NIT Toyama College

Rapid concentration of environmental pollutants into droplets

- Simple and sensitive environmental analysis -

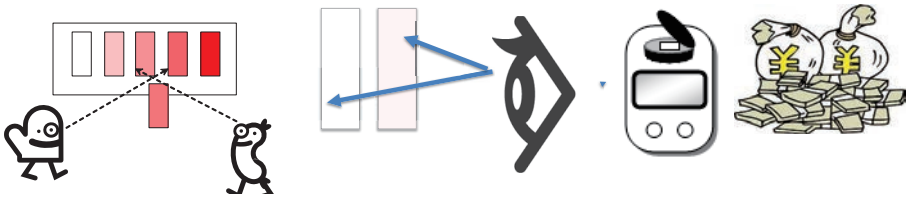
• Grant-in-Aid for Scientific Research（C）,Japan (2016~2018)
• Environment Research and Technology Development Fund of the Ministry of the Environment, Japan (2017~2019)

Abstract

In proposed method, heavy metals present in water at extremely low concentrations is , rapidly concentrated to row volume of droplets. Using this technology, colorimetric analysis of trace amount of heavy metals is able to be realized. On the other hands, we developed simple colorimetric analyzer using smart device by original attachment and application software. By combination with concentration method and smart device color analyzer, simple and high performance on-site analysis could be developed.

Background

Colorimetry

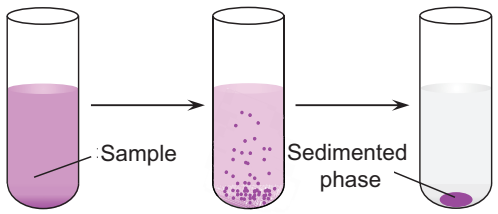


Problem

1. Low sensitivity
2. Difference of analytical result
   →Using color analyzer
   (Increase analytical cost)

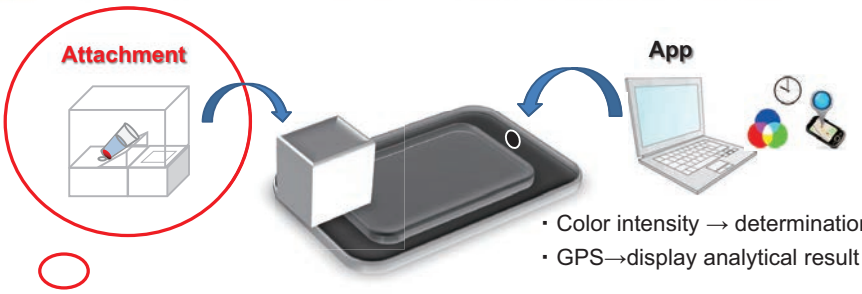
In this study

1. Homogeneous Liquid-Liquid Extraction (HoLLE)



Target is concentrated to small amount of sedimented phase

2. Smart device Color analyzer

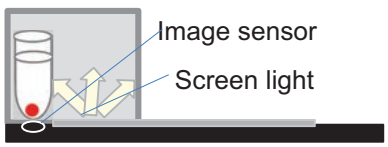


- Color intensity → determination
- GPS→display analytical result on map

Smart device → Color analyzer

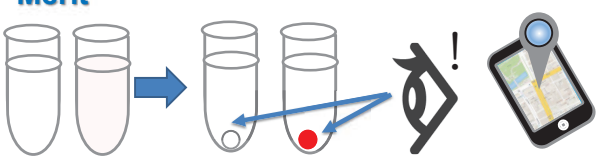
Original attachment

3-D printer



- sample is fixed on image sensor
- Screen light used as Light source

Merit



High sensitivity

High accuracy
Mapping function

Contact us

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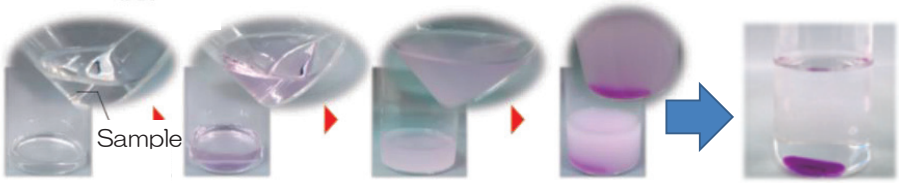
Result and discussion

Extraction for hexavalent chromium

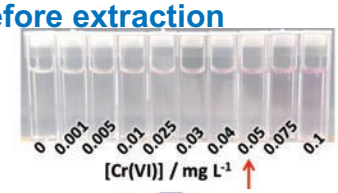


Cokored Cr(VI) with Diphenil carbadido

Phase separation

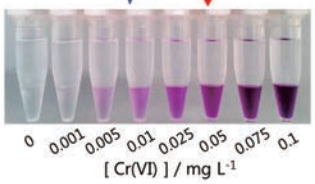
Concentrated (colored Cr(VI))

Before extraction



Standard

After HoLLe



Measurement with smart device

Sample was fixed with Original attachment

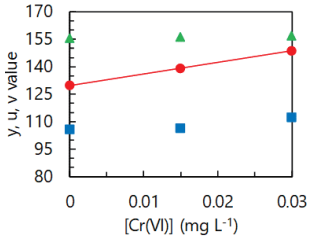
Measurement with App

Mapping function

Other

Concentrated (colored Cd(II))

Result of color analysis



▲ : y(Brightness), ■ : u(Color difference (Blue))
● : v(Color difference (Red))

Colored Cr(IVI) with Diphenil carbadido was concentrated to small amount of sedimented phase, and high sensitive color analysis for ppb revel of Cr(VI) was developed. Moreover, using original attachment and application software, v value (color difference of red)was changed with sample concentration, and analytical results were displayed on map. These result indicated that smart device is useful as on-site color analyzer,

Conclusion

Achievement

- Several kind of colored heavy metals was able to be extracted to sedimented phase with HoLLE.
- High sensitive color analysis for hexavalent chromium with smart device was able to be realized.

In the near future

- User test, field test
- Application to other heavy meals analysis.
- Product commercialization

Reference

- *Bull.Chem.Soc.Jpn.* **92**, 807-810 (2019).
- *BUNSKI KAGAKU*, in press.
- Japan patent 2017-032418

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