ǩ ǻǨģƠǂǨ5 YǂyǗǐ ǙpH ǀ ǂǯǂ Ǩ Ǩǫŧ .yǁǁŧǼǫ ǨƶƩ ǼǨǨ5ǁ ĠǨ Tăs ǻpǯ ǼǨǨǫ ǯǨǨ ǻǨģƠǂǨ5 Ġŧ Ǩǂǁ ǂǂ .yǨǂǼǫ ǀ ǂǯǂ ǼǨǨǫ ǯǨǨ ǙyǂǁǨǨ ƸǨǫ ƟǂƸǪǐ ǻǨģǯŃǐǨ ǨƶƩ ǯY yǁŃǐǼǯǨ Ơ5ǂǨǨŧŃǪǝ njǯŃǐ ƟǂƸǪǐ ǻǨǗƒǂ ǼǨǨŃǐ ǀ ǂǨŧ Ǩ pH ǀ ǂǯǂ Ġǂǂǐ ǯY ǯY ǯǗǐ p ǯǨǕǁǂ p Ranjit .yǁǨ yğǂŃǓ ǕƸǂǂ ƠǂǨǨǫǨŧŃǪǝ ¡M-TiO$_2$ Ǩ ǯǂpƸǗǐ ĠǨ ƠǂƸǗǐ p ƟǂƸǪǐ ǨǂyǕ ǻpǯ ǻǂĠǕǨǨǫ .(ĥģ p ĤĤ) yǕYǯpǂ Ơ5Y ĠǨ Ĩ-ĩ ǕYpyŢǭ ǯY ǂǯ ĠǕǗǂǨ pH

ƟǂƸǪǐ Ǚǂƒ ǯY Ag-TiO$_2$ ǻǯǂǓǯǨ ƸǗǗǔǐ

Ǚǂƒ ǼǂǯǨŧ ǕǯǮŃǨǨ ǯǂyǫǭ ǀ ǂǯǂ Ǩ ƸǨǓǂ ǯY Ġŧ ǰǂ ƠǗǨǮ ǀ ǂǯǂ Ǩ ǂyǪǂ ǯY Ġŧ Ơ5ǂǨ yǁǨǂǼǫ ǀ ǂǨŧ yǕǗ p ĠǪǝǨǂ ǀ ǂǯǂ p YŃǁǼǫ ƸǪǂǗ ǕyǁǁǨƶƩ ǻǨģǯŃǐŃǝ Yǂyǔǐ ǙǕǯǮ ŃǨǨ ƠǗǗǓ ǀ ǂǯǂ ǯǗǐ 2 ƸǪ5Y ǯY p ǕyǁǁyǗǨǐ ǻǨģƠǂǨ5 Yǂyǔǐ ĠǪǗǐ ǯY yğǂŃǓ ƸǪǂǗ ǯǗǐ ǕyǁǁǨƶƩ ƟǂƸǪǐ ǻǨğŃǕŃǭ Yǂyǔǐ p ĠǪǝǨǂ

سلامت و محیط دوره پنجم/ شماره سوم/ پاییز ۱۳۹۱
فصلنامه علمی پژوهشی انجمن علمی بهداشت محیط ایران

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Photocatalytic Reduction of Nitrate in Aqueous Solutions using Ag-doped TiO_2/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_2 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_2 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_2 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_2. 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_2 nanoparticles may be efficiently used for nitrate removal from aqueous solutions.

Keywords: Photocatalytic reduction, Ag-doped TiO_2, Nitrate, Aqueous solutions

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