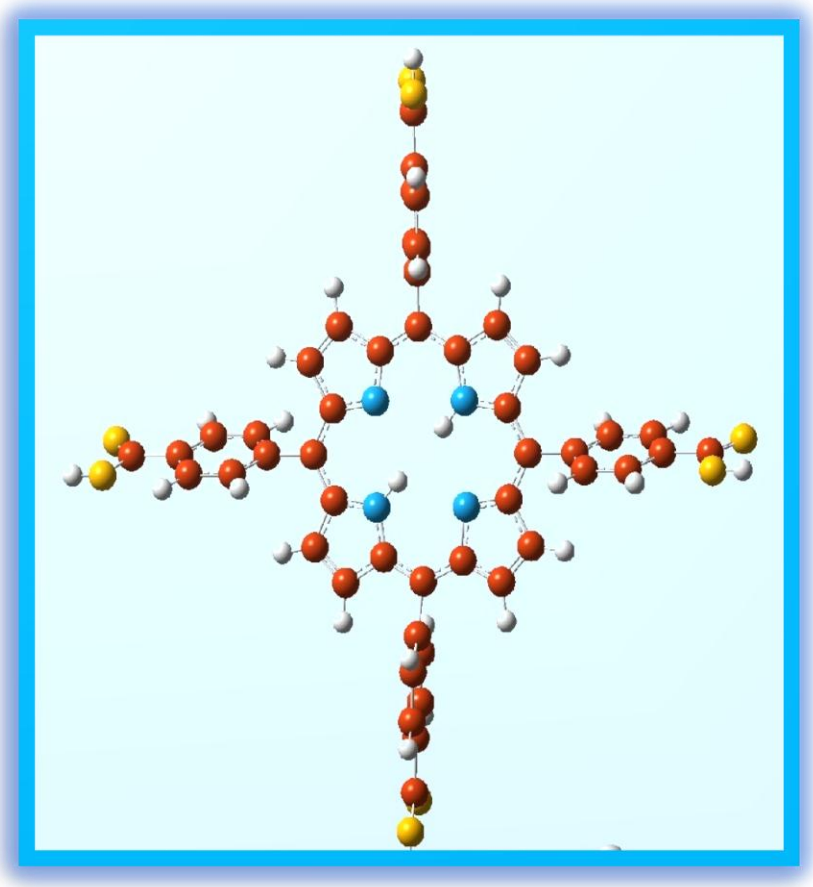
Bioinorganic Chemistry Research Laboratory



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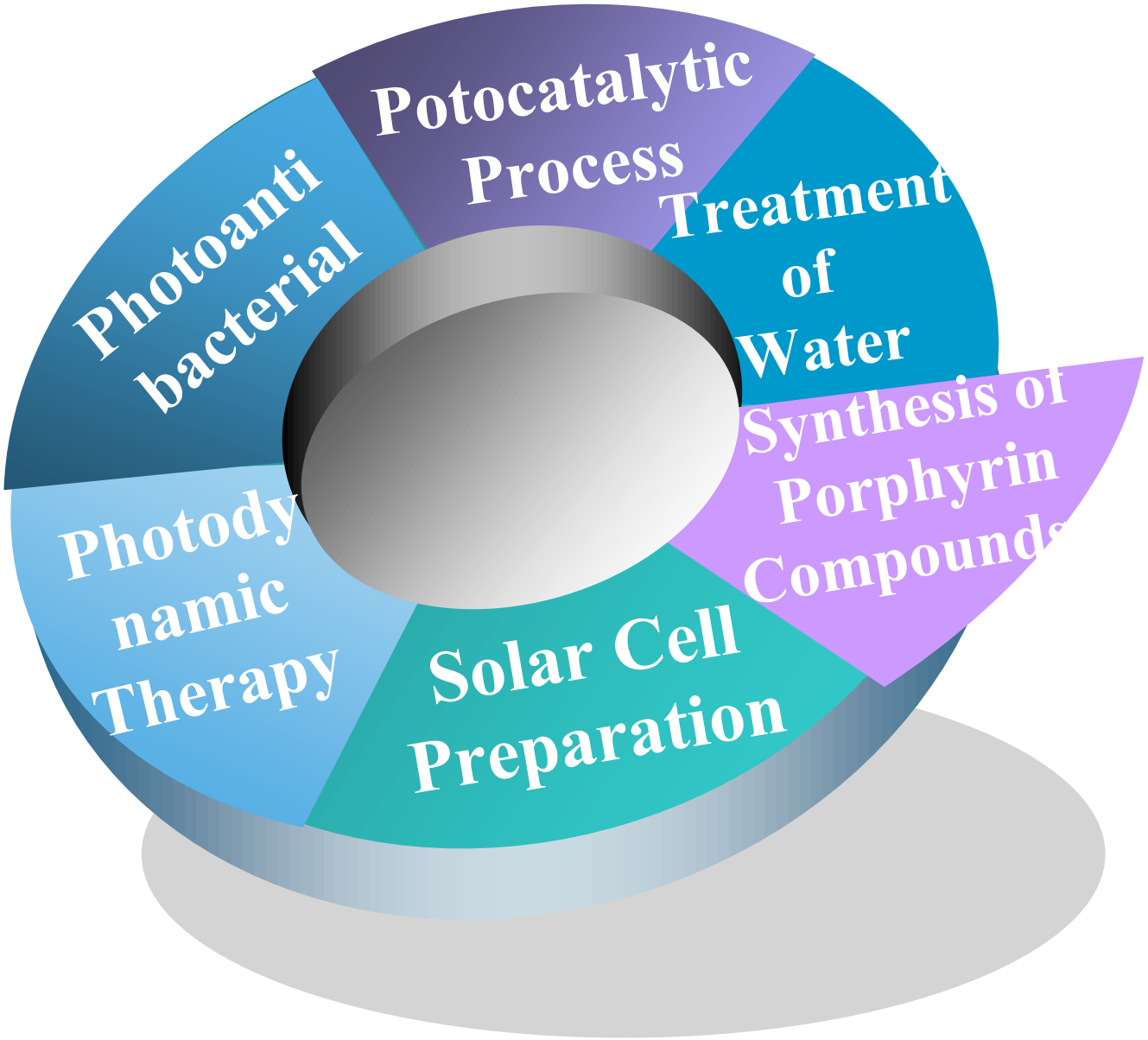
Research Subjects



Introduction

Porphyrin is a well-known and useful compound which is synthesized in this laboratory. With regard to the literatures in this field it is determined that porphyrin compounds have been used in several applications. On the other world, porphyrin is described as a multifunction compound.

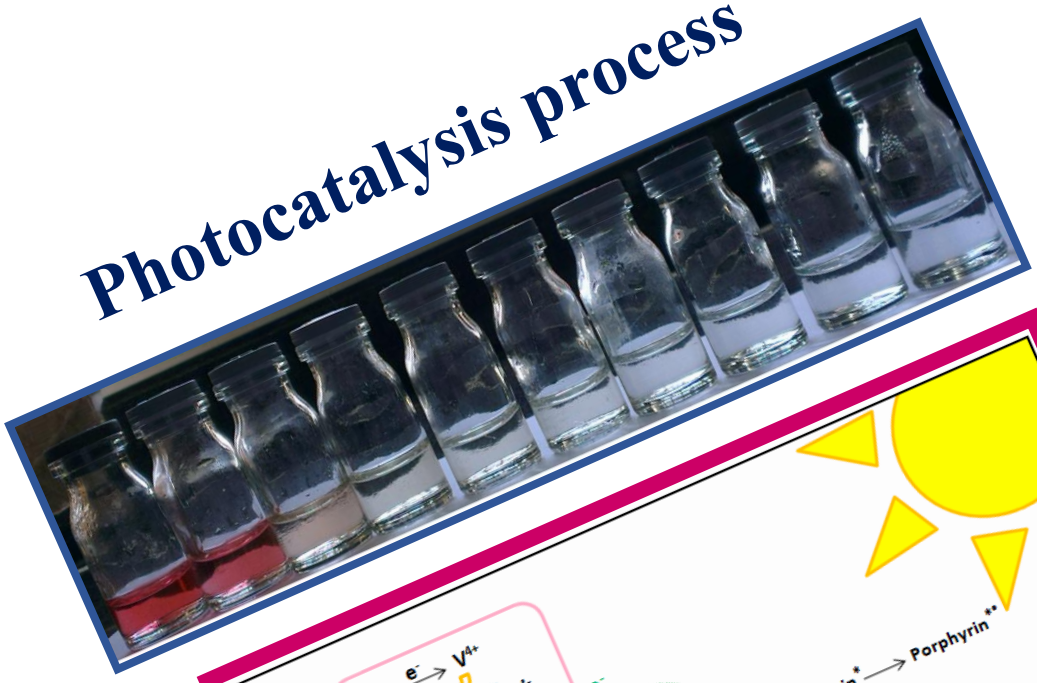
Some of the useful properties of porphyrins are strong light harvesting, chelating properties, medicinal and catalytic properties. The research field of porphyrin is in the photodynamic therapy of cancers, solar cells, photocatalytic process (treatment of wastewaters, photoantibacterial and photooxidation process) and catalytic process in the preparation of organic compounds.

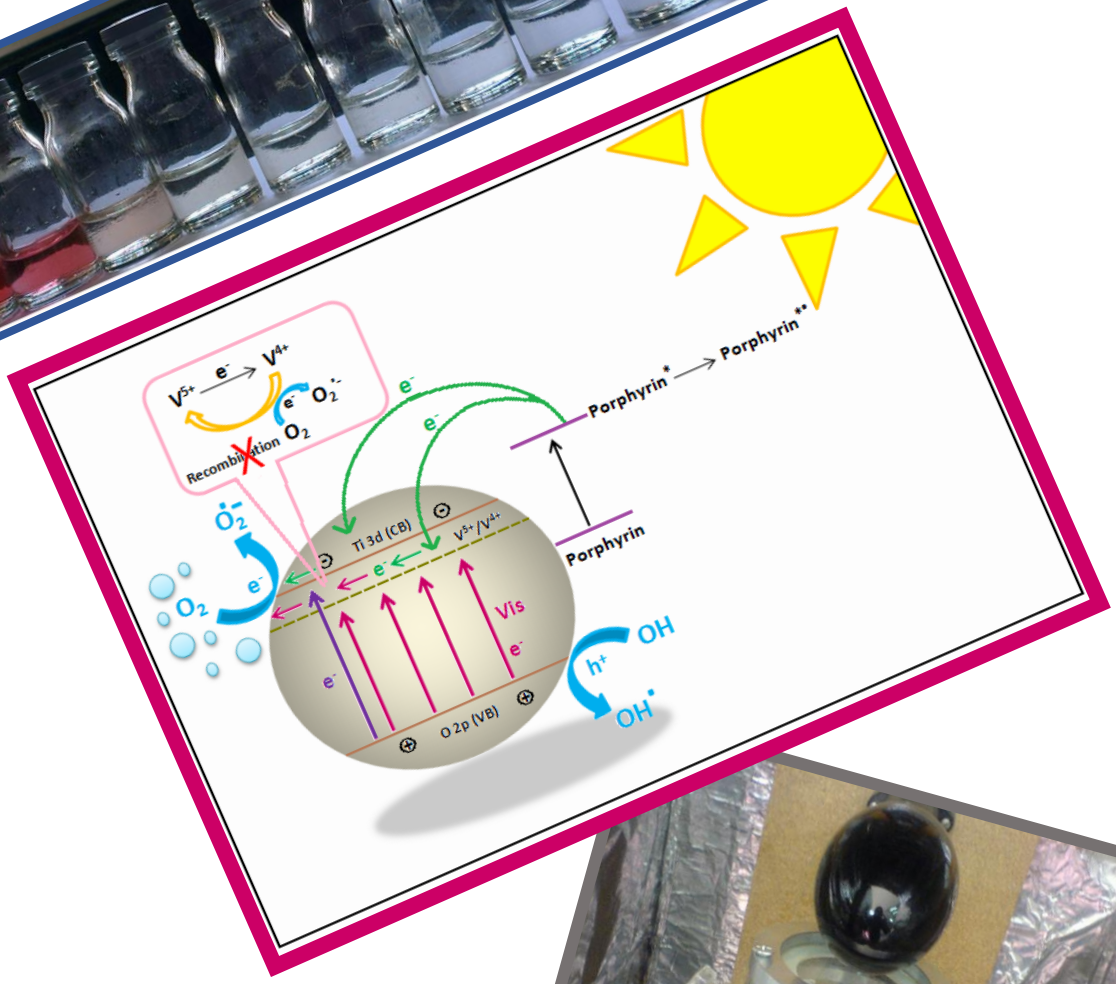
Graphene, graphene oxide and nanoparticles with special morphology are also prepared in this laboratory. Removal of heavy metals from wastewaters, photocatalytic process (photoantibacterial, photocatalytic treatment of wastewaters and photooxidation process), preparation of solar cells as well as the preparation of efficient absorbance for biological toxins.

UV-Vis spectrophotometer, glow box, vacuum oven, refrigerated microcentrifuge, incubator, refrigerator (-85 °C), Optical microscope, Laminar flow hood, furnace, special systems for photocatalytic process and other laboratory instruments are available in this laboratory.

Main purposes and achievements of laboratory

Photocatalysis process

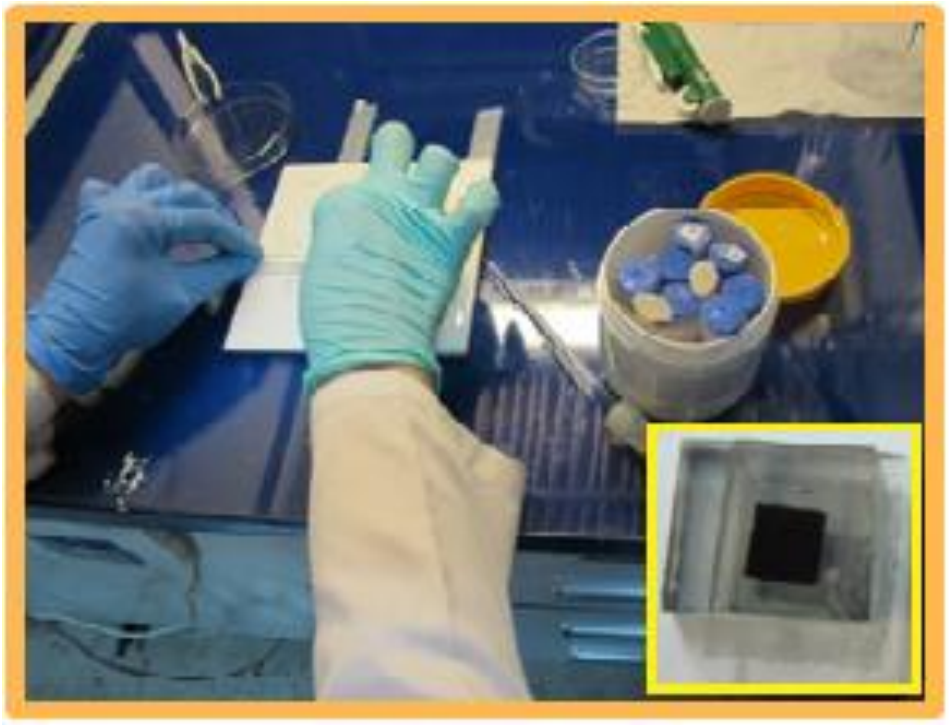




Photocatalytic system

Photo Antibacterial process

Solar cell preparation



Some instrumentations of laboratory

Optical microscope

Laminar flow hood

Refrigerator (-85 °C)

Raw	Instrument	Contact numbers
1	Oven	021-77240540 021-77240543 (2776)
2	Oven with temperature gradient	
3	Vacuum oven	
4	Incubator CO_2	
5	UV-vis spectrometer	
6	Digital scale balance	
7	Several lamps (mercury, tungsten, xenon, LED)	
8	Equipments of photocatalytic tests	
9	Full sets of sampler	
10	Refrigerator	
11	Refrigerator (-85 °C)	
12	Vacuum Pump	
13	Microcentrifuge (max 13500)	
14	Microcentrifuge (max 18000)	
15	Centrifuge (max 4000)	
16	Laminar flow hood	
17	Optical microscope	
18	Rotary evaporator	
19	Glovebox	
20	pH meter	
21	Furnace	
22	Ultrasonic bath	

Research papers in recent years

2015:

1- Rahmatollah Rahimi, Mahdi Heidari-Golafzani, Mahboubeh Rabbani, "Preparation and photocatalytic application of Zn—Fe_2O_4@ZnO core–shell nanostructures" *Superlattices and Microstructures*, 85 (2015) 497-503.

2- Hossein Ghafuri, Zahra Movahedinia, Rahmatollah Rahimi and Hamid Reza Esmaili Zand, Synthesis of 5, 10, 15, 20-tetrakis (4-naphtalen-2-yl-benzoate) porphyrin, its complexes with Zinc and Cobalt and Fe_3O_4@ZrO_2-TNBP as photocatalyst and investigating its photocatalytic activities, *RSC Advances*, DOI: 10.1039/C5RA11126A

3- Rahmatollah Rahimi, Samaneh Shariatinia, Solmaz Zargari, Marzieh Yaghoubi Berijani, Ali Ghaffarinejad and Zahra Sadat Shojaie, "Synthesis, characterization, and photocurrent generation of a new nanocomposite based Cu–TCPP MOF and ZnO nanorod" RSC Adv., 2015, 5, 46624.

4- Ahmad Najafian, Mahboubeh Rabbani, Rahmatollah Rahimi, Mehdi Deilamkamar, Ali Maleki, "Synthesis and characterization of copper porphyrin into SBA-16 through "ship in a bottle" method: A catalyst for photo oxidation reaction under visible light", *Solid State Sciences*, (2015) 46, 7-13.

5- Rahmatollah Rahimi, Javad Shokraiyan, Mahboubeh Rabbani and Fatemeh Fayyaz, "Enhanced photobactericidal activity of ZnO nanorods modified by meso-tetrakis(4-sulfonatophenyl)porphyrin under visible LED lamp irradiation" *Water Science & Technology*, (2015) 71, 1249–1254.

6- Rahmatollah Rahimi, Marzieh Yaghoubi Berijani, Solmaz Zargari "Synthesis of ZnO Nanorods via Coprecipitation Method and its Sensitizing with Tetrakis (4-Carboxy Phenyl) Porphyrin and its Tin Complex to Enhance the Visible Light Photocatalytic Activity", Nanomaterials 6:19 (2014) 228.

7- Fatemeh Hashemzadeh, Ali Gaffarinejad, Rahmatollah Rahimi, "Porous *p*-NiO/*n*-Nb_2O_5 nanocomposites prepared by an EISA route with enhanced photocatalytic activity in simultaneous Cr(VI) reduction and methyl orange decolorization under visible light irradiation", *Journal of Hazardous Materials*, (2015) 286, 64-74.

2014:

1- Mohsen Moradi-Haji Jafana, Mohammad-Reza Zamani-Meymian, Rahmatollah Rahimi, Mahboubeh Rabbani, "Effect of pyrolysis temperature on the electrical, optical, structural, and morphological properties of ITO thin films prepared by a sol–gel spin coating process" *Microelectronic Engineering* (2014) 130, 40–45.

2- Ali Maleki, Rahmatollah Rahimi, Saied Maleki, " Preparation and characterization of magnetic chlorochromate hybrid nanomaterials with triphenylphosphine surface-modified iron oxide nanoparticles" *J. Nanostruct Chem*., DOI 10.1007/s40097-014-0131-0

3- Ali Maleki, Rahmatollah Rahimi, Saied Maleki and Negar Hamidi, "Synthesis and characterization of magnetic bromochromate hybrid nanomaterials with triphenylphosphine surface-modified iron oxide nanoparticles and their catalytic application in multicomponent reactions", *RSC Adv*. (2014) 4, 29765-29771.

4- Milad Fallah, Mohammad-Reza Zamani-Meymian, Rahmatollah Rahimi, Mahboubeh Rabbani, " Effect of annealing treatment on electrical and

optical properties of Nb doped TiO_2 thin films as a TCO prepared by sol–gel spin coating method" *Applied Surface Science* (2014) 316, 456–462.

5- Ali Maleki, Rahmatollah Rahimi, Saied Maleki, "Preparation and characterization of a new surface-modified dichromate/triethylamine/silica/iron oxide magnetic hybrid nanomaterial" *J. Iran Chem. Soc*. DOI 10.1007/s13738-014-0473-z.

6- Ali Maleki*, Rahmatollah Rahimi, Saied Maleki, Synthesis, characterization and morphology of new magneticfluorochromate hybrid nanomaterials with triethylamine surfacemodified iron oxide nanoparticles, *Synthetic Metals*, 194 (2014) 11–18.

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8- Fatemeh Hashemzadeh, Rahmatollah Rahimia, Ali Gaffarinejada, Vahideh Jalalata, Siamak Safapour, "Photocatalytic treatment of wastewater containing Rhodamine B dye via Nb_2O_5 nanoparticles: effect of operational key parameters", *Desalination and Water Treatment*, (2014) 1–13, doi: 10.1080/19443994.2014.936516

9- Mohsen Moradi-Haji Jafan, Mohammad-Reza Zamani Meymian, Rahmatollah Rahimi, Mahboubeh Rabbani, "The effect of solvents and the thickness on structural, optical and electrical properties of ITO thin films prepared by a sol–gel spin-coating process", *J Nanostruct. Chem*. 4 (2014) 89, DOI 10.1007/s40097-014-0089-y.

10- Mahboubeh Rabbani, Rahmatollah Rahimi, Mohammad Bozorgpour, Javad Shokraiyan, Samaneh Safalou Moghaddam, "Photocatalytic application

of hollow CuO microspheres with hierarchical dandelion-like structures synthesized by a simpletemplate free approach", *Materials Letters* 119 (2014) 39–42.

11- F. Hashemzadeh, R. Rahimi, A. Ghaffarinejad, "Mesoporous nanostructures of Nb_2O_5 obtained by an EISA route forthe treatment of malachite green dye-contaminated aqueous solutionunder UV and visible light irradiation", *Ceramics International*, 40 (2014) 9817–9829.

12- Fatemeh Hashemzadeh, Rahmatollah Rahimi, Ali Gaffarinejad, "Influence of operational key parameters on the photocatalyticdecolorization of Rhodamine B dye using$Fe^{2+}/H_2O_2/Nb_2O_5$/UV system", *Environ. Sci. Pollut. Res.*, 21 (2014) 5121-5131.

13- Farhadi Houshang, Hashemzadeh Fatemeh, Rahimi Rahmatollah, Gaffarinejad Ali, "Surfactant-Free Hydrothermal Synthesisof Mesoporous Niobia Samples and Their Photoinduced Decomposition of Terephthalic Acid (TPA)", *J. Clust. Sci.*, 25 (2014) 651-666.

14- Rahmatollah Rahimi, Ali Maleki, Saied Maleki, "Preparation of magnetic fluorochromate hybrid nanomaterials with triphenylphosphine surface modified iron oxide nanoparticles and their characterization", *Journal of Magnetism and Magnetic Materials*, 355(2014)300–305.

15- Rahmatollah Rahimi, Ali Maleki, Saied Maleki, Ali Morsali, Mohmmad Javad Rahimi, "Synthesis and characterization of magnetic dichromate hybridnanomaterials with triphenylphosphine surface modified iron oxidenanoparticles ($Fe_3O_4@SiO_2@PPh_3@Cr_2O_7^{2-}$)", *Solid State Sciences* 28 (2014) 9-13.

2013:

16- Rahmatollah Rahimi, Ali Maleki, Saied Maleki, Ali Morsali, Mohmmad Javad Rahimi, "Synthesis and characterization of magnetic

dichromate hybridnanomaterials with triphenylphosphine surface modified iron oxidenanoparticles (Fe_3O_4@SiO_2@PPh_3@$Cr_2O_7^{2-}$)", *Solid State Sciences* 28 (2014) 9-13.

17- F. Hashemzadeh, R.Rahimi, A.Gaffarinejad, "Photocatalytic Degradation of Methylene blue and Rhodamine B dyes by Niobium Oxide Nanoparticles synthesized Via Hydrothermal method", *International Journal of Applied Chemical Sciences Research*, 1 (2013) 95-102, ISSN: 2328-2827 (Online).

18- Rahmatollah Rahimi, Masoumeh Mahjoub Moghaddas, Solmaz Zargari, "$SbVO_4$-TiO_2 Cation Deficient Photocatalyst: Synthesis and Photocatalytic Investigation", *Advanced Materials Research*, 702 (2013) 51-55.

19- Rahmatollah Rahimi, Masoumeh Mahjoub Moghaddas, Solmaz Zargari, Rahim Rahimi, "Synthesis of Mesoporous V-TiO_2 with Different Surfactants: The Effect of Surfactant Type on Photocatalytic Properties", *Advanced Materials Research*, 702 (2013) 56-61.

20- Rahmatollah Rahimi, Solmaz Zargarib, Masoumeh Mahjoub Moghaddas, "$BiVO_4$-TiO_2 Nanocomposite: Synthesis and Photocatalytic Investigation", *Advanced Materials Research*, 702 (2013) 172-175.

21- R. Rahimi, M. Mahjoub Moghaddas, S. Zargari "Investigation of the anchoring silane coupling reagent effect in porphyrin sensitized mesoporous V-TiO_2 on the photodegradation efficiency of methyl orange under visible light irradiation" *Sol-Gel Sci. Technol.* 65(3) (2013) 420-429.

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1- Rahmatollah Rahimi, Azadeh Tadjarodi, Mahboubeh Rabbani, Hamed Kerdari, Mina Imani, "Preparation, Characterization and Photocatalytic Properties of Ba-Cd-Sr-Ti Doped Fe_3O_4 Nanohollow Spheres on Removal of

Congo Red Under Visible-Light Irradiation", *J. Supercond. Nov. Magn.* 26 (2013) 219–228.

2- Ahmad Nozad Golikand, Khadijeh Didehban, Rahmatollah Rahimi, "Investigation of the properties of conductive hydrogel composite containing Zn particles", *Journal of Applied Polymer Science*, 126 (2012) 436–441.

3- Rahmatollah Rahimi, Ensieh Gholamrezapor, Mohammad Reza Naimi-Jamal, Mahboubeh Rabbani, "Oxidation of *o*-chloro and *o*-hydroxy benzyl alcohols catalyzed by copper (II) tetraphenylporphyrin nanoparticles synthesized by mixed solvent method", *Current Chemistry Letters* 1 (2012) 101–108.

4- Rahmatallah Rahimi and Neda Goodarzi, "Simultaneous Determination Water-soluble Vitamin B9 or Folic Acid in Mint Vegetable, by HPLC Method Coupled with a Solid Phase Extraction", *International Journal of Pure & Applied Chemistry*, 7 (2012) 59-63.

5- Rahmatollah Rahimi, Seyyedeh Zahra Ghoreishi & Mohammad G. Dekamin, "Immobilized metalloporphyrins on 3- aminopropyl-functionalized silica support as heterogeneous catalysts for selective oxidation of primary and secondary alcohols", *Monatsh. Chem.* 143 (2012) 1031-1038.

6- Masoomeh Madadi, Rahmatollah Rahimi, "Zeolite-Encapsulated Fe(III) Complex with 5,10,15,20-Tetraphenyl Porphyrin as Heterogeneous Catalysts for Epoxidation of α-Pinene: Synthesis, Characterization and Catalytic Activity", J. *Chem. Chem. Eng.* 6 (2012) 173-178.

7- M. Madadi , R. Rahimi, "Zeolite-immobilized Mn(III), Fe(III) and Co(III) complexes with 5,10,15,20-tetra(4-methoxyphenyl)porphyrin as heterogeneous catalysts for epoxidation of (R)-(+)-limonene: Synthesis, characterization and catalytic activity", *Reaction Kinetics, Mechanisms and Catalysis* 107 (2012) 215–229.

8- A. Tadjarodi, R. Rahimi, M. Imani, H. Kerdari, M. Rabbani, "Synthesis, characterization and microwave absorbing properties of the novel ferrite nanocomposites", *Journal of Alloys and Compounds* 542 (2012) 43–50.

9- Rahmatollah Rahimi, Samaneh Safalou Moghaddam, Mahboubeh Rabbani, "Comparison of photocatalysis degradation of 4-Nitrophenol using N, S co-doped TiO_2 nanoparticles synthesized by two different routes", *Journal o Sol-Gel science and technology*, 64 (2012) 17–26.

10- Rahmatollah Rahimi, Elham Honarvar Fard, Sara Saadati, Mahboubeh Rabbani, "Degradation of methylene blue via Co-TiO_2 nano powders modified by meso-tetra(carboxyphenyl)porphyrin", ", *Journal of Sol-Gel science and technology* 62 (2012) 351–357.

2011:

11- Ebrahim Alizadeh-Gheshlaghi, Behrouz Shaabani, Ali Khodayari, Yashar Azizian-Kalandaragh, Rahmatollah Rahimi. "Investigation of the catalytic activity of nano-sized CuO, Co_3O_4 and $CuCo_2O_4$ powders on thermal decomposition of ammonium perchlorate", *Powder Technology* 217 (2012) 330–339.

12- Rahmatollah Rahimi, Hamed Kerdari, Mahboubeh Rabbani, Majid Shafiee, "Synthesis, characterization and adsorbing properties of hollow Zn-Fe_2O_4 nanospheres on removal of Congo red from aqueous solution", *Desalination* 280 (2011) 412–418.

13- Seyed Hossein Hosseini, Rahmatollah Rahimi and Hamed Kerdari, "Preparation of a nanocomposite of magnetic, conducting nanoporous polyaniline and hollow manganese ferrite", *Polymer Journal* (2011) 1–6.

14- Rahmatolah Rahimi, Ensieh Gholamrezapor, Mohammad Reza Naimi-jamal, "Oxidation of benzyl alcohols to the corresponding carbonyl compounds catalyzed by copper (II) meso-tetra phenyl porphyrin as

Cytochrome P-450 model reaction", *Inorganic Chemistry Communications* 14 (2011) 1561–1568.

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16- Rahmatollah Rahimi, Mahbobeh Rabbani, Pegah Tavakoli, "Solar energy and solar cells", *Journal of Physics Education development*, winter 2010

17- Rahmatollah Rahimi, Maryam Mokhtari Mehr Mahbobeh Rabbani, "Interaction between sulfunated tetra phenyl porphyrin (TPPS) and dopa melanin", *Journal of Basic Sciences of Islamic Azad University*, 2010

18- Rahimi Rahmatollah, mohammadnezhad,"Synthesis and Characterization of Titanium Mesoporous Silicate", *Synthesis and Reactivity in Inorganic Metal-Organic and Nano-Metal Chemistry*, (2010)

19- Rahimi Rahmatollah, Rabani Mahboubeh, "Mineral contents of some plants used in Iran", *Pharmacognosy Research*, July 2010, Vol 2, Issue 4

20- Rahmatollah Rahimi, Maryam Eskandari, Ali Morsali," Spectroscopic, structural and solution studies of new Tl^{I} complexe with 3-nytrobenzylidne-4-aminobenzoate", *Asian Journal of Chemistry*, 22 No. 9 (2010)

21- R. Rahmatollah, M. Anbia, G.H. Mohamadnezhad and M. Rabani, "Synthesis of Mesoporouse Silicate Molecular Sieves", *Asian Journal of Chemistry*, 22 (2010) 6961-6976.

22- Jamal Asadpoor, Rahmatollah Rahimi, Kamran Akhbari and Ali Morsali, "Nanoparticles of a New Potassium (I) Coordination Polymer from Thermal Treatment with Oleic Acid: Syntheses, Characterization, Thermal, Structural and Solution Studies", *Journal of Inorganic and Organometallic Polymers and Materials*, 20 (2010).

Patents

1- "Application of LED lamps for treatment and disinfection of wastewaters using nanophotocatalysts" Rahmatollah Rahimi, Javad Shokraian, Mahboobeh Rabbani, 1393

2- "Synthesis of ZnO Nanorods in low temperature via Coprecipitation Method" Rahmatollah Rahimi, Marzieh Yaghoubi Berijani, Solmaz Zargari, 1393

3- "Synthesis of BiVO4 photocatalyst with two monoclinic and tetragonal phases, active in visible and ultraviolet region", Rahmatollah Rahimi, Marzieh Yaghoubi Berijani, Solmaz Zargari, 1393

4- "Synthesis of polypyrrole-iron oxide functionalized with porphyrin as an efficient sorbent of industrial pollutions", Rahmatollah Rahimi, Meisam Asadi Davati, Solmaz Zargari, 1392

5- " Synthesis of Titanium dioxide (TiO_2)-Vanadium phosphorous nanocomposite oxidized with silver (Ag-VPO) as a catalyst (Ag-VPO/TiO_2) and is organic pollution degradation under visible light illumination", Rahmatollah Rahimi, Masoumeh Mahjoub Moghaddas, Solmaz Zargari, 1391

6- " Synthesis of $SbVO_4$-TiO_2 nanocomposite as a catalysts and its investigation in degradation of organic pollutions under visible light irradiation", Rahmatollah Rahimi, Masoumeh Mahjoub Moghaddas, Solmaz Zargari, 1391

7- "Synthesis of Titanium dioxide-Bismut vanadat ($BiVO_4$-TiO_2) sensitized with porphyrin (TCPP) and its photocatalytic application under visible light irradiation", Rahmatollah Rahimi, Masoumeh Mahjoub Moghaddas, Solmaz Zargari, 1391

8- "Preparation of V-TiO_2-TCPP and its concurrent application in removal and degradation of industrial pollutants", Rahmatollah Rahimi, Masoumeh Mahjoub Moghaddas, Solmaz Zargari, 1391

9- "Preparation of V doped TiO_2 mesoporous and sensitized with porphyrin over SBA-15 substrate", Ahmad Najafian, Masoumeh Mahjoub Moghaddas, Rahmatollah Rahimi, 1391

10- "Preparation of porphyrin on SBA-15 catalysts", Mehdi Deilam Kamar, Ahmad najafian, Rahmatollah Rahimi, 1391.

11- “Nanoporous TiO_2 solar cell sensitized with tetra(4-carboxyphenyl)porphyrin”, Rahmatollah Rahimi, Pegah Tvakoli fard, 2010