Chemical mixture identification using transmission surface plasmon resonance based metallic grating sensor chip and pattern-recognition technique

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The artificial pattern-recognition sensors using the fingerprint of transmission surface plasmon resonance (TSPR) spectra can be utilized for organic solvents and Japanese sake classifications. TSPR signals obtained from a wide range of light incident angles and broad TSPR spectra covering visible-to-NIR light region contain a lot of optical information that is the fingerprint of the chemical. This fingerprint is the pattern that can be classified using pattern recognition analysis (PCA). The TSPR spectra of gold-coated grating substrate at several incident angles ranging from 5^o to 40^o were recorded using spectrometer. Furthermore, to improve the performance of this method, gold-coated grating substrate was functionalized by several types of thiol chemicals to modify the wettability of the surface of substrates. The TSPR spectra from TSPR substrates with different thiol chemicals were included in PCA. This technique have been employed for classification of concentration and type of organic solvents and Japanese sake samples. The preliminary results of organic solvents and sake samples classification are shown in Figs. 1a and 1b, respectively. TSPR coupled with PCA technique for chemical mixture classification is simple, rapid detection, and no need to use complicate equipment. This technique also shows high possibility to further develop to be a portable device for an on-site sensing platform.

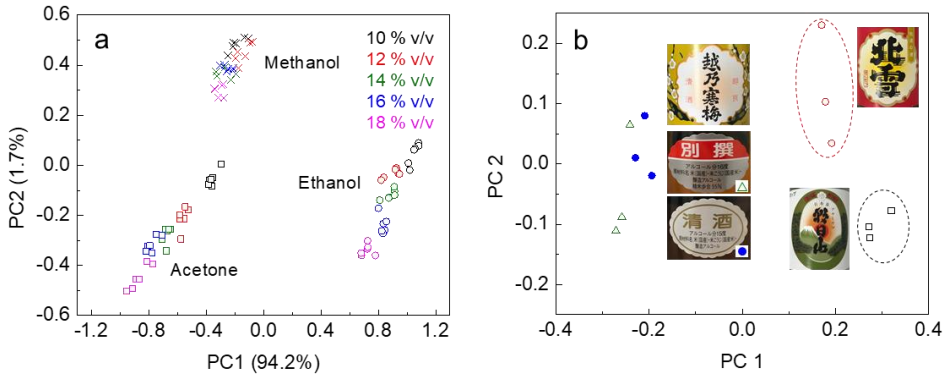

Fig. 1 (a) PCA for different types and concentrations of organic solvents. (b) PCA for different trademarks and different kinds of Japanese sake samples. The TSPR signals obtained from 6 and 3 sensing regions for classification of organic solvents and sake samples, respectively.

References

1) Stewart S., *et al.*, *Chem. Soc. Rev.*, 2014, 43, 70-84.

2) Macias G., *et al.*, *Nanoscale*, 2019, 11, 15216-15223.