Organic Liquid Scintillators Based Source Localisation in Radiation Monitoring

Kelum A.A. Gamage, Craig Hickman

Department of Engineering, Lancaster University, Lancaster, LA1 4YR, UK

Portal radiation monitors are used to detect radioactive materials contained in moving vehicles at border crossings or to prevent illicit import of nuclear and radiological materials into the port. Portal monitor systems are also used in security applications in hospital and industry environments, for example to protect radioactive materials from theft. These systems are passive (not designed to generate or emit radiation) and activate an alarm in the event of detection of radioactive material; however provide little information on energy of detected radiation to the operator. They often use detectors based on the use of helium-3 gas for neutron detection and plastic scintillator detectors for gamma-ray detection. The currently used Helium-3 is generated as a result of tritium radioactive decay and the production of helium-3 has drastically decreased in recent years. Fast organic liquid scintillators became popular as a result of recent advances in digital pulse-shape discrimination methods and demanding requirements in security applications associated with helium-3 replacement. In this paper we are going to use an array of organic liquid scintillators (which is sensitive to both neutrons and gamma rays) and investigate the potential of localisation of radioactive sources in three-dimensional space relevant to portal monitoring applications.

1. Suzuki, K., Artificial neural networks – architectures and applications, http://dx.doi.org/10.5772/3409, (2013).
2. Basheer, I.A., Hajmeer, M., Artificial neural networks: fundamentals, computing, design, and application, Journal of Microbiological Methods, Vol. 43 (2000) pp 3–31.
3. Bishop, C.M., Pattern recognition and machine learning, Springer, (2006).
4. Ibrić, S., Djuriš, J., Parojčić, J., Djurić, Z., Artificial neural networks in evaluation and optimization of modified release solid dosage forms, Pharmaceutics, Vol. 4 (2012) pp 531-550.
5. Nascimento, C.L., Artificial Neural Networks for Control and Optimization, PhD thesis, Manchester University, (1994).