NOVEL SENSOR DESIGN FOR DETECTION OF DANGEROUS CONTAMINATED MARINE BIOTOXINS

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To my parents:

Abdul Rahman Bin Daud

and

Mariah Binti Abdul Rahman

Abstract

Planar electromagnetic sensing system has been used as one of the NDT methods to evaluate the material properties i.e., to evaluate near-surface properties such as conductivity, permeability and dielectric properties. The applications of planar electromagnetic sensors will depend on both the characteristic of the sensor type chosen and also the characteristic of material under test. Conventional planar interdigital sensors and novel planar interdigital sensors have been designed, fabricated and tested for detection of dangerous marine biotoxins in seafood. Our main objective is to sense the presence of dangerous contaminated acid in mussels and other seafoods. Initial studies were conducted with three peptide derivatives namely Sarcosine, Proline and Hydroxylproline. These three chemicals are structurally closely related to our target molecule (domoic acid). The initial results have shown that all sensors respond very well to the chemicals and it is possible to discriminate the different chemicals from the output of the sensor. Novel interdigital sensors have shown better sensitivity measurement compared to conventional interdigital sensors. The novel interdigital sensors were then being tested with three seafood products. Results from the analysis have shown that novel interdigital sensor with configuration #1 (Sensor_1) has better sensitivity compared to other sensors. Sensor_1 has been chosen for experiment using proline and mussels. The changes in sensor sensitivity were analysed with mussels before and after adding the proline. The presence of proline on the mussel surface and also injected proline to the mussel samples were clearly detected by Sensor_1. Further experiment was conducted with small amount of domoic acid (0.5 µg to 5.0 µg) injected to a mussel and it was found that Sensor_1 was able to detect small amount of domoic acid (1.0 µg) injected into the mussel sample. Sensor_1 was able to detect approximately 12.6 µg/g of domoic acid in mussel meat. Three threshold levels of particular sample thickness have been established for detection of domoic acid. The first prototype of a low cost sensing system known as SIT (Seafood Inspection Tool) has been developed. The outcomes from the experiments provide chances of opportunity for further research in developing a low cost miniature type of sensors for reliable sensing system for commercial use.

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