REFERENCES

Anamaria, S., Raluca, N.D., Marian, T., Georgeta, C., and Cornelia, V. (2012) Low density polyethylene composites containing cellulose pulp fibers. Composites: Part B, 43, 1873–1880.

Andreeva, N., Ishizaki, T., Baroch, P., Saito, N. (2012) Rapid sterilization of Escherichia coli by solution plasma process. Journal of Applied Physics, 51, 155-158.

Ateh, DD., Navsaria, HA., Vadgama, P. (2006) Polypyrrole-based conducting polymers and interactions with biological tissues. Journal of Royal Society Interface, 3, 741-752.

Balint, R., Cassidy, N.J., Cartmell, S.H. (2014) Conductive polymers: Towards a smart biomaterial for tissue engineering. Acta Biomaterialia, 10(6), 2341-2353.

Benitez, A.N., Monzon, M.D., Angulo, I., Ortega, Z., Hernandez, P.M., Marrero, M.D. (2013) Treatment of banana fiber for use in the reinforcement of polymeric matrices. Measurement, 46, 1065-1073.

Bettinger, CJ., Bruggeman, JP., Misra, A., Borenstein, JT., Langer, R. (2009) Biocompatibility of biodegradable semiconducting melanin films for nerve tissue engineering. Biomaterials, 30, 3050-3057.

Bilba, K., Arsene, M., Ouensanga, A. (2007) Study of banana and coconut fibers botanical composition, thermal degradation and texture observations. Bioresource Technology, 98, 58-68.

Bledzki, A.K., Gassan, J. (1999) Composites reinforced with cellulose based fibres. Pogress Polymer Science, 24(2), 221-74.

Bober, P., Stejskal, J., Trchova, M., Prokes, J. (2014) In-situ prepared polyaniline-silver composites: Single-and-two-step strategies. Electrochimica Acta, 122, 259-266.

Bratescu, M.A., Takai, O., Saito, N. (2013) One-step synthesis of gold bimetallic nanoparticles with various metal-compositions. Journal of Alloys and Compounds, 562, 74-83.

Calvimontes, A., Mauersberger, P., Nitschke, M., Dutschk, V., and Simon, F. (2011) Effects of oxygen plasma on cellulose surface. Cellulose,18, 803–809.

Casado, U.M., Aranguren, M.I., Marcovich, N.E. (2014) Preparation and characterization of conductive nanostructured particles based on polyaniline and cellulose nanofibers. Ultrasonics Sonochemistry, 21, 1641-1648.

Chaplin, M. (2009) Water structure and science. Available: http://www.lsbu.ac.uk/water/hycmc.html

Choudhury A. (2009) Polyaniline/silver nanocomposites: Dielectric properties and ethanol vapour sensitivity. Sensors and Actuator B: Chemical, 138, 318-325.

Elanthikkal, S., Gopalakrishnapanicker, U., Varhese, S., Guthrie, J.T. (2010) Cellulose microfibers produced from banana plant wastes: Isolation and characterization. Carbohydrate Polymers, 80, 852-859.

Fakirov, S. and Bhattacharyya, D. (2007) Engineering biopolymers: homopolymers, blends and composites. Munich Hanser Publishers.

Fridman, A., and Kennedy, L.A. (2004) Plasma physics and engineering. New York: Taylor and Francis group.

Frollini, E., Leao, A.L., Mattoso, L.H. (Eds.) (2000) Characterization and factors effecting fiber properties in natural polymers and agro fibres based composites. Natural polymers and biobased composites, Brazil: USP, Unesp, Embrapa, 115–135.

Gassan, J., Bledzki, A.K. (1995) Internationales Techtexil Symposium. Frankfurt, 20–22 June.

Ghasemi-Mobarakeh, L., Prabhakaran, MP., Morshed, M., Nasr-Esfahani, MH., Ramakrishna, S. (2009) Electrical stimulation of nerve cells using conductive nanofibrous scaffolds for nerve tissue engineering. Tissue Engineering Part A, 15, 3605-3619.

Ghasemi-Mobarakeh, L., (2011) Application of conductive polymers, scaffolds and electrical stimulation for nerve tissue engineering. Journal of Tissue Engineering and Regenerative Medicine, 5, 17-35.

Gospodinova, N., Terlemezyan, L. (1998) Conducting polymers prepared by oxidative polymerization: polyaniline. Pergamon Polymer Science, 23, 1443-1484.

Guo, B., Zhao, Y., Wu, W., Meng, H., Zou, H., Chen, J. (2013) Research on the preparation technology of polyaniline nanofiber based on high gravity chemical oxidative polymerization. Chemical Engineering and Processing: Process Intensification, 70, 1-8.

Hu, X., Shen, X., Takai, O., Saito, N. (2013) Facile fabrication of PtAu alloy clusters using solution sputtering and their electrocatalytic activity. Journal of Alloys and Compounds, 552, 351-355.

Ibrahim, K.A. (2013) Synthesis and characterization of polyaniline and poly(aniline-co-o-nitroaniline) using vibrational spectroscopy. Arabian Journal of Chemistry.

Ismail, Y.A., Martinez, J.G., Otero, T.F. (2014) Fibroin/ polyaniline microfibrous mat. Preparation and electrochemical characterization as reactive sensor. Electrochimica Acta, 123, 501-510.

Jaymand, M. (2013) Recent progress in chemical modification of polyaniline. Progress in Polymer Science, 38, 1287-1306.

Joseph, P.V., Joseph, K., Thomas, S., Pillai, CKS., Prasad, V.S., Groeninckx, G. (2003) The thermal and crystallization studies of short sisal fibre reinforced polypropylene composites. Composites Part A-Applied Science and Manufacturing, 34(3), 253-266.

Kabir, M.M., Wang, H., Lau, K.T., Cardona, F. (2012) Chemical treatments on plant-based natural fibre reinforced polymer composites: An overview. Composites: Part B, 43, 2883-2892.

Kang, J., Li, O.L., Saito, N. (2013) Synthesis of structure-controlled carbon nano spheres by solution plasma process. Carbon, 60, 292-298.

Kang, J., Li, O.L., Saito, N. (2013) A simple synthesis method for nano-metal catalyst supported on mesoporous carbon: the solution plasma process. Nanoscale, 5, 6874-6882.

Khampan, T., Thavarungkul, N., Tiansuwan, J., and Kamthai, S. (2010) Wet strength improvement of pineapple leaf paper for evaporative cooling pad. World Academy of Science, Engineering and Technology, 72, 254-257.

Khanna, P.K., Singh, N., Charan, S., Viswanath, A.K. (2005) Synthesis of Ag/polyaniline nanocomposite via an in situ photo-redox mechanism. Materials Chemistry and Physics, 92, 214-219.

Kim, D.H., Richardson-Burns, S.M., Hendricks, J.L., Martin, D.C. (2007) Effect of immobilized nerve growth factor on conductive polymers: Electrical properties and cellular response. Advanced Functional Materials, 17, 79-86.

Kritschewsky, G.E. (Eds). (1985) Chemische technology von textil materialien. Moskau: Legprombitisdat.

Kulkarni, S.B., Joshi, S.S., Lokhande, C.D. (2011) Facile and efficient route for preparation of nanostructured polyaniline thin films: Schematic model for simplest oxidative chemical polymerization. Chemical Engineering Journal, 166, 1179-1185.

Kunzo. P., Lobotka, P., Micusik, M., Kovacova, E. (2012) Palladium-free hydrogen sensor based on oxygen-plasma-treated polyaniline thin film. Sensors and Actuators B: Chemical, 171-172, 838-845.

Lakard, B., Ploux, L., Anselme, K., Lallemand, F., Nardin, M. (2009) Effect of ultrasounds on the electrochemical synthesis of polypyrrole, application to the adhesion and growth of biological cells. Bioelectrochemistry, 75, 148-157.

Lee, C.W., Chi, K.W., Hwang, H.Y., Jeong, H.M. (2009) Synthesis and properties of high performance nanostructured polyaniline: Effect of initiator dosage and molecular oxygen. Synthetic Metals, 159, 1757-1760.

Leonard, Y.M., Martin, P.A. (2002) Chemical modification of hemp, sisal, jute and kapok fibres by alkalization. Apply Polymer Science, 84(12), 2222-2234.

Li, D., Huang, J., Kaner, R.B.(2009) Polyaniline nanofibers: A unique polymer nanostructure for versatile applications. Accounts and Chemical Research, 42, 135-145.

Li, E., Ye, L., Mai, Y. (1997) Application of plasma technologies in fibre-reinforced polymer composites: a review of recent developments. Composites Part A, 28A, 73-86.

Lieberman, A.M., and Lichtenberg, J.A. (2005) Principles of plasma discharges and materials processing. Canada: John Wiley and Sons.

Liu, X., Yue, Z., Higgins, MJ., Wallace, GG. (2011) Conducting polymers with immobilized fibrillar collagen for enhanced neural interfacing. Biomaterials, 32, 7309-7317.

Liu, X., Zhou,W., Qian, X., Shen, J., An, Xianhui. (2013) Polyaniline/cellulose fiber composite prepared using persulfate as oxidant for Cr(VI)-detoxification. Carbohydrate Polymers, 92, 659-661.

Ma, P.C., Tang, B.Z., Kim, J.K. (2008) Effect of CNT decoration with silver nanoparticles on electrical conductivity of CNT-polymer composites. Carbon, 46, 1497-1505.

Madsen, B. (2004) Properties of plant fibre yarn polymer composites. PhD thesis, BYGDTU, Technical University of Denmark.

Meheswari, C.U., Reddy, K.O., Muzenda, E., Guduri, B.R., Rajulu, A.V. (2012) Extraction and characterization of cellulose microfibrils from agricultural residue-Cocos nucifera L. Biomass and Bioenergy, 46, 555-563.

Maksimov, A.I., Nikiforov, A.Y. (2007) Comparison of plasma and plasma-solution modifications of polymer materials in the liquid phase. High Energy Chemistry, 41(6), 454-459.

Mohanty, A.K., Misra, M., Hinrichsen, G. (2000) Biofibres, biodegradable polymers and biocomposites: An overview. Macromolecular Materials and Engineering, 266-277(1), 1-24.

Mohanty, A.K., Misra, M., Drzal, L.T. (Eds). (2005) Fibre-matrix adhesion in natural fibre composites. Natural Fibres, Biopolymers and Biocomposites. CRC, Boca Raton, p. 37.

Najim, T.S., Salim, A.J. (2014) Polyaniline nanofibers and nanocomposites: Preparation, characterization, and application for Cr(VI) and Phosphate ions removal from aqueous solution. Arabian Journal of Chemistry, 3, 70-76.

Nevell, T.P., and Zeronian, S.H. (Eds.) (1985) Cellulose chemistry and its applications. New York: Wiley.

Oke, I.W. (2010) Nanoscience in nature: Cellulose nanocrystals. Studied by undergraduate researchers at Guelph, Winter 3, 77–80.

Paisoonsin, S., Pornsunthorntawee, O., Rujiravanit, R. (2013) Preparation and characterization of ZnO-deposited DBD plasma-treated PP packaging film with antibacterial acivities. Applied Surface Science, 273, 824-835.

Pootawang, P., Saito, N., Takai, O. (2012) Solution plasma for template removal in mesoporous silica: pH and discharge time varying characteristics. Thin Solid Films, 519, 7030-7035.

Pootawang, P., Saito, N., Takai, O., Lee, S.Y. (2012) Rapid synthesis of ordered hexagonal mesoporous silica and their incorporation with Ag nanoparticles by solution plasma. Materials Research Bulletin, 47, 2726-2729.

Prasertsung, I., Damrongsakkul, S., Saito, N. (2013) Degradation of ß-chitosan by solution plasma process (SPP). Polymer Degradation and Stability, 98, 2089-2093.

Ragupathy, D., Gomathi, P., Lee, S.C., Al-Deyab, S.S. (2012) One-step synthesis of electrically conductrically conductive polyaniline nanostructures by oxidative polymerization method. Journal of Industrial and Engineering Chemistry, 18, 1213-1215.

Ravichandran, R., Sundarrajan, S., Venugopal, JR., Mukherjee, S., Ramakrishna, S. (2010) Applications of conducting polymers and their tissues in biomedical engineering. Journal and Royal Society Interface, 7, 559-579.

Rjeb, M., Labzour, A., Rjeb, A., Sayouri, S., Idrissi, M.C.E., Massey, S., Adnot, A., and Roy, D. (2004) Contribution to the study by x-ray photoelectron spectroscopy of the natural aging of the polypropylene. Moroccan Journal of Condensed Matter, 5, 168-172.

Robert, J.C. (1996) The chemistry of paper. The Royal Society of Chemistry, 2nd ed., London : Chapman and Hall, 98-119.

Sadov, F., Korchagin, M., Matetsky, A. *et al.* (Eds). (1978) Chemical Technology of Fibrous Materials. Moscow: Mir Publishers.

Saito, G., Nakasugi, Y., Yamashita, T., Akiyama, T. (2014) Solution plasma synthesis of ZnO flowers and their photoluminescence properties. Applied Surface Science, 290, 419-424.

Sapurina, I. Yu., Stejskal, J. (2010) The effect of pH on the oxidative polymerization of aniline and the morphology and properties of products. Russian Chemical Rewiews, 79(2), 1123-1143.

Sgriccia, N., Hawley, M.C., Misra, M. (2008) Characterization of natural fibre surfaces and natural fibre composites. Composition Part A-Applied Science and Manufacturing, 39(10), 1632-1637.

Shao, D., Chen, C., Wang, X. (2012) Application of polyaniline and multiwalled carbon nanotube magnetic composites for removal of Pb(II). Chemical Engineering Journal, 185-186, 144-150.

Shirafuji, T., Himeno, Y. (2013) Generation of three-dimensionally integrated micro-solution plasma and its application to decomposition of methylene blue molecules in water. Japan Journal of Applied Physics, 52, 236-241.

Shumakovich, G., Kurova, V., Vasil'eva, I., Pankratov, D., Otrokhov, G., Morozava, O., Yaropolov, A. (2012) Laccase-mediated synthesis of conducting polyaniline. Journal of Molecular Catalysis B: Enzymatic, 77, 105-110.

Sreekala, MS., Kumaran, MG., Joseph, S., Jacob, M. (2000) Oil palm fibers reinforced phenol formaldehyde composites: Influence of fibers surface modifications on the mechanical performance. Applied Composite Materials, 7(5-6), 295-329.

Stejskal, J., Saputina, I., Trchova, M. (2010) Polyaniline nanostructures and the role of aniline oligomers in their formation. Progress in Polymer Science, 35, 1420-1481.

Takai, O. (2008) Solution plasma processing (SPP). Pure and Applied Chemistry, 80(9), 2003-2011.

Tiwari, A., Singh, V. (2008) Microwave-induced synthesis of electrical conducting gum acacia-graft-polyaniline. Carbohydrate Polymers, 74, 427-434.

Toumis, G.T. (1991) Structure, properties and utilization. Science and Technology of Wood, New York: Van Nostrand Reinhold, 494.

Vieira, A.P., Santana, S.A., Bezerra, W.B., Silva, A.S., Chaves, A.P., Melo, C.P., Airoldi, C. (2011) Epicarp and mesocarp of babassu (Orbignya speciosa): Characterization and application in copper phtalocyanine dye removal. Journal of Brazilian Chemical Society, 22(1), 21-29.

Wallace, G., Spinks, G. (2007) Conducting polymers-bridging the bionic interface. Soft Matter, 3, 665-671.

Wang, B., Panigrahi, S., Tabil, L., Crerar. W. (2007) Pre-treatment of flax fibres for use in rotationally molded biocomposites. Journal of Reinforced Plastics and Composites, 26(5), 447-463.

Wang, H., Zhu, E., Yang, J., Zhou, P., Sun, D.,Tang, W. (2012) Bacterial cellulose nanocomposites with flake-shaped morphology as supercapacitor electrodes. Physical Chemistry, 116, 13013-13019.

Watthanaphanit, A., Saito, N. (2013) Effect of polymer concentration on the depolymerization of sodium alginate by the solution plasma process. Polymer Degradation and Stability, 98, 1072-1080.

Watthanaphanit, A., Panomsuwan, G., Saito, N. (2014) A novel one-step synthesis of gold nanoparticles in an alginate gel matrix by solution plasma sputtering. RSC Advances, 4, 1622-1629.

Yu, QZ., Shi, MM., Deng, M., Wang, M., Chen, HZ. (2008) Morphology and conductivity of polyaniline sub-micron fibers prepared by electrospinning. Masterials Science and Engineering B-Solid, 150, 70-76.

Zakaria, S., Poh, L.K. (2002) Polystyrene-benzoylated EFB reinforced composites. Polymer Plastic Technology Engineering, 41(5), 951-962.

Zhou, DD., Cui, XT., Hines, A., Greenberg, RJ. (2010) Conducting polymers in neural stimulation applications. Implantable Neural Prostheses, 2, 217-252.

Zimmermann, T., Pohlerand, E., and Geiger, T. (2004) Cellulose fibrils for polymer reinforcement. Advanced Engineering Materials, 6(9), 754-761.

APPENDICES

Appendix A Effect of Plasma Treatment Time on Cellulose Sheet

Table A1 Effect of solution plasma treatment time on water contact angle values of cellulose sheets

Time of plasma treatment (minutes)	Water contact angle (degree)
0	65.9±3.19
30	60.2±3.47
60	57.5±2.36
90	54.4±2.25
120	53.2±1.11

Table A2 Effect of solution plasma treatment time on stiffness of cellulose sheets.

Time of plasma treatment (mins)	Stiffness (mN)
0	23±1.87
30	29±2.24
60	35±1.22
90	37±1.92
120	39±2.79

Appendix B Effect of Cellulose to Aniline Monomer Ratio on Electrical Conductivity

Table B Effect of cellulose to aniline monomer ratio on electrical conductivity

Cellulose : Aniline Monomer	Electrical Conductivity (S/cm)				SD
	1	2	3	Average	
1 : 0.5	1.23×10^{-4}	9.22×10^{-5}	8.95×10^{-5}	1.02×10^{-4}	1.86×10^{-5}
1 : 1	4.50×10^{-4}	3.41×10^{-4}	3.28×10^{-4}	3.73×10^{-4}	6.70×10^{-5}
1 : 5	6.53×10^{-4}	7.80×10^{-4}	7.94×10^{-4}	7.42×10^{-4}	7.77×10^{-5}
1 : 6	4.16×10^{-4}	5.63×10^{-4}	4.89×10^{-4}	4.89×10^{-4}	7.35×10^{-5}

Appendix C Effect of Silver Particles on Polyaniline Coated on Cellulose Sheet

Table C1 Effect of reducing agent ($NaBH_4$) on amount of silver particles

$AgNO_3$: $NaBH_4$	Silver particles (g)
1:0	0
1:1	0.0913
1:2	0.1070
1:3	0.1070
1:4	0.1073

Table C2 The size of silver particles by using reducing agent and solution plasma

Silver particles size (nm)	Amount
1-10	11
11-20	37
21-30	33
31-40	5
41-50	7
51-60	2
61-70	2
71-80	3
Average	23.9 nm
SD	14.91 nm

Table C3 The size of silver particles by using reducing agent

Silver particles size (nm)	Amount
1-10	18
11-20	42
21-30	21
31-40	7
41-50	3
51-60	3
61-70	1
71-80	2
81-90	0
91-100	2
101-110	1
Average	37.4 nm
SD	94.1 nm

Table C4 Effect of silver particles added into polyaniline coated on cellulose sheet on electrical conductivity

$AgNO_3$ concentration (M)	Electrical Conductivity (S/cm)				SD
	1	2	3	Average	
0.01	1.11×10^{-4}	9.85×10^{-5}	8.94×10^{-5}	9.96×10^{-4}	1.08×10^{-4}
0.03	1.16×10^{-3}	1.74×10^{-3}	1.55×10^{-3}	1.48×10^{-3}	2.96×10^{-4}
0.05	2.42×10^{-3}	2.53×10^{-3}	2.91×10^{-3}	2.62×10^{-3}	2.57×10^{-4}
0.07	3.39×10^{-3}	3.54×10^{-3}	3.14×10^{-3}	3.36×10^{-3}	2.02×10^{-4}

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1. Anantasattakul, P.; and Rujiravanit, R. (2015, April 21) Synthesis and Deposition of Polyaniline and Silver Particles on Cellulose Fibers by Solution Plasma Process. Proceedings of the 6th Research Symposium on Petrochemical and Materials Technology and The 21st PPC Symposium on Petroleum, Petrochemicals, and Polymers, Bangkok, Thailand.

Presentations:

1. Anantasattakul, P.; and Rujiravanit, R. (2015, January 23-26) Synthesis of Polyaniline on Cellulose Fibers by Using Solution Plasma Process. Paper presented at the 15th International Symposium on Biomimetic Materials Processing (BMMP-15), Nagoya, Japan.
2. Anantasattakul, P.; and Rujiravanit, R. (2015, June 21-26) Solution Plasma Process for Synthesis of Polyaniline and Silver Coating on Cellulose Fibers. Paper presented at the European Polymer Federation 2015, Dresden, Germany.