Chem_8

Removal and detection of Bisphenol-A by environment-friendly processes: Two-way benefits from Water Hyacinth

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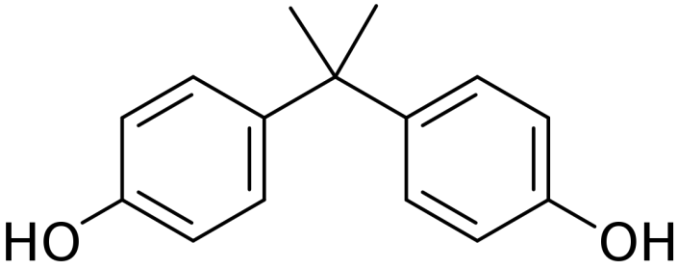
Bisphenol-A (BPA)



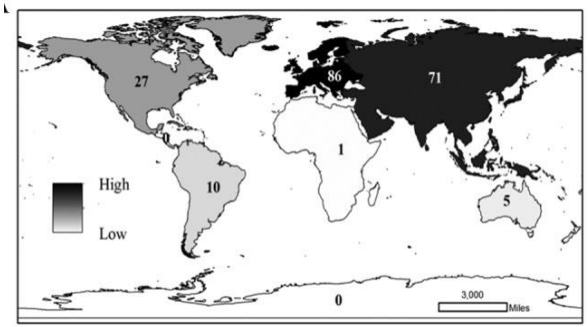
Bisphenol-A (BPA)

- **Polycarbonate**
  - *Plastic Containers*
  - *Medical Instruments*

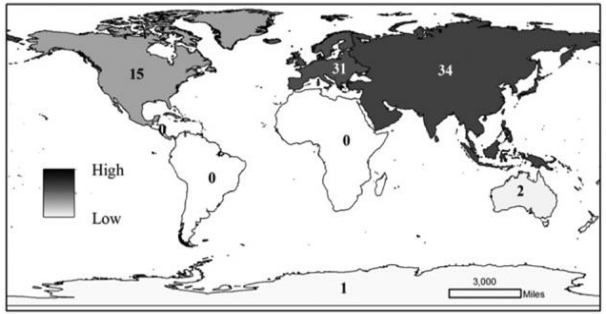
- **Epoxy Resins**
  - *Can coating*
  - *Dental Sealants*

(https://med.stanford.edu/news/all-news/2008/04/bisphenol-a-facts.html, https://en.wikipedia.org/wiki/Bisphenol_A,https://northparkfamilydentalok.com/sealants/, https://www.artbasel.com/catalog/artwork/38154/Ceal-Floyer-Monochrome-Till-Receipt-White-Swiss-Version)

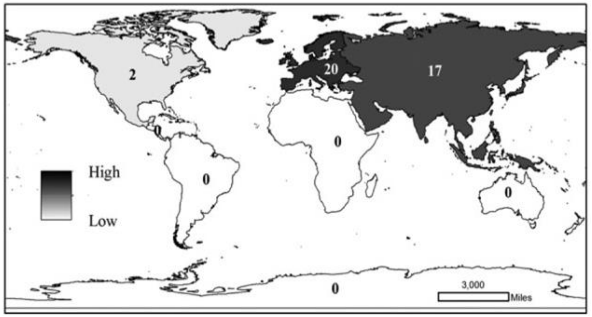
Contamination of BPA worldwide



BPA in surface water and effluent



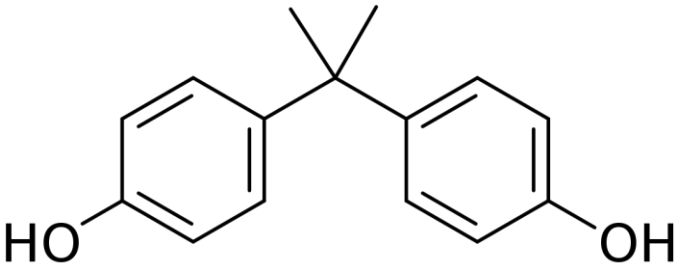
BPA in sediment, soil, biosolids, and air



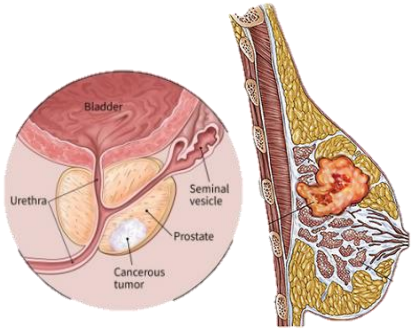
BPA in wildlife

(https://www.ncbi.nlm.nih.gov/pmc/PMC4674187/)

Bisphenol-A (BPA)

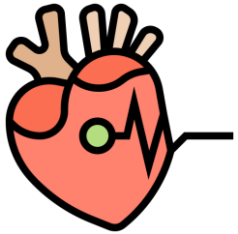


Bisphenol-A (BPA)



Prostate and breast cancer

Problems of Fetus development



Heart Attack

(https://pubmed.ncbi.nlm.nih.gov/25813067/,
https://www.cancer.org/cancer/prostate-cancer/about/what-is prostate-cancer.html,
https://www.aboutkidshealth.ca/article?contentid=331&language=english,
https://emabalhospitals.com/what-is-breast-cancer/)

BPA Free Campaigns

(https://www.nationalgeographic.com/science/article/news-BPA-free-plastic-safety-chemicals-health, http://www.greenshopcafe.com/greennews821.html)

Water Hyacinth

An aquatic weed which is problematic worldwide.

(https://guardian.ng/sunday-magazine/newsfeature/water-hyacinth-pain-in-the-neck-of-coastal-communities-residents/)

Objectives: Two-way benefits from Water Hyacinth

1

BPA

Removal

2

BPA

Detection

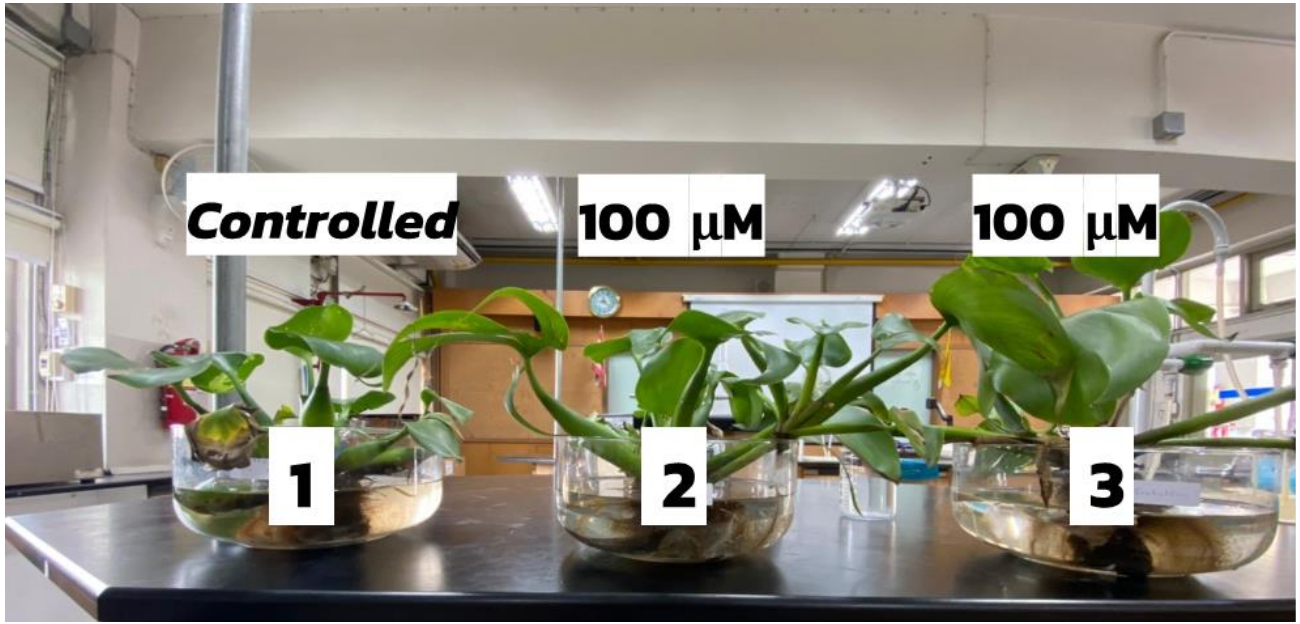
(Illustration by Barbara Degregorio
https://magazine.wellesley.edu/summer-2015/gathering-flowers)

Methodology

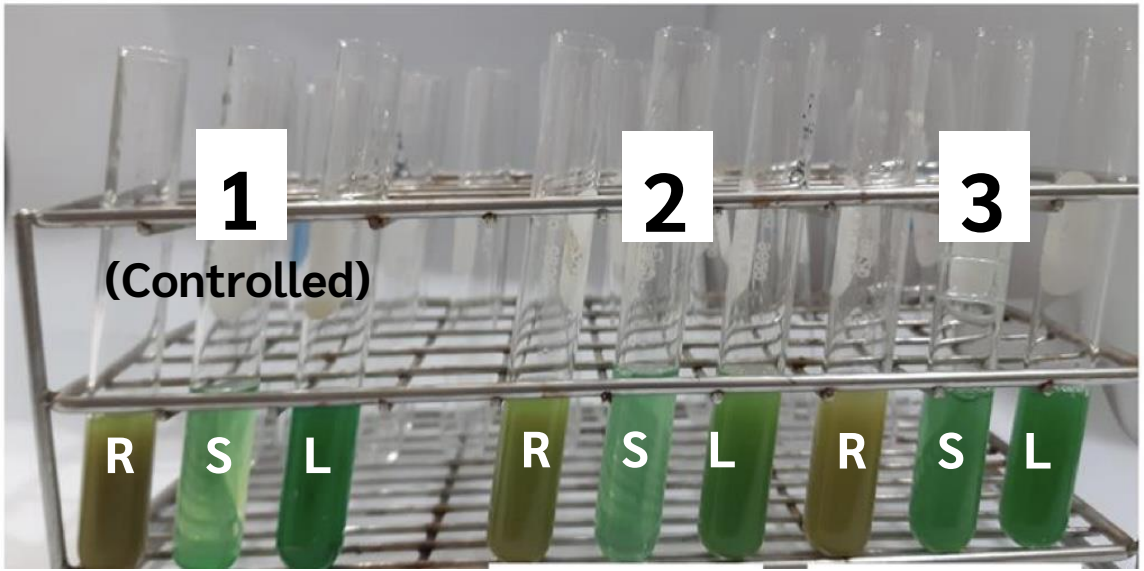
1

BPA Removal

Removal of BPA by Water Hyacinth



Removal of BPA by Water Hyacinth



Extracts

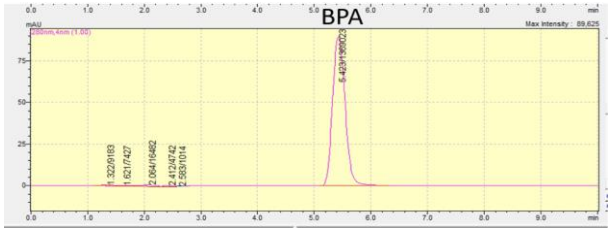
R: Roots

S: Stems

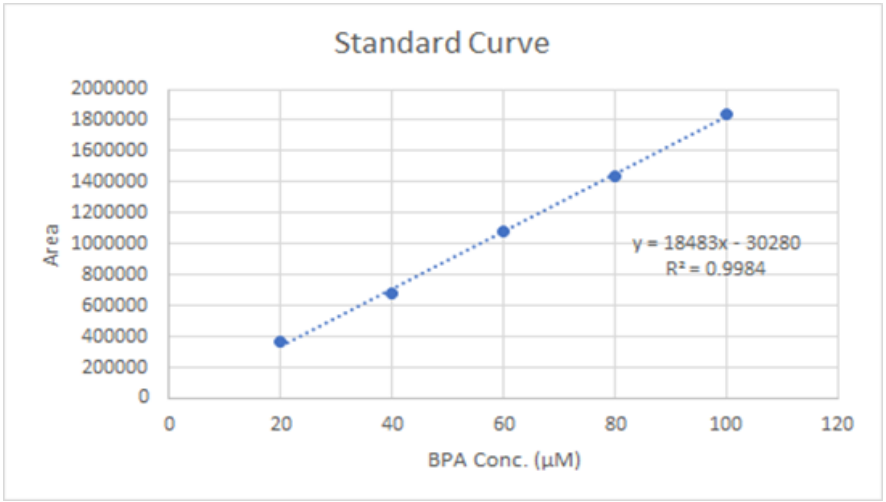
L: Leaves

Removal of BPA by Water Hyacinth

High-Performance Liquid Chromatography (HPLC)



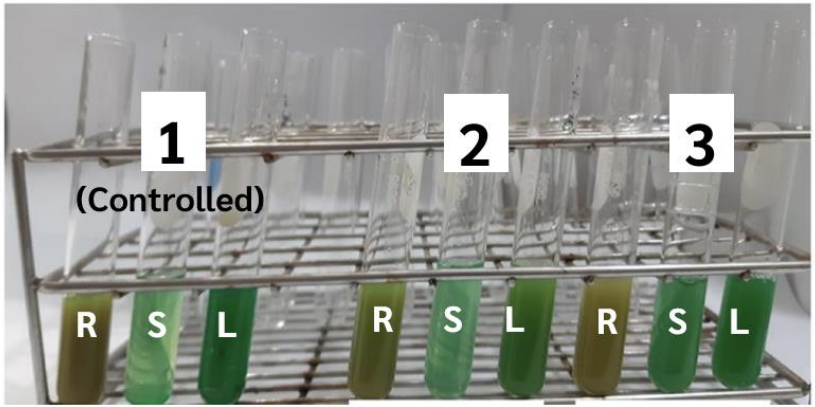
An example graph from HPLC



Calibration Curve: BPA Concentrations (20, 40, 60, 80, and 100 µM) and HPLC graph areas

Removal of BPA by Water Hyacinth

High-Performance Liquid Chromatography (HPLC)



Removal of BPA by Water Hyacinth

Results

Water Hyacinth	#1 Controlled	#2 (100 μM BPA initial conc.)	#3 (100 μM BPA initial conc.)	%
Roots	0 μM	17.1 μM	19.0 μM	45.52
Stems	0 μM	7.3 μM	9.2 μM	20.81
Leaves	0 μM	12.5 μM	14.2 μM	33.67
Sum	0 μM	36.9 μM	42.4 μM	

- BPA containing capacity Root > Leaf > Stem

- Water Hyacinth is able to **remove** BPA in the solutions.

Methodology

2
BPA
Detection

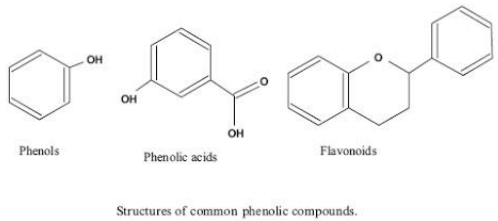
Water Hyacinth Extract for BPA Detection

Green Synthesis of Water Hyacinth Extract coated - Ag Nanoparticles (Ag-NPs) for the detection of BPA

Preparation of
Water Hyacinth Extract

Water Hyacinth Extract for BPA Detection

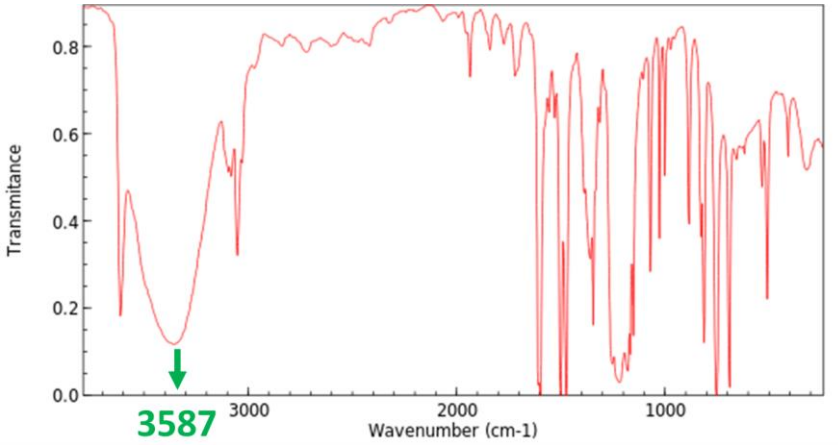
Fourier transform infrared (FTIR)



Structures of common phenolic compounds.

Phenolic Compounds

IR Spectrum of the water hyacinth extract

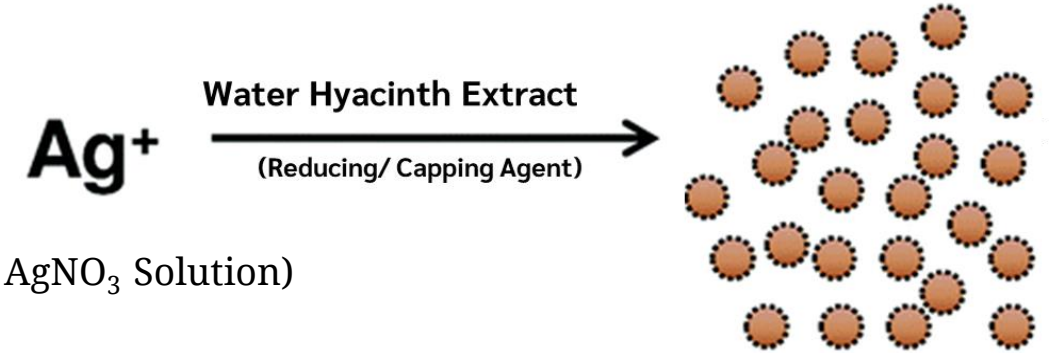


Phenolic group

(http://www.foodnetworksolution.com/wiki/word/2585/phenolic-compounds-/,
https://en.wikipedia.org/wiki/Fourier-transform_infrared_spectroscopy)

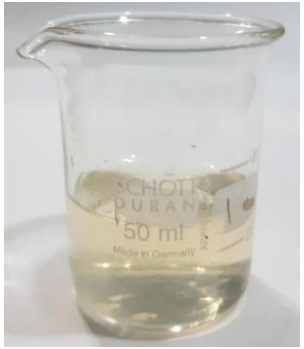
Water Hyacinth Extract for BPA Detection

Green Synthesis of the Ag-NPs for the detection of BPA



(From $AgNO_3$ Solution)

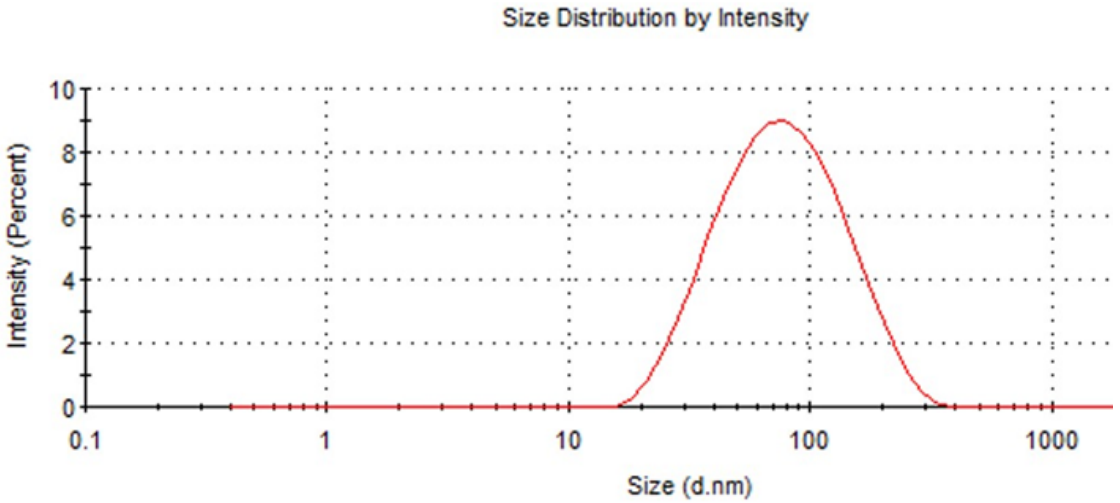
Green Synthesis



The synthesized Ag-NPs

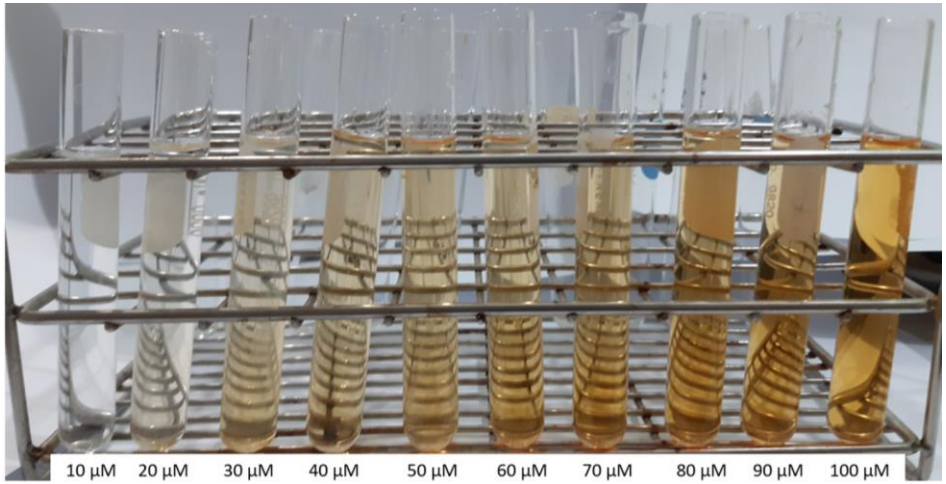
Water Hyacinth Extract for BPA Detection

Size of the Ag-NPs by Dynamic Light Scattering (DLS)



- 88.26 nm
- Good graph distribution

Water Hyacinth Extract for BPA Detection



BPA Concentration

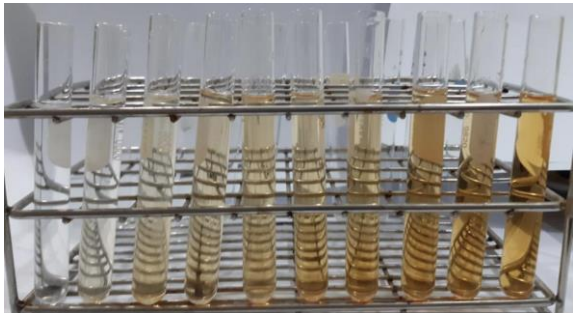
10 µM → **100 µM**

BPA Detection by synthesized Ag-NPs

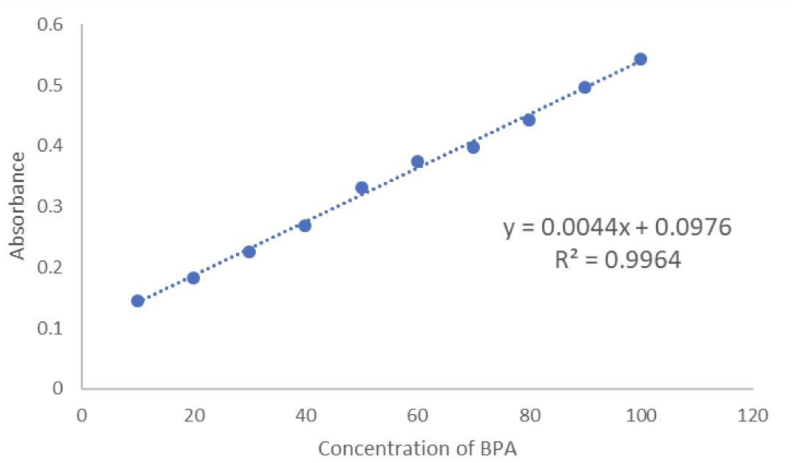
- Obvious color changes
- Can be observed by naked eyes
- Limit of Detection (LOD) = 0.97 µM

Water Hyacinth Extract for BPA Detection

Application for detecting unknown BPA solutions



UV-visible
Spectrophotometer

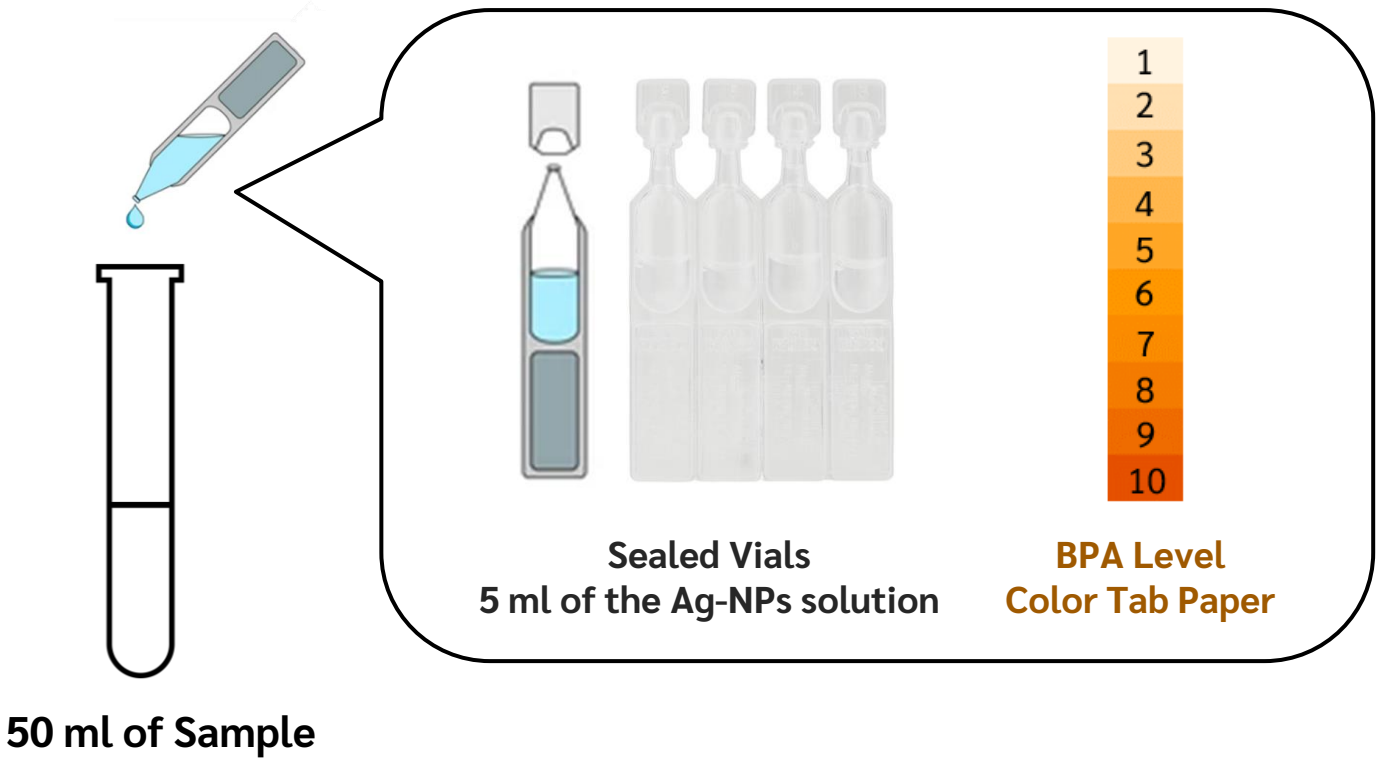


- The excellent R-squared value
- Can be developed to be a BPA test kit

Calibration Curve: BPA Concentrations and Absorbance

BPA Test Kit

Environment-friendly Innovation



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Thank you for your attention