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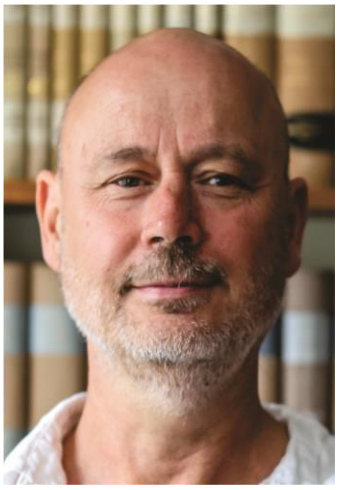

STAFF INFORMATION
Professor G.M Watkins
Bsc(Hons); PhD (University of Cape Town); MSACI Associate Professor of Inorganic Chemisrty & 3rd Year Course Coordinator

Find Me:

Postal Address: Department of Chemistry, Chemical and Pharmaceutical Sciences Building, Corner of University and Artillery Roads, Grahamstown, 6140

Courier Address: Department of Chemistry, Cnr of University and Artillery Roads, Rhodes University, Grahamstown, 6140, South Africa

Teaching:

1st Year: Chemical & physical equilibria

3rd Year: Coordination compounds & transition metal chemistry: Theoretical aspects, application in magnetism and spectroscopy.

Honours Year: Group theory; Advanced applied vibrational spectroscopy; Inorganic reaction mechanisms.

Previous:

2nd Year: Foundational Chemical Principles: Periodic trends of the main group elements

Research Interests:

"Thermal and spectroscopic studies of transition metal complexes & applied chemical technology"

As a physical inorganic chemist, my areas of interest are molecular spectroscopy, coordination chemistry and bioinorganic chemistry, applied to areas such as nanotechnology, medicinal and industrial uses. The group works with nmr, infrared and Raman spectroscopy, UV-visible spectroscopy, XRD(P), thermal analysis (TG, DSC and TG-FTIR) BET and molecular modelling. The group currently consists of six PhD, three MSc and two Honours students. Current Research Areas:

1. *Nanomaterials: Metal Organic Framework materials (MOF's);*
   MOFs may be formed in the crystalline phase by the self- assembly of structurally defined molecular modules possessing translational symmetry of one or more dimensionality. Such open framed network nano-materials have a wide variety of structural diversity and are expected to exhibit novel properties such as inclusion behaviour. This behaviour has application in two areas of interest; in environmental applications and in separation science. In the area of environmental impact, there are two foci for MOFs relating to the adsorption of hydrogen, and of carbon monoxide. Currently MOFs are the only materials that meet the US Department of Energy targets for hydrogen storage devices, but at present at economically unfavourable pressure and temperature conditions. Certain MOFs have also been shown to have carbon dioxide adsorption characteristics double that of current commercial absorbers. Alternate MOFs are under investigation to identify candidates with better gas adsorption characteristics and selectivity for separation science.
2. *Bioinorganic metal complexes*
   Metal Schiff base complexes have recently been shown to demonstrate antiplasmodial activity; the proposed activity of octahedral metal complexes containing N4O2 donors thought to occur by steric inhibition of haemozoin formation, thereby preventing the biomineralisation of the haeme which is toxic to the parasite. An alternative mechanism proposed for the antimalarial activity of four coordinate copper(II) complexes is the facile reduction to the cuprous species with subsequent activation of intracellular oxygen. Both mechanisms are targets of approach in this antimalarial study. This project involves the synthesis, characterization and in vitro and in vivo biological evaluation screening of different classes of Co(II), Co(III), Ni(II) and Cu(II) complexes with ligands containing ONO, ONS or NNS as donor atoms. Key biological techniques for the proposed study involve the use of antimicrobial bioassay, cell proliferation assays and antiplasmodial assays.
3. *Ligand isotope studies of transition metal complexes.*
   Isotopic labelling of ligands is an important tool in identifying vibrational spectroscopic interactions within metal complexes; it is essential in vibrational analysis, and may provide relevant information in determining reaction mechanisms, amongst other things. These studies are allied with molecular modelling (DFT, CPMD, etc.)

Past Postgraduate Students:

PhD:

- Dr N.P. Magwa. "The development of amine-based extractants for separation of base metals in a sulfate medium."(2015) (Co-supervisor)
- Dr. T.E. Olalekan. *"Synthesis, Characterisation and biological activity of 2-(methylthiomethyl) anilines, 2-(methylthio)anilines, their Schiff base derivatives and Metal(II) (Co, Ni, Cu) complexes"* (2013)
- Dr. A.O. Sobola. *"Synthesis, characterisation and antimicrobial activity of Cu(II) complexes of some hydroxybenzaldimines and their derivatives."* (2012)
- Dr. R.O. Shaibu. *"A bioinorganic study of some cobalt(II) complexes of variously substituted hydroxybenzaldimines."* (2008)

- Dr. E. Lamprecht. *"Thermal, spectroscopic and X-ray diffraction studies of copper(II) 1, 2, 4, 5- benzenetetracarboxylates and copper(II) oxalate: A study of metal-organic frameworks."*(2008)
- Dr. J.J. Guthrie Strachan. *"The investigation, development and characterisation of novel zirconium-based tanning agents."* (2006)
- Dr. A. Dairam. *"An investigation into the neuroprotective properties of the non-steroidal anti-inflammatory agent tolmetin, sulindac and tumeric."* (2006)(Co-supervisor).
- Dr. G.J.M. Medina. *"Ligand isotope vibrational spectroscopic and DFT studies of Pt(II) & Cu(I) complexes."* (2005)
- Dr. A.P.M. Antunes. *"Removal and recovery of Gold and Platinum from aqueous solutions utilizing the non-viable biomass Azolla filiculoides."* (2002)(Joint supervisor).

MSc:

- Mr W. Moloto.*"A bulk and fraction-specific geochemical study of the origin of diverse high-grade hematitic iton ores from the Transvaal Supergroup, Northern Cape Province, South Africa."* (2017) (Co-supervisor)
- Mr W. Feldmann. *"Study into the Synthesis, Characterisation and Applications of Vanadium-based Metal Organic Frameworks, using 1, 2, 4, 5-Benzenetetracarboxylic acid."* (2016)
- Mr. M.J. Coombes *"A Comparative Study of Two Copper(II) Based Metal-Organic Frameworks: Cu2¼(OH)½B4C•8H2O and Cu2Na(OH)B4C•7H2O"* (2013(Distinction)
- Mr. C.A. Makanjee *"An experimental and theoretical investigation of unstable Fischer chromium carbine complexes."* (2013) (Co-supervisor)
- Ms. N.P. Magwa *"A spectroscopic study of the electronic effects on copper(II) and copper(I) complexes of ligands derived from variously substituted benzaldehyde- and cinnamaldehyde-based Schiff bases."* (2010)
- Ms. E. Mopp *"An bioinorganic investigation of some metal complexes of the Schiff base N,N'-bis(3-methoxysalicylaldimine)propan-2-ol."* (2010)

2018 Publications:

1. **Achadu, O.J.** and **Nyokong, T.** (2018) Fluorescence "turn-ON" nanosenor for cyanide ion using supramolecular hybrid of graphene quantum dots and cobalt pyrene-derivatized phthalocyanine. *Dyes and Pigments.* 2018. p.1-8.

2. **Ayeni, A.O.**, **Watkins, G.M.** and Hosten, E.C. (2018) Polymorphism of a new Mannich base-[-4-methyl-2-((4-(4-nitrophenyl) piperazin-1-yl) methyl) phenol]. *Journal of Molecular Structure.* 1160 (2018). p.38-45.

3. **Ayeni, A.O.** and **Watkins, G.M.** (2018) Synthesis and evaluation of catecholase activities of metal complexes of 1, 4-substituted piperazine Mannich Base of 4-acetamidophenol. *Turkish Journal of Chemistry.* 42 (2018). p.1275-1284.

4. **Ayeni, A.O.** and **Watkins, G.M.** (2018) Biomimetics of mononuclear and dinuclear Cu(II) and Fe(III) complexes of a newly synthesized piperazyl Mannich base with or without thiocyanate towards catechol. *Monatshefte Fur Chemie.* 149 (2018). p.2175-2182.

5. **Ayeni, A.O.**, **Watkins, G.M.** and Hosten, E.C. (2018) Molecular and Crystal structure of a novel Mannich quaternary salt: 3-(dimethylamino)-1-*p*-tolylpropan-1-one hydrochloride. *Journal of Structural Chemistry*. 59 (7). p.1688-1690.

6. **Beteck, R.M.**, **Isaacs, M.**, **Hoppe, H.C.** and **Khanye, S.D.** (2018) Synthesis, *in vitro* Cytotoxicity and Trypanosomal Evaluation of Novel 1,3,6-Subsituted Non-fluoroquinolones. *South African Journal of Chemistry – Suid-Afrikaanse Tydskrif Vir Chemie.* 71 (2018). p.188-195.

7. **Centane, S.**, **Sekhosana, K.E.**, **Matshitse, R.** and **Nyokong, T.** (2018) Electrocatalytic activity of a push-pull phthalocyanine in the presence of reduced and amino functionalized graphene quantum dots towards the electrooxidation of hydrazine. *Journal of Electroanalytical Chemistry.* 820 (2018). p.146-160.

8. **Chani, F.M.**, **Ngcoza, K.M.**, **Chikunda, C.** and **Sewry, J.D.** (2018) Exploring the Mediation of Learning of Chemical Equilibrium to High-achieving Students in a Selected Senior Secondary School in Namibia. *African Journal of Research in Mathematics, Science and Technology Education*. 22 (3). p.287-296.

9. **Chindeka, F.**, **Mashazi, P.**, **Britton, J.**, **Fomo, G.**, **Oluwole, D.O.**, **Sindelo, A.** and **Nyokong, T.** (2018) Optimizing phthalocyanine based dye-sensitized solar cells: The role of reduced graphene oxide. *Synthetic Metals.* 246 (2018). p.236-245.

10. **Darrell, O.T.**, **Hulushe, S.T.**, **Mtshare, T.E.**, **Beteck, R.M.**, **Isaacs, M.**, **Laming, D.**, **Hoppe, H.C.**, **Krause, R.W.M.** and **Khanye, S.D.** (2018) Synthesis, Antiplasmodial and Antitrypanosomal Evaluation of a Series of Novel 2-Oxoquinoline-based Thiosemicarbazone Derivatives. *South African Journal of Chemistry – Suid-Afrikaanse Tydskrif Vir Chemie*. 71 (2018). p.174-181.

11. Milanowski, D.J., Oku, N., Cartner, L.K., Bokesch, H.R., Williamson, R.T., Sauri, J., Liu, Y., Blinov, K.A., Ding, Y., Li, X.C., Ferreira, D., Walker, L.A., Khan, S., **Davies-Coleman, M.T.**, Kelley, J.A., McMahon, J.B., Martin, G.E., and Gustafson, K.R. (2018) Unequivocal determination of caulamidines A and B: application and validation of new tools in the structure elucidation tool box. *Chemical Science*. 9 (2018). p.307-314.

12. **Dube, E.** and **Nyokong, T.** (2018) Effect of gold nanoparticles shape and size on the photophysicochemical behaviour of symmetric and asymmetric zinc phthalocyanines. *Journal of Luminescence.* 2018. p.1-8.

13. **Dube, E.**, **Nwaji, N.**, **Mack, J.** and **Nyokong, T.** (2018) The photophysicochemical behavior of symmetric and asymmetric zinc phthalocyanines, surface assembled onto gold nanotriangles. *New Journal of Chemistry.* 42 (2018). p.14290-14299.

14. **Dube, E.**, **Oluwole, D.O.** and **Nyokong, T.** (2018) Improved Photophysical and Photochemical Properties of Thiopheneethoxy Substituted Metallophthalocyanines on Immobilization onto Gold-speckled Silica Nanoparticles. *Photochemistry and Photobiology.* 94 (2018). p.521-531.

15. **Dube, E.**, **Oluwole, D.O.**, **Prinsloo, E.** and **Nyokong, T.** (2018) A gold-chitosan composite with low symmetry zinc phthalocyanine for enhanced singlet oxygen generation and improved photodynamic therapy activity. *New Journal of Chemistry.* 42 (2018). p.10214-10225.

16. **Dube, E.**, **Oluwole, D.O.**, **Nwaji, N.** and **Nyokong, T.** (2018) Glycosylated zinc phthalocyanine-gold nanoparticle conjugates for photodynamic therapy: Effect of nanoparticle shape. *Spectrochimica Acta Part A – Molecular and Biomolecular Spectroscopy.* 203 (2018). p.85-95.

17. **Faridoon, H.**, **Mnkandhla, D.**, **Isaacs, M.**, **Hoppe, H.C.** and **Kaye, P.T.** (2018) Synthesis and evaluation of substituted 4-arylimino-3-hydroxybutanoic acids as potential HIV-1 integrase inhibitors. *BIOORGANIC & Medicinal Chemistry Letters.* 28 (2018). p.1067-1070.

18. **Fomo, G.**, **Achadu, O.J.** and **Nyokong, T.** (2018) One-pot synthesis of graphene quantum dots phthalocyanines supramolecular hybrid and the investigation of their photophysical properties. *Journal of Materials Science.* 53 (2018). p.538-548.

19. **Fomo, G.**, **Nwaji, N.** and **Nyokong, T.** (2018) Low symmetric metallophthalocyanine modified electrode via click chemistry for simultaneous detection of heavy metals. *Journal of Electroanalytical Chemistry.* 813 (2018). p.58-66.

20. **Gumbo, M.**, **Beteck, R.M.**, **Mandizvo, T.**, Seldon, R., Warner, D.T., **Hoppe, H.C.**, **Isaacs, M.**, **Laming, D.**, Tam, C.C., Cheng, L.W., Liu, N., Land, K.M. and **Khanye, S.D.** (2018) Cinnamoyl-Oxaborole Amides: Synthesis and Their in Vitro Biological Activity. *Molecules.* 23 (2018). p.1-13.

21. **Idowu, M.A.**, **Xego, S.**, **Arslanoglu, Y.**, **Mack, J.**, **Antunes, E.** and **Nyokong, T.** (2018) Photophysicochemical behaviour and antimicrobial properties of monocarboxy Mg (II) and Al (III) phthalocyanine-magnetite conjugates. *Spectrochimica Acta Part A – Molecular and Biomolecular Spectroscopy.* 193 (2018). p.407-414.

22. **Isalomboto Nkanga, C.** and **Krause, R.W.M.** (2018) Abstract: Formualtion and characterization of pH-/light-responsive liposomes for macrophage targeted delivery of isoniazid. *Chemical Papers.* 10 (2018). p.24-25.

23. **Isalomboto Nkanga, C.** and **Krause, R.W.M.** (2018) Conjugation of isoniazid to a zinc phthalocyanine via hydrazone linkage for pH-dependent liposomal controlled release. *Applied Nanoscience*. 8 (2018). p.1313-1323.

24. **Isalomboto Nkanga, C.**, **Walker, R.B.** and **Krause, R.W.M.** (2018) pH-Dependant release of isoniazid from isonicotinic acid (4-hydroxy-benzylidene)-hydrazide loaded liposomes. *Journal of Drug Delivery Science and Technology.* 45 (2018). p.264-271.

25. **Olawode, E.O.**, **Tandlich, R.**, **Prinsloo, E.**, **Isaacs, M.**, **Hoppe, H.C.**, Sheldon, R., Warner, D.T., Steenkamp, V. and **Kaye, P.T.** (2018) Synthesis and biological screening of diethyl [N-(thiazol-2-yl)carbamoyl]methylphosphonates. *Arkivoc.* 7 (2018). p.110-118..

26. Kumar, A., **Khan, F.I.** and Olaniran, A.O. (2018) Chloroacetaldehyde dehydrogenase from *Ancylobacter aquaticus* UV5: Cloning, expression, characterization and molecular modeling. *International Journal of Biological Macromolecules.* 114 (2018). p.1117-1126.

27. Ali, S., **Khan, F.I.**, Chen, W., Rahaman, A. and Wang, Y. (2018) Open and closed states of Mrlip1 DAG lipase revealed by molecular dynamics simulation. *Molecular Simulation.* 44 (18). p.1520-1528.

28. Gulzar, M., Syed, S.B., **Khan, F.I.**, Khan, P., Ali, S., Hasan, G.M., Taneja, P. and Hassan, M.I. (2018) Elucidation of interaction mechanism of ellagic acid to the integrin linked kinase. *International Journal of Biological Macromolecules.* 2018. p.1-8.

29. Beg, A., **Khan, F.I.**, **Lobb, K.A.**, Islam, A., Ahmad, F. and Hassan, M.I. (2018) High throughput screening, docking, and molecular dynamics studies to identify potential inhibitors of human calcium/calmodulin-dependent protein kinase IV. *Journal of Biomolecular Structure & Dynamic.* 2018. p.1-14.

30. Husain, F.M., Ahmad, I., **Khan, F.I.**, Al-Shabib, N.A., Baig, M.H., Hussain, A., Rehman, M.T., Alajmi, M.F. and **Lobb, K.A.** (2018) Seed Extract of *Psoralea corylifolia* and Its Constituent Bakuchiol Impairs AHL-Based Quorum Sensing and Biofilm Formation in Food- and Human-Related Pathogens. *Frontiers in Cellular and Infection Microbiology*. 8 (351). p.1-16.

31. Syed, S.B., **Khan, F.I.**, Khan, S.H., Srivastava, S., Hasan, G.M., **Lobb, K.A.**, Islam, A., Hassan, M.I. and Ahmad, F. (2018) Unravelling the unfolding mechanism of human intergrin linked kinase by GdmCl-induced denaturation. *International Journal of Biological Macromolecules.* 117 (2018). p.1252-1263.

32. Mohammad, T., **Khan, F.I.**, **Lobb, K.A.**, Islam, A., Ahmad, F. and Hassan, M.I. (2018) Identification and evaluation of bioactive natural products as potential inhibitors of human microtubule affinity-regulating kinase 4 (MARK4). *Journal of Biomolecular Structure & Dynamics.* 2018. p.1-17.

33. Syed, S.B., **Khan, F.I.**, Khan, S.H., Srivastava, S., Hasan, G.M., **Lobb, K.A.**, Islam, A., Hassan, M.I. and Ahmad, F. (2018) Unravelling the unfolding mechanism of human intergrin linked kinase by GdmCl-induced denaturation. *International Journal of Biological Macromolecules.* 117 (2018). p.1252-1263.

34. Khan, S., **Khan, F.I.**, Mohammad, T., Khan, P., Hasan, G.M., **Lobb, K.A.**, Islam, A., Ahmad, F. and Hassan, M.I. (2018) Exploring molecular insights into the interaction mechanism of cholesterol derivatives with the Mce4A: A combined spectroscopic and molecular dynamic simulation studies. *International Journal of Biological Macromolecules.* 111 (2018). p.548-560.

35. Odame, F., Betz, R., Hosten, E.C., Krause, J., **Isaacs, M.**, **Hoppe, H.C.**, **Khanye, S.D.**, Sayed, Y., Frost, C.L., **Lobb, K.A.** and Tshentu, Z.R. (2018) A New Synthetic Method for Tetraazatricyclic Derivatives and Evaluation of Their Biological Properties. *ChemistrySelect*. 3 (2018). p.13613-13618.

36. Gounden, D., **Khene, S.** and Nombona, N. (2018) Electroanalytical detection of heavy metals using metallophthalocyanine and silica-coated iron oxide composites. *Chemical Papers.* 72 (2018). p.3043-3056.

37. Namondo, B.V., Foba-Tendo, J., Etape, E.P. and **Krause, R.W.M.** (2018) Potential of blended biomass feedstock from some species of raffia palm (*Raffia farinifera, Raffia hookeri and Raffia vinifera*) and Oil Palm Empty Fruit Bunch (OPEFB) from Cameroon. *African Journal of Pure and Applied Chemistry*. 12 (4). p.25-33.

38. **Kubheka, G.**, **Sanusi, K.**, **Mack, J.** and **Nyokong, T.** (2018) Optical limiting properties of 3,5-dipyrenylvinylene BODIPY dyes at 532 nm. *Spectrochimica Acta Part A – Molecular and Biomolecular Spectroscopy.* 191 (2018). p.357-364.

39. **Lebechi, A.K.**, Gai, L., Shen, Z., **Nyokong, T.** and **Mack, J.** (2018) Electrospun 3,5-dithienylvinyleneBODIPY embedded polystyrene nanofibers for the photocatalytic degradation of azo dyes in industrial wastewaters. *Journal of Porphyrins and Phthalocyanines.* 22 (2018). p.501-508.

40. **Musyoka, T.M.**, **Tastan Bishop, O.**, **Lobb, K.A.** and **Moses, V.** (2018) The determination of CHARMM force field parameters for the Mg2+ containing HIV-1 integrase. *Chemical Physics Letters.* 711 (2018). p.1-7.

41. Odame, F., Krause, J., Hosten, E.C., Betz, R., **Lobb, K.A.**, Tshentu, Z.R. and Frost, C.L. (2018) Synthesis, Characterization and DPPH Scavenging Activity of some Benzimidazole Derivatives. *Bulletin of the Chemical Society of Ethiopia.* 32 (2). p.271-284.

42. Odame, F., Hosten, E.C., Betz, R., **Lobb, K.A.** and Tshentu, Z.R. (2018) Characterization and Computational Studies of a Co-Crystal of 2-Aminobenzimdazole and 2-[(Benzolycarbamothioyl) Amino]Propanoic Acid. *Journal of Structural Chemistry.* 59 (5). p.1200-1204.

43. Liang, X., Li, M., **Mack, J.**, **Lobb, K.A.** and Zhu, W. (2018) Iron(III)porphyrin electrocatalyzed enantioselective carbon-chloride bond cleavage of hexachlorocyclohexanes (HCHs): combined experimental investigation and theoretical calculations. *Dalton Transactions.* 47 (2018). p.11470-11476.

44. Bomanda, B.T., Waudo, W., Ngoy, B.P., Muya, J.T., Mpiana, P.T., Mbala, M., Openda, I., **Mack, J.** and **Nyokong, T.** (2018) Photophysical and *in vitro* Antibacterial Studies of 2,6-Dibromo-BODIPY Dye Substituted with Dithienylenevinylene at 3,5-Positions. *Macroheterocycles*. 11 (4). p.429-437.

45. Abdurrahmanoglu, S., Canlica, M., **Mack, J.** and **Nyokong, T.** (2018) Pyridone substituted phthalocyanines: Photophysico-chemical properties and TD-DFT calculations. *Journal of Porphyrins and Phthalocyanines*. 22 (2018). p.25-31.

46. Liang, X., Luo, H., Lan, Y., Zhu, W., **Mack, J.**, **Hlatshwayo, Z.**, **Nyokong, T.** and Chen, Q. (2018) n - Extended BODIPY Analogues: Synthesis, Electronic Structure, Potential Utility for *in vivo* Imaging Applications and Cytotoxicity. *Macroheterocycles*. 11 (4). p.421-428.

47. Liang, X., Qin, M., Zhou, L., Liu, T., Li, M., **Mack, J.**, **Ndebele, N.**, **Nyokong, T.** and Zhu, W. (2018) Porphyrin dimers with a bridging chiral amide-bonded benzo-moiety: Influence of positional isomerism on the molecular chirality. *Dyes and Pigments.* 154 (2018). p.229-233.

48. Yuan, X., Li, M., Meng, T., **Mack, J.**, **Soy, R.**, **Nyokong, T.**, Zhu, W., Xu, H. and Liang, X. (2018) Core-modified rubyrins with phenanthrene-fused pyrrole rings: Highly selective and tunable response to Hg2+ ions. *Dyes and Pigments.* 158 (2018). p.188-194.

49. **Mafukidze, D.M.** and **Nyokong, T.** (2018) A comparative study of the singlet oxygen generation capability of a zinc phthalocyanine linked to graphene quantum dots through ?-? stacking and covalent conjugation when embedded in asymmetric polymer members. *Journal of Molecular Structure*. 1180 (2018). p.307-317.

50. **Magadla, A., Oluwole, D.O., Britton, J. and Nyokong, T. Magadla, A.**, **Oluwole, D.O.**, **Britton, J.** and **Nyokong, T.** (2018) Effect of nature of nanoparticles on the photophysicochemical properties of asymmetrically substituted Zn phthalocyanines. *Inorganica Chimica Acta.* 482 (2018). p.438-446.

51. **Makinde, Z.O.**, **Louzada, M.S.**, **Britton, J.**, **Nyokong, T.** and **Khene, S.** (2018) Spectroscopic and nonlinear optical properties of alkyl thio substituted binuclear phthalocyanines. *Dye and Pigments.* 2018. p.1-8.

52. **Managa, M.**, **Achadu, O.J.** and **Nyokong, T.** (2018) Photophysical studies of graphene quantum dots - Pyrene-derivatized porphyrins conjugates when encapsulated within Pluronic F127 micelles. *Dyes and Pigments.* 148 (2018). p.405-416.

53. **Managa, M.**, **Britton, J.**, **Prinsloo, E.** and **Nyokong, T.** (2018) Effects of Pluronic F127 micelles as delivering agents on the *vitro* dark toxicity and photodynamic therapy activity of carboxy and pyrene substituted porphyrins. *Polyhedron.* 152 (2018). p.102-107.

54. **Managa, M.**, **Khene, S.**, **Britton, J.**, Martynov, A.G., Gorbunova, Y.G., Tsivadze, A.Y. and **Nyokong, T.** (2018) Photophysics and NLO properties of Ga(III) and In(III) phthalocyaninates bearing diethyleneglycol chains. *Journal of Porphyrins and Phthalocyanines.* 22 (2018). p.137-148.

55. **Managa, M.**, **Ngoy, B.P.**, **Mafukidze, D.M.** and **Nyokong, T.** (2018) Incorporation of metal free and Ga 5,10,15,20-tetrakis(4-bromophenyl) porphyrin into Pluronic F127-folic acid micelles. *Journal of Luminescence.* 194 (2018). p.739-746.

56. **Matlou, G.G.**, Kobayashi, N., Kimura, M. and **Nyokong, T.** (2018) Physicochemical properties of water-soluble unsymmetrical phthalocyanine-folic acid conjugates. *Dyes and Pigments.* 149 (2018). p.393-398.

57. **Matlou, G.G.**, **Oluwole, D.O.**, **Prinsloo, E.** and **Nyokong, T.** (2018) Photodynamic therapy activity of zinc phthalocyanine linked to folic acid and magnetic nanoparticles. *Journal of Photochemistry and Photobiology B – Biology.* 186 (2018). p.216-224.

58. **Matlou, G.G.**, **Oluwole, D.O.** and **Nyokong, T.** (2018) Evaluation of the photosensitizing properties of zinc and indium tetra cinnamic acid phthalocyanines linked to magnetic nanoparticles on human breast adenocarcinoma cells. *Journal of Luminescence.* 2018. p.1-8.

60. **Matshitse, R.** and **Nyokong, T.** (2018) Singlet Oxygen Generating Properties of Different Sizes of Charged Graphene Quantum Dot Nanoconjugates with a Positively Charged Phthalocyanine. *Journal of Fluorescence.* 28 (2018). p.827-838.

61. **Matshitse, R.**, **Nwaji, N.**, **Managa, M.**, **Prinsloo, E.** and **Nyokong, T.** (2018) Effect of number of positive charges on the photophysical and photodynamic therapy activities of quaternary benzothiazole substituted zinc phthalocyanine. *Journal of Photochemistry and Photobiology A – Chemistry* 367 (2018). p.253-260.

62. **Mbaba, M.**, **De La Mare, J.A.**, **Sterrenberg, J.N.**, **Kajewole, D.I.**, **Maharaj, S.**, **Edkins, A.L.**, **Isaacs, M.**, **Hoppe, H.C.** and **Khanye, S.D.** (2018) Novobiocin-ferrocene conjugates possessing anticancer and antiplasmodial activity independent of HSP90 inhibition. *Journal of Biological Inorganic Chemistry.* 2018. p.1-11.

63. **Mgidlana, S.**, **Oluwole, D.O.** and **Nyokong, T.** (2018) Effects of the carboxylic acid substituents on the photophysical and nonlinear optical properties of asymmetrical Zn(II) phthalocyanines-quantum dots conjugates. *Inorganic and Nano-Metal Chemistry*.

64. **Mgidlana, S.**, **Oluwole, D.O.** and **Nyokong, T.** (2018) Fabrication of efficient nonlinear optical absorber using Zn phthalocyanine-semiconductor quantum dots conjugates. *Polyhedron.* 2018. p.1-14.

65. **Molupe, N.**, **Babu, B.**, **Oluwole, D.O.**, **Prinsloo, E.**, **Mack, J.** and **Nyokong, T.** (2018) The investigation of *in vitro* dark cytotoxicity and photodynamic therapy effect of a 2,6-dibromo-3,5- distyryl BODIPY dye encapsulated in Pluronic® F-127 micelles. *Journal of Coordination Chemistry.* 71 (21). p.3444-3457.

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