1	Application of Electronic Nose, Spectroscopy Sensor, and
2	Machine Learning for the Freshness Evaluation of Fish Fillet
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4	2022/05/04
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16	<u>Abstract</u>
17	Biochemical, microbiological, sensory and oxidation-reduction reactions are associated
18	with the deterioration of fish quality during trading, transiting and storage. The estimation
19	of freshness is an important issue in fish which is related to its overall quality. In the past,
20	a large number of different measurement methods were applied to measure the freshness
21	of fish. However, many of them required complex sample preparation, experienced
22	operators, or high cost of instruments. In recent years, metal oxide semiconductor (MOS)
23	and machining learning have been widespread used in food quality evaluation. In our
24	research, ten gas sensors and a multi-wavelength spectroscopy sensor, AS7265x, were
25	designed for the freshness detection of fish during storage period. The performance of
26	designed gas sensors system was evaluated. The results showed the response and
27	recovery time was fast, and all in 5 minutes. Among all sensors, MQ-138 sensor observed
28	an even shorter response in 1 minute. The linearities of MQ sensors were tested by
29	simulating a concentration-dependent gas phase environment through different aqueous
30	alcohol solutions. The coefficient of determination (R^2) of MQ-3 and MQ-138 sensors
31	were over 0.99 which offered great response linearity. The other sensors also showed
32	good linearities with R ² at least over 0.95. The sensor-to-sensor variability was also tested
33	by comparing four of the identical MQ sensors in different concentrations of alcohol
34	aqueous solution. However, significant varieties were obtained between identical MQ
35	sensors. Therefore, two of each identical sensors with closed response were selected and
36	assembled into two sensor boxes for further application of fish freshness fast detection.
37	Currently, the sensor abilities for using as volatiles detection units in the designed sensor
38	boxes was confirmed. The future studies will focus on the detection of 50 fillets by the
39 40	designed sensor box, and comparison of sensor results with the measured TVB-N and K
40 41	value during storage. The obtained date will be processed using artificial neural network
41	(ANN) model to build a fish freshness prediction system.