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Random Laser: A new potential biosensor

Dr. W. Z. Wan Ismail, Senior Lecturer
Faculty of Engineering and Built Environment,
Universiti Sains Islam Malaysia, Malaysia
email: drwanzakiah@usim.edu.my

Abstract:

Biosensors are normally applied in biomedical diagnosis, environment monitoring and food safety to detect specific molecules in a certain medium. The sensitivity of the detection is very crucial in any biosensor. We investigate the application of random lasers as potential biomolecule sensing and measurement techniques. Random lasers work based on similar principle with conventional lasers which need feedback and light amplification. If gain exceeds loss, lasing threshold is achieved. The feedback in conventional lasers is provided by the cavity (mirrors)whereas in conventional lasers,multiple light scattering plays important roles for the feedback [1]. In biosensing area, random lasers have been used to sense lipid emulsion [2] and pH [3] while we use random lasers to detect dopamine, a neurotransmitter distributed in the brain tissues and body fluids of mammals [4,5]. Dopamine sensing is important to detect, monitor and treat Parkinson and Huntington's diseases [4]. In thisrandom laser based sensor, gold nanoparticles are used to scatter the light while Rhodamine 640 is added as the random laser gain medium.Dopamine with copper ions triggers the aggregation of gold nanoparticles and thus influences properties of random lasers; emission intensity, linewidth and lasing threshold [5]. Dopamine causes the metal nanoparticles to aggregate due to interfering with the surface ionic layer that stabilizes the colloidal particles [6]. Gold nanoparticles are able to enhance the properties of random lasers due to localized surface plasmon. The effects of metal nanoparticles on properties of random lasers has been discussed in [7].Dopamine sensing is achieved using four parameters; emission peak shift, emission linewidth, signal to noise ratio (emission peak intensity/noise) and threshold. We demonstrate sensitivity to nanomolar concentrations by using random lasers to measure the dopamine concentration.

Biography: Wan Zakiah Wan Ismail was born in Kota Kinabalu, Sabah, Malaysia in 1982. She finished undergraduate study (Bachelor of Electronic Engineering) at Multimedia University, Malaysia in 2005 and further studies for Master degree (Master in Telecommunication Engineering) in Melbourne, Australia in 2007. Both undergraduate and postgraduate studies were sponsored by Telekom Malaysia. Then she served Multimedia University as a lecturer in Faculty of Engineering and Technology teaching electronics. Five years later, she pursued her study in PhD after being awarded Prime Minister's Australia Endeavour award and Universiti Sains Islam Malaysia (USIM) fellowship. Her PhD study focuses on optical device specialized in laser engineering. Currently, she works as a lecturer in Faculty of Engineering and Built Environment, USIM. She has published more than 20 peer-review journals and conference proceedings. She is a member ofInstitute of Electrical and Electronics Engineers(IEEE) and Optical Society of America (OSA), professional member of Malaysia's Board of Technologist (MBOT) and graduate member of Board of Engineers (BEM).