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Publications:

1. Kampalanonwat, P.; Supaphol, P.; Morlock, G.E. “*Quantification of water soluble food dyes on electrospun nanofibers,*” in preparation.
2. Kampalanonwat, P.; Supaphol, P.; Morlock, G.E. “*Electrospun nanofibres with fluorescence indicator UV₂₅₄ for detection of UV-active compounds,*” in preparation.
3. Kampalanonwat, P.; Supaphol, P. “*Competitive Adsorption of Ag(I), Cu(II), Fe(II), and Pb(II) Ions in Aqueous Solutions by Aminated Electrospun Polyacrylonitrile Nanofiber Mats,*” in preparation.
4. Kampalanonwat, P.; Supaphol, P. (2011) “*Preparation of Hydrolyzed Electrospun Polyacrylonitrile Fiber Mats as Chelating Substrates: a Case Study on Copper(II) Ions,*” Industrial & Engineering Chemistry Research, 50(21), 11912-11921. (November) (JIF = 2.071)
5. Kampalanonwat, P.; Supaphol, P. (2010) “*Preparation and Adsorption Behavior of Aminated Electrospun Polyacrylonitrile Nanofiber Mats for Heavy Metal Ion Removal,*” ACS Applied Materials & Interfaces, 2(12), 3619–3627. (December) (JIF = 2.925)

Presentations:

1. Kampalanonwat, P.; Supaphol, P. “*Aminated Polyacrylonitrile Nanofiber Mats for the Removal of Heavy Metal Ions,*” RGJ-Ph.D. Congress XII (Pattaya, Thailand, April 1-3, 2011), Thailand Research Fund (TRF), Thailand.

2. Kampalanonwat, P.; Supaphol, P. "Chelating Nanofiber Mat for Heavy Metal Removal," The 1st Polymer Conference of Thailand (PCT-1) 2010 (Bangkok, Thailand, October 7-8, 2010), Thai Polymer Society, Thailand.
3. Kampalanonwat, P.; Supaphol, P. (2007) "Chelating fibers from Electrospinning process," The 10th Pacific Polymer Conference (PPC10) 2007 (Kobe, Japan, December 4-7 2007), The Society of Polymer science, Japan, Paper#5P2S8-115a

Patent applications

1. การประดิษฐ์ (0901004184/16 ก.ย. 2552) เรื่อง การเตรียมเส้นใยไฮโดรไลซ์พอลิอะคริลาไมด์สำหรับใช้ในการจับไอออนของโลหะ โดย รองศาสตราจารย์ ดร. พิชญ์ สุภผล และ นางสาวพิมลพรรณ กำพลานนท์วัฒน์
2. การประดิษฐ์ (0801005190/10 ต.ค. 2551) เรื่อง การเตรียมแผ่นเส้นใยไฮโดรไลซ์พอลิอะคริลาไมด์สำหรับใช้ในการจับไอออนของโลหะ โดย รองศาสตราจารย์ ดร. พิชญ์ สุภผล และ นางสาวพิมลพรรณ กำพลานนท์วัฒน์

Book Chapters

พิชญ์ สุภผล ผกากรอง สังข์เสนาะ และ พิมลพรรณ กำพลานนท์วัฒน์, "บทที่ 6 วัสดุชีวภาพที่มีสมบัติพิเศษ" ใน วัสดุชีวภาพรักษ์โลก (Green Biomaterials) (รังสิมา ชลคุป วีรศักดิ์ สมิตพิพงศ์ และ กล้าณรงค์ ศรีรอด, บรรณาธิการ), หกก. มณีสฟิล์ม, นนทบุรี, 111-144, 2552. (ISBN: 9789743007507)

References

- Afkhami, A.; Saber-Tehrani, M.; Bagheri, H. Simultaneous removal of heavy-metal ions in wastewater samples using nano-alumina modified with 2,4-dinitrophenylhydrazine, *J. Hazard. Mater.* 181 (2010) 836-844.
- Aman, T.; Kazi, A. A.; Sabri, M. U.; Bano, Q. Potato peels as solid waste for the removal of heavy metal copper(II) from waste water industrial effluent. *Colloid Surf., B* 2008, 63, 116–121.
- An, H.; Shin, C.; Chase, G.G. Ion exchanger using electrospun polystyrene nanofibers, *J. Membrane Sci.* 283 (2006) 84-87.
- Atia, A.A.; Donia, A.M.; Yousif, A.M. Removal of some hazardous heavy metals from aqueous solution using magnetic chelating resin with iminodiacetate functionality, *Sep. Purif. Technol.* 61 (2008) 348-357.
- Aydin, A.; Imamoglu, M.; G€ulfen, M. Separation and recovery of gold(III) from base metal ions using melamine formaldehyde thiourea chelating resin. *J. Appl. Polym. Sci.* 2008, 107, 1201–1206.
- Augustine, A.A.; Orike, B.D.; Edidiong, A.D. Adsorption kinetics and modeling of Cu(II) ion sorption from aqueous solution by Mercaptoacetic acid modified Cassava (*Manihot Sculenta Cranz*) wastes, *EJEAFChe*, 6 (2007) 2221-2234.
- Bezuidenhout, L.W.; Brett, M.J. Ultrathin layer chromatography on nanostructured thin films, *Journal of Chromatography A* 1183 (2008) 179–185.
- Bergshoef, M.M.; Vancso, G.J. Transparent nanocomposites with ultrathin, electrospun Nylon-4,6 fiber reinforcement, *Adv. Mater.* 11 (1999) 1362-1365.
- Bilba, N.; Bilba, D.; Moroi, G. Synthesis of a polyacrylamidoxime chelating fiber and its efficiency in the retention of palladium ions. *J. Appl. Polym. Sci.* 2004, 92, 3730–3735.
- Bilba, D.; Suteu, D.; Malutan, T. Removal of reactive dye brilliant red HE-3B from aqueous solutions by hydrolyzed polyacrylonitrile fibres: equilibrium and kinetics modeling. *Cent. Eur. J. Chem.* 2008, 6, 258–266.
- Chang, X.; Su, Q.; Liang, D.; Wei, X.; Wang, B. Efficiency and application of poly(acryldinitrophenylamidrazone-dinitroacrylphenylhydrazine) chelating

- fiber for pre-concentrating and separating trace Au(III), Ru(III), In(III), Bi(III), Zr(IV), V(V), Ga(III) and Ti(IV) from solution samples, *Talanta* 57 (2002) 253–261.
- Chang, X.; Yang, X.; Wei, X.; Wu, K. Efficiency and mechanism of new poly(acryl-phenylamidrazone phenylhydrazide) chelating fiber for adsorbing trace Ga, In, Bi, V and Ti from solution, *Anal. Chim. Acta.* **2001**, *450*, 231–238.
- Chibowski, E.; González-Caballero, F. THEORY AND PRACTICE OF THIN-LAYER WICKING *Langmuir* 9(1993) 330–340.
- Clark, J.E.; Olesik, S.V. Electrospun glassy carbon ultra-thin layer chromatography devices, *Journal of Chromatography A*, 1217 (2010) 4655-4662.
- Clark, J.E.; Olesik, S.V. Technique for Ultrathin Layer Chromatography Using an Electrospun, Nanofibrous Stationary Phase, *Anal. Chem.* , **2009**, *81*, 4121–4129.
- Chen, C. Y.; Lin, M. S.; Hsu, K. R. Recovery of Cu(II) and Cd(II) by a chelating resin containing aspartate groups. *J. Hazard. Mater.* 2008, 152, 986–993.
- Chen, J.P.; Wang, L. Characterization of metal adsorption kinetic properties in batch and fixed-bed reactors., *Chemosphere* 54 (2004) 397-404.
- Dąbrowski, A.; Hubicki, Z.; Podkościelny, P.; Robens, E. Selective removal of the heavy metal ions from waters and industrial wastewaters by ion-exchange method, *Chemosphere* 56 (2004) 91–106.
- Dambies, L.; Guimon, C.; Yiacoumi, S.; Guibal, E. Characterization of metal ion interactions with chitosan by X-ray photoelectron spectroscopy. *Colloids Surf., A* 2001, 177, 203–214.
- Deng, S.; Bai, R.; Chen, J. P. Aminated polyacrylonitrile fibers for lead and copper removal, *Langmuir.* **2003**, *19*, 5058-5064.
- Deng, S.; Bai, R.; Chen, J.P. Behaviors and mechanisms of copper adsorption on hydrolyzed polyacrylonitrile fibers, *J. Colloid Interf. Sci.* **2003**, *260*, 265–272.
- Dimitrov, D.I.; Milchev, A.; Binder, K. Capillary rise in nanopores: molecular dynamics evidence for the Lucas-Washburn equation, *Phys. Rev. Lett*, 99 (2007) 054501–054504.

- Ding, B.; Kim, H.Y.; Lee, S.C.; Shao, C.L.; Lee, D.R.; Park, S.J.; Kwag, G.B.; Choi, K.J. Preparation and characterization of a nanoscale poly(vinyl alcohol) fiber aggregate produced by an electrospinning method, *J. Polym. Sci. Pol. Phys.* 40 (2002) 1261-1268.
- Dinu, M.V., Dragan, E.S., Trochimczuk, A.W. Sorption of Pb(II), Cd(II) and Zn(II) by iminodiacetate chelating resins in non-competitive and competitive conditions, *Desalination* 249 (2009) 374-379.
- Dinu, M.V.; Dragan, E.S. Heavy metals adsorption on some iminodiacetate chelating resins as a function of the adsorption parameters, *React. Funct. Polym.* 68 (2008) 1346–1354.
- Doshi, J. and Reneker, D.H. (1995) Electrospinning process and applications of electrospun fibers. *Journal of Electrostatics*, 35, 151–160.
- Dragan, E.S.; Dinu, M.V.; Timpu, D. Preparation and characterization of novel composites based on chitosan and clinoptilolite with enhanced adsorption properties for Cu²⁺, *Bioresource Technol.* 101 (2010) 812–817.
- Fried B and Sherma J (1999). *Thin Layer Chromatography*, 4th Edition, published by Marcel. Dekker Inc., New York.
- Gong, B.; Li, X.; Wang, F.; Chang, X. Synthesis of spherical macroporous epoxy-dicyandiamide chelating resin and properties of concentration and separation of trace metal ions from samples. *Talanta* 2000, 52, 217–223.
- Gong, B. Synthesis of polyacrylaminoimidazole chelating fiber and properties of concentration and separation of trace Au, Hg and Pd from samples. *Talanta* 2002, 57, 89–95.
- Good, R.J.; Lin, N.J. Rate of penetration of a fluid into a porous body. , *J. Colloid Interface. Sci.* , 54 (1976) 52-58.
- Haider, S.; Park, S.Y. Preparation of the electrospun chitosan nanofibers and their applications to the adsorption of Cu(II) and Pb(II) ions from an aqueous solution, *J. Membrane Sci.* 328 (2009) 90-96.
- Han, R.; Zou, W.; Zhang, Z.; Shi, J.; Yang, J. Removal of copper(II) and lead(II) from aqueous solution by manganese oxide coated sand I. Characterization and kinetic study, *J. Hazard. Mater.* 137 (2006) 384-395.

- Hauck, H.E.; Bund, O.; Fischer, M.; Schulz, M. Ultra-Thin Layer Chromatography (UTLC)—A New Dimension in Thin-Layer Chromatography, *Journal of Planar Chromatography*, 14 (2001) 234–236.
- Hauck, H.E.; Schulz, M. Ultrathin-Layer Chromatography, *J Chromatogr Sci*, 40 (2002) 550-552.
- Huang, S.; Chen, D. Rapid removal of heavy metal cations and anions from aqueous solutions by an amino-functionalized magnetic nano-adsorbent, *J. Hazard. Mater.* 163 (2009) 174–179.
- Huang, Z.M., Zhang, Y.Z., Kotaki, M., and Ramakrishna, S. (2003) A review on polymer nanofibers by electrospinning and their applications in nanocomposites. *Composite Science and Technology*, 63, 2223-2253.
- Immamuglu, M.; Tekir, O. Removal of copper (II) and lead (II) ions from aqueous solutions by adsorption on activated carbon from a new precursor hazelnut husks. *Desalination* 2008, 228, 108–113.
- Jing, X.; Liu, F.; Yang, X.; Ling, P.; Li, L.; Long, C.; Li, A. Adsorption performances and mechanisms of the newly synthesized N, N0-di(carboxymethyl) dithiocarbamate chelating resin toward divalent heavy metal ions from aqueous media. *J. Hazard. Mater.* 2009, 167, 589–596.
- Jiang, Y.; Pang, H.; Liao, B. Removal of copper(II) ions from aqueous solution by modified bagasse. *J. Hazard. Mater.* 2009, 164, 1–9.
- Kara, A.; Uzun, L.; Beşirli, N.; Denizli, A. Poly(ethylene glycol dimethacrylate-*n*-vinyl imidazole) beads for heavy metal removal, *J. Hazard. Mater.* 106B (2004) 93–99.
- Kampalanonwat, P.; Supaphol, P. Preparation and adsorption behavior of aminated electrospun polyacrylonitrile nanofiber mats for heavy metal ion removal. *ACS Appl. Mater. Inter.* 2010, 2, 3619–3627.
- Karpacheva, G. P.; Zemtsov, L. M.; Bondarenko, G. N.; Litmanovich, A. D.; Plat_e, N. A. Formation of conjugated CdN bonds and their transformation in the alkaline hydrolysis of poly(acrylonitrile). *Polym. Sci. Ser. A+* 2000, 42, 620–625.

- Kavaklı, P.A.; Güven, O. Removal of Concentrated Heavy Metal Ions from Aqueous Solutions Using Polymers with Enriched Amidoxime Groups, *J. Appl. Polym. Sci.* 93 (2004) 1705–1710.
- Kenawy, E.R., Bowlin, G.L., Mansfield, K., Layman, J., Simpson, D.G., Sanders, E.H., and Wnek, G.E. (2002) Release of tetracycline hydrochloride from electrospun poly(ethylene-co-vinylacetate), poly(lactic acid), and a blend. *Journal of Controlled Release*, 81, 57-64.
- Kim, G.H. Electrospun PCL nanofibers with anisotropic mechanical properties as a biomedical scaffold, *Biomed. Mater.* 3 (2008) 025010.
- Ko, Y. G.; Choi, U. S.; Park, Y. S.; Woo, J. W. Fourier-transform infrared spectroscopy study of the effect of pH on anion and cation adsorption onto poly(acryloamidino diethylenediamine), *J. Polym. Sci. Pol. Chem.* **2004**, 42, 2010–2018.
- Ko, Y. G.; Choi, U. S. Observation of metal ions adsorption on novel polymeric chelating fiber and activated carbon fiber, *Sep. Purif. Technol.* **2007**, 57, 338–347.
- Koombhongse, S. (2001) The formation of nanofibers from electrospinning process. Doctoral Dissertation, The University of Akron.
- Kozodynska, D. Iminodisuccinic acid as a new complexing agent for removal of heavy metal ions from industrial effluents. *Chem. Eng. J.* 2009, 152, 277–288.
- Kruijf, N.D.E.; Rijk, M.A.H.; Pranoto-Soetardhi, L.A.; Schouten, A. Thin-layer chromatographic procedure for the identification of preservatives in cosmetic products, *Journal of Chromatography A*, 410 (1987) 395-411.
- Kurban, L.; Lovell, A.; Jenkins, D.; Bennington, S.; Loader, I.; Schober, A.; Skipper N. Turbostratic graphite nanofibres from electrospun solutions of PAN in dimethylsulphoxide, *European Polymer Journal.* **2010**, 46, 1194–1202.
- Kyzas, G.Z.; Kostoglou, M.; Lazaridis, N.K. Copper and chromium(VI) removal by chitosan derivatives—Equilibrium and kinetic studies, *Chem. Eng. J.* 152 (2009) 440–448.

- Li, S.; Chen, J.; Wu, W. Electrospun polyacrylonitrile nanofibrous membranes for lipase immobilization, *Journal of Molecular Catalysis B: Enzymatic*. **2007**, *47*, 117–124.
- Liu, R.; Tang, H.; Zhang, B. Removal of Cu(II), Zn(II), Cd(II) and Hg(II) from waste water by poly(acrylamino-phosphonic)-type chelating fiber. *Chemosphere* 1999, *38*, 3169–3179.
- Luu, Y. K.; Kim, K.; Hsiao, B. S.; Chu, B.; Hadjiargyrou, M. Development of a nanostructured DNA delivery scaffold via electrospinning of PLGA and PLA-PEG block copolymers. *J. Controlled Release* 2003, *89*, 341–353.
- Ma, N.; Yang, Y.; Chen, S.; Zhang, Q. Preparation of amine group-containing chelating fiber for thorough removal of mercury ions, *J. Hazard. Mater.* *171* (2009) 288–293
- Martínez, J. M. L.; Rodríguez-Castellón, E.; Sánchez, R. M. T.; Denaday, L. R.; Buldaina, G. Y.; Dall'Orto, V. C. XPS studies on the Cu(I,II)-polyampholyte heterogeneous catalyst: An insight into its structure and mechanism. *J. Mol. Catal. A: Chem.* 2011, *339*, 43–51.
- Mauchauffe, S.; Meux, E. Use of sodium decanoate for selective precipitation of metals contained in industrial wastewater. *Chemosphere* 2007, *69*, 763–768.
- Mbareck, C.; Nguyen, Q.T.; Alaoui, O.T.; Barillier, D. Elaboration, characterization and application of polysulfone and polyacrylic acid blends as ultrafiltration membranes for removal of some heavy metals from water, *J. Hazard. Mater.* *171* (2009) 93–101.
- McComb, M. E.; Gesser, H. D. Preparation of polyacryloamidoxime chelating cloth for the extraction of heavy metals from water, *J. Appl. Polym. Sci.* **1997**, *65*, 1175–1192.
- Michelson, D. (1990) Electrostatic Atomization. New York: Adam Hilger.
- Miller, J.M. *Chromatography-Concepts and Contrasts*, 2nd Edition, 2005, published by John Wiley & Sons, Inc., Hoboken, New Jersey.
- Miretzky, P.; Cirelli, A. F. Hg(II) removal from water by chitosan and chitosan derivatives: A review. *J. Hazard. Mater.* 2009, *167*, 10–23.

- Mishra, P.C.; Patel, R.K. Removal of lead and zinc ions from water by low cost adsorbents, *J. Hazard. Mater.* 168 (2009) 319–325.
- Mohandas, J.; Kumara, T.; Rajan, S. K.; Velmurugan, S.; Narasimhan, S. V. Introduction of bifunctionality into the phosphinic acid ion-exchange resin for enhancing metal ion complexation. *Desalination* 2008, 232, 3–10.
- Monier, M.; Ayad, D.M.; Sarhan A.A. Adsorption of Cu(II), Hg(II), and Ni(II) ions by modified natural wool chelating fibers, *J. Hazard. Mater.* 176 (2009) 348-355.
- Morlock, G.E.; Oellig, C.; Bezuidenhout, L.W.; Brett, M.J.; Schwack, W. Miniaturized planar chromatography using office peripherals, *Analytical Chemistry*. **2010**, 82, 2940–2946.
- Mosser, C.; Mosser, A.; Romeo, M.; Petit, S.; Decarreau, A. Natural and synthetic copper phyllosilicates studied by XPS. *Clays Clay Miner.* 1992, 40, 593–599.
- Mullins, B.J.; Braddock, R.D.; Kasper, G. Capillarity in Porous, Fibrous Filter Media: relationship to media properties, *Chemical Engineering Science*, 62 (2007) 6191-6198.
- Mugisidi, D.; Ranaldo, A.; Soedarsono, J. W.; Hikam, M. Modification of activated carbon using sodium acetate and its regeneration using sodium hydroxide for the adsorption of copper from aqueous solution. *Carbon* 2007, 45, 1081–1084.
- Navarro, R.R.; Wada, S.; Tatsumi, K. Heavy metal precipitation by polycation–polyanion complex of PEI and its phosphonomethylated derivative, *J. Hazard. Mater.* B123 (2005) 203–209.
- Neumann, S. and Fatula, P. Principles of Ion Exchange in Wastewater Treatment, *Asian Water*, **2009**, March.
- Nurok, D. Strategies for optimizing the mobile phase in planar chromatography. *Chemical Reviews*. **1989**, 89, 363–375.
- O’Connell, D.W.; Birkinshaw, C.; O’Dwyer, T.F. Heavy metal adsorbents prepared from the modification of cellulose: A review, *Bioresource Technol.* 99 (2008) 6709–6724.

- Otero, M.; Rozada, F.; Morán, A.; Calvo, L.F.; García, A.I. Removal of heavy metals from aqueous solution by sewage sludge based sorbents: competitive effects, *Desalination* 239 (2009) 46-57.
- Panayotova, T.; Dimova-Todorova, M.; Dobrevsky, I. Purification and reuse of heavy metals containing wastewaters from electroplating plants, *Desalination* 206 (2007) 135-140.
- Panayotova, T.; Dimova-Todorova, M.; Dobrevsky, I. Purification and reuse of heavy metals containing wastewaters from electroplating plants, *Desalination* 206 (2007) 135–140.
- Pels, J. R.; Kapteijn, F.; Moulun, J. A.; Zhu, Q.; Thomas, K. M. Evolution of nitrogen functionalities in carbonaceous materials during pyrolysis. *Carbon* 1995, 33, 1641–1653.
- Piia K. Salo, Hannele Salomies, Kirsi Harju, Raimo A. Ketola, Tapio Kotiaho, Jari Yli-Kauhaluoma, R. Kostianen, Analysis of Small Molecules by Ultra Thin-Layer Chromatography-Atmospheric Pressure Matrix-Assisted Laser Desorption/Ionization Mass Spectrometry, *Journal of the American Society for Mass Spectrometry*, 16 (2005) 906-915.
- Poole, C.F. *The Essence of Chromatography*, Elsevier Science, Amsterdam, 2003.
- Poole, C.F.; Poole, S.K. Multidimensionality in planar chromatography, *Journal of Chromatography A*, 703 573-612.
- Poole, C.F. Thin-layer chromatography: challenges and opportunities, *Journal of Chromatography A*, 1000 (2003) 963-984.
- Poole, C.F. Planar chromatography at the turn of the century, *Journal of Chromatography A*, 856 (1999) 399-427.
- Poole, C.F and Poole, S.K. Modern thin layer chromatography. *Anal. Chem.*, 1989, 61, (22), 1257–1269.
- Ren, Y. M.; Zhang, M. L.; Zhao, D. Synthesis and properties of magnetic Cu (II) ion imprinted composite adsorbent for selective removal of copper. *Desalination* 2008, 228, 135–149.
- Reneker, D. H.; Yarin, A. L. Electrospinning jets and polymer nanofibers. *Polymer*. 2008, 49, 2387-2425.

- Reneker, D.H. and Chun, I. (1996) Nanometre diameter fibres of polymer, produced by electrospinning. *Nanotechnology*, 7, 216-223
- Rangel-Mendez, J. R.; Monroy-Zepeda, R.; Leyva-Ramos, E.; Diaz-Flores, P. E.; Shirai, K. Chitosan selectivity for removing cadmium (II), copper (II), and lead (II) from aqueous phase: pH and organic matter effect. *J. Hazard. Mater.* 2009, 162, 503–511.
- Rengaraj, S.; Yeon, J. W.; Kim, Y.; Jung, Y.; Ha, Y. K.; Kim, W. H. Adsorption characteristics of Cu(II) onto ion exchange resins 252H and 1500H: Kinetics, isotherms and error analysis. *J. Hazard. Mater.* 2007, 143, 469–477.
- Saeed, K.; Haider, S.; Oh, T.; Park, S. Preparation of amidoxime-modified polyacrylonitrile (PAN-oxime) nanofibers and their applications to metal ions adsorption, *J. Membrane Sci.* **2008**, 322, 400–405.
- Shen, W.; Chen, S.; Shi, S.; Li, X.; Zhang, X.; Hu, W.; Wang, H. Adsorption of Cu(II) and Pb(II) onto diethylenetriamine-bacterial cellulose. *Carbohydr. Polym.* 2009, 75, 110–114.
- Sherma, J.; Fried, B. *Handbook of Thin Layer Chromatography*, **2003**, published by Marcel Dekker Inc., New York.
- Shin, Y. M.; Hohman, M. M.; Brenner, M. P.; Rutledge, G. C. Experimental characterization of electrospinning: the electrically forced jet and instabilities, *Polymer*. **2001**, 42, 9955-9967.
- Siouffi, A. From Paper to Planar: 60 Years of Thin Layer Chromatography Separation and Purification Reviews, 34 (2005) 155-180.
- Srivastava, V.C.; Mall, I.D.; Mishra, I.M. Removal of cadmium(II) and zinc(II) metal ions from binary aqueous solution by rice husk ash, *Colloid. Surface. A* 312 (2008) 172-184.
- Supaphol, P.; Chuangchote, S. On the electrospinning of poly(vinyl alcohol) nanofiber mats: a revisit. *J. Appl. Polym. Sci.* 2008, 108, 969–978.
- Sutasinpromprae, J.; Jitjaicham, S.; Nithitanakul, M.; Meechaisue, C.; Supaphol, P. Preparation and characterization of ultrafine electrospun polyacrylonitrile fibers and their subsequent pyrolysis to carbon fibers, *Polym Int.* **2006**, 55, 825–833. **2006**, 17, 2317-2329.

- Shukla, S.R.; Pai, R.S.; Shendarkar, A.D. Adsorption of Ni(II), Zn(II) and Fe(II) on modified coir fibres, *Sep. Purif. Technol.* 47 (2006) 141–147.
- Sun, S.; Wang, A. Adsorption properties of N-succinyl-chitosan and cross-linked N-succinyl-chitosan resin with Pb (II) as template ions. *Sep. Purif. Technol.* 2006, 51, 409–415.
- Taylor, G. (1969) Electrically driven jets. *Proceedings of the Royal Society of London*, A313, 453-475.
- Taepaiboon, P.; Rungsardthong, U.; Supaphol, P. Drugloaded electrospun mats of poly(vinyl alcohol) fibres and their release characteristics of four model drugs. *Nanotechnology* 2006, 17, 2317–2329.
- The Pollution Control Department of the Ministry of Natural Resources and Environment of Thailand. Provisional Guidelines Controlling the Quality of Wastewater from Industries and Industrial Villages; The 3rd Announcement of the Ministry; 1996 (in Thai).
- Tobias, B.; Strickler, R.C. Photoactivated zinc silicate in thin layer chromatography plates: A potential cause for error in liquid scintillation counting, *Steroids*, 37 (1981) 213-221.
- Tungprapa, S.; Jangchud, I.; Supaphol, P. Release characteristics of four model drugs from drug-loaded electrospun cellulose acetate fiber mats, *Polymer* 48 (2007) 5030-5041.
- Türkmen, D.; Yılmaz, E.; Öztürk, N.; Akgöl, V; Denizli, A. Poly(hydroxyethyl methacrylate) nanobeads containing imidazole groups for removal of Cu(II) ions, *Mater. Sci. Eng. C* 29 (2009) 2072–2078.
- Vilensky, M.Y.; Berkowitz, B.; Warshawsky, A. In situ remediation of groundwater contaminated by heavy- and transition-metal ions by selective ion-exchange methods, *Environ. Sci. Technol.* 36 (2002) 1851-1855.
- Vilar, V.J.P.; Botelho, C.M.S.; Boaventura, R.A.R. Copper desorption from *Gelidium* algal biomass, *Water Res.* 41 (2007) 1569-1579.
- Wang, X.; Zheng, Y.; Wang, A. Fast removal of copper ions from aqueous solution by chitosan-g-poly(acrylic acid)/attapulgitite composites. *J. Hazard. Mater.* 2009, 168, 970–977.

- Wall, P.E. *Thin-layer Chromatography – A Modern Practical Approach*, 2005, published by The Royal Society of Chemistry, Cambridge, UK.
- Washburn, E.W. The dynamics of capillary flow, *Phys. Rev.*, 17 (1921) 273-283.
- World Health Organization (WHO). *Copper in Drinking-Water: Background Document for Development of WHO Guidelines for Drinking-Water Quality*; 2004.
- Wu, L.L.; Yuan, X.Y.; Sheng, J. Immobilization of cellulase in nanofibrous PVA membranes by electrospinning, *J. Membrane Sci.* 250 (2005) 167-173.
- Wutticharoenmongkol, P.; Pavasant, P.; Supaphol, P. Osteoblastic phenotype expression of MC3T3-E1 cultured on electrospun polycaprolactone fiber mats filled with hydroxyapatite nanoparticles. *Biomacromolecules* 2007, 8, 2602–2610.
- Yamashiro, K.; Miyoshi, K.; Ishihara, R.; Umeno, D.; Saito, K.; Sugo, T.; Yamada, S.; Fukunaga, H.; Nagai, M. High-throughput solid-phase extraction of metal ions using an iminodiacetate chelating porous disk prepared by graft polymerization, *J. Chromatogr. A* 1176 (2007) 37-42.
- Yan, W.L.; Bai, R. Adsorption of lead and humic acid on chitosan hydrogel beads, *Water Res.* 39 (2005) 688-698.
- Zhang, S.; Li, X.; Chen, J.P. Preparation and evaluation of a magnetite-doped activated carbon fiber for enhanced arsenic removal, *Carbon* 48 (2010) 60–67
- Zhang, G.; Qu, R.; Sun, C.; Ji, C.; Chen, H.; Wang, C.; Niu, Y. Adsorption for Metal Ions of Chitosan Coated Cotton Fiber, *J. Appl. Polym. Sci.* 110 (2008) 2321–2327.
- Zhou, Z.; Lai, C.; Zhang, L.; Qian, Y.; Hou, H.; Reneker, D.H.; Fong, H. Development of carbon nanofibers from aligned electrospun polyacrylonitrile nanofiber bundles and characterization of their microstructural, electrical, and mechanical properties, *Polymer*. 2009, 50, 2999–3006.
- Zhu, S.; Yang, N.; Zhang, D. Poly(*N,N*-dimethylaminoethyl methacrylate) modification of activated carbon for copper ions removal, *Mater. Chem. Phys.* 113 (2009) 784–789.