Using Mobile Apps & Custom-made Devices for Conducting Chemistry Practical Tasks

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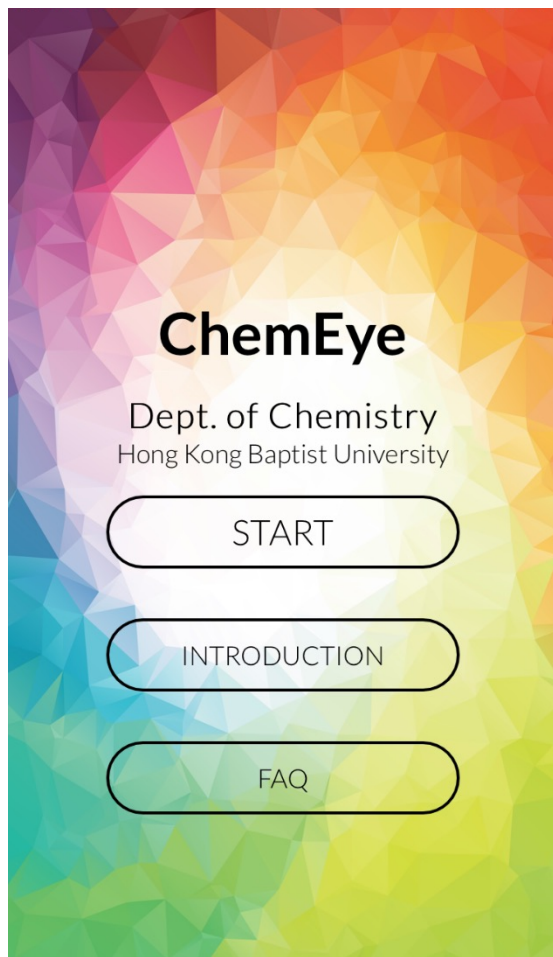
Workshop Rundown

- 02:30 pm   Registration

- 02:40 pm   Opening Remarks and Group Photo

- 02:50 pm   Introduction of ChemEye and Lab Briefing

- 03:00 pm   Hands-on (experiment 1 – 2 and 3)

- 04:00 pm   Lab Briefing

- 04:10 pm   Hands-on (experiment 4A and 4B)

- 04:50 pm   Debriefing and Closing Remarks

- 05:00 pm   Evaluation

"ChemEye" (smartphone colorimetry)
– mini-portable laboratory hiding in smartphone
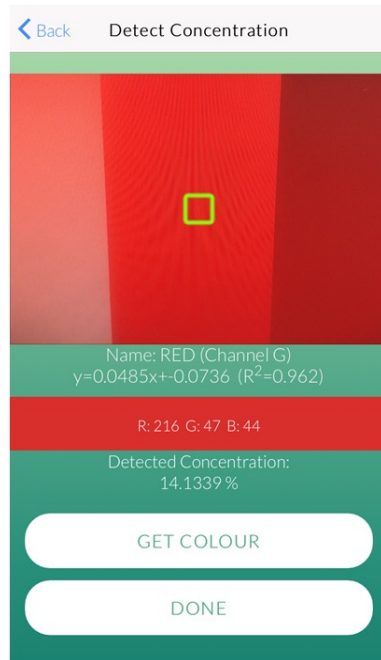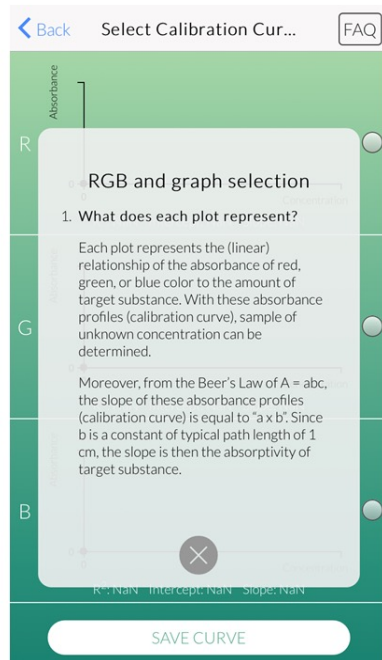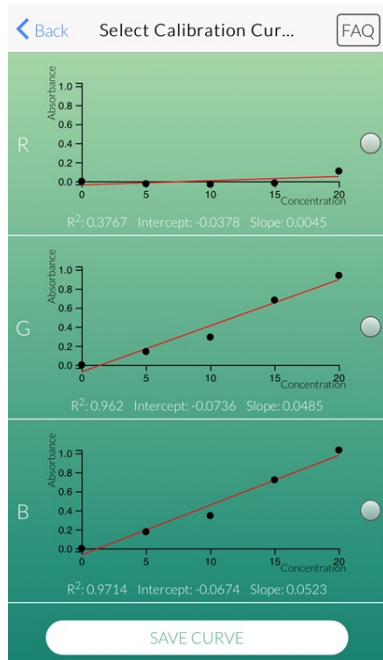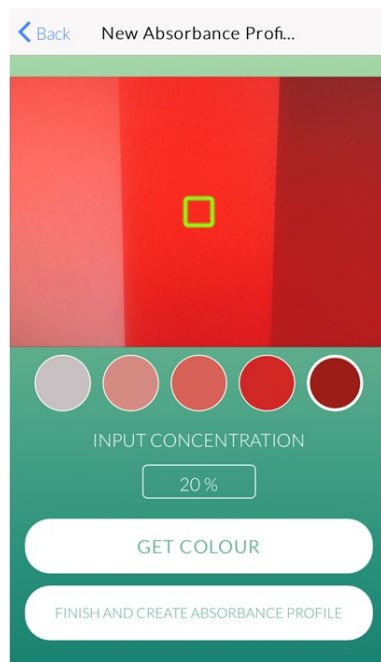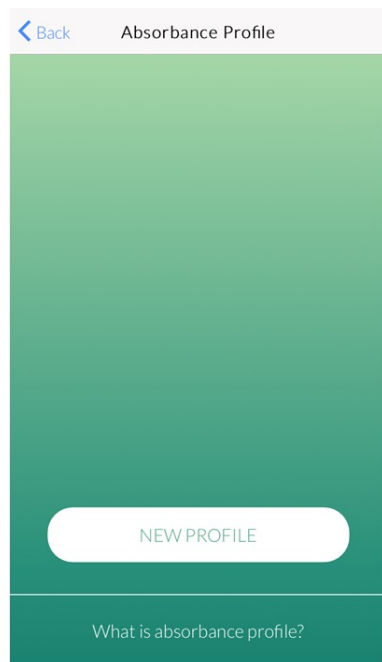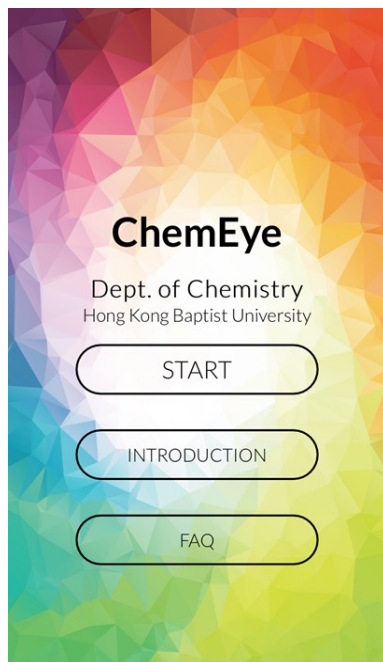

- Launched since May, 2018

Aims

- To understand the basic principles and theory of colorimetry;

- To solve real-life analytical science problem;

- To perform detection anytime and anywhere;

- To learn outside the laboratory.

iOS

Android

- Using camera in the smartphone as detector for transmitted light intensity

- RGB value

- Transmittance & Absorbance

- Calibration curves for R, G, and B

- Analyte (sample) concentration

- On-demand tooltips within the workflow
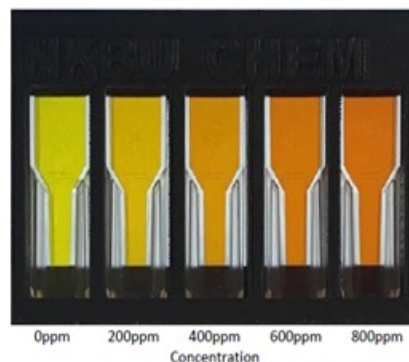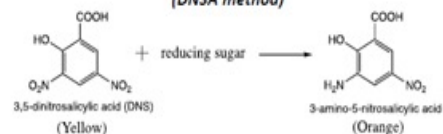
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There are more than 20 colorimetric methods developed and validated using ChemEye.

- Food Analysis:
  - Sugar in candy and beverage,
  - Protein in milk,
  - Food preservatives in food,
  - Food colorants in food,
  - Alcohol content in beverage,
  - Caffeine in coffee, etc.

- Environmental Analysis:
  - Water pollutants in water,
  - Air pollutants in air, etc.

- Drug Analysis:
  - Iron in food supplement,
  - Sugar in herbal medicine

- Biological Analysis:
  - Chlorophyll in plant,
  - Antioxidants in plant

Accuracy: +/-10%

Precision: +/-10%

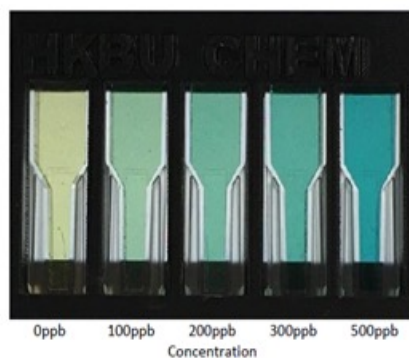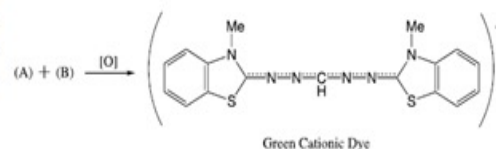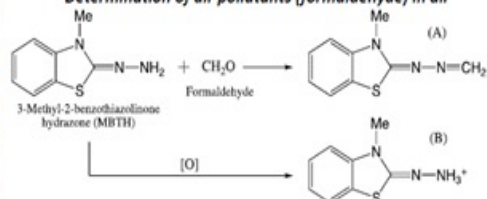Validated by UV-vis spectrophotometer (bench-top)

Content

Determination of reducing sugar in food and beverage (DNSA method)

Determination of protein in milk (Bradford method)

Determination of air pollutants (formaldehyde) in air
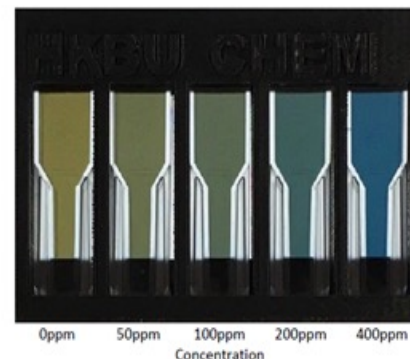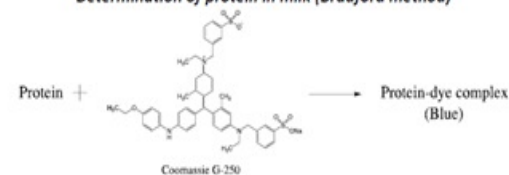
Determination of alcohol in beverages, e.g., beer and wine (Ethanol)
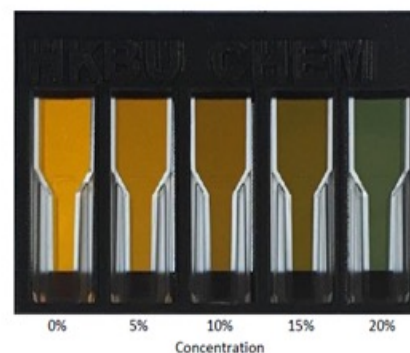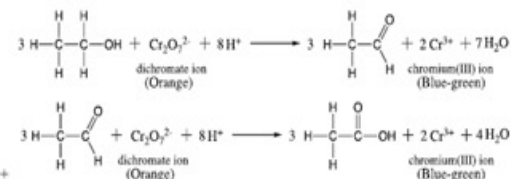
Some methods have been used in teaching at the universities and secondary schools.

- Study Tour, Department of Chemistry, HKBU

- Summer GE Course, Department of Chemistry, HKBU

- SCIE1005 Integrated Science Laboratory, HKBU

- CHEM3035 Integrated Laboratory for ATS, HKBU

- Department of Applied Biology and Chemical Technology & School of Hotel and Tourism Management, PolyU

- Hong Kong Innovation and Technology Commission
  - Teaching Kit on Chemical Testing for NSS Curriculum

- Hong Kong Education Bureau

- Sugar (Bar.Deck.Lounge), East Hotel, Hong Kong

Experiment 1 – 2
Determination of Food Colorant in Beverages

Sunset Yellow (E110) in Lucozade

Tartrazine (E102) in Cream Soda

- Stock solution of 1000 mg/L

- Standard solutions of 0, 5, 10, 15, and 20 mg/L

- Degassed sample

  (either using ultrasonic bath or by standing overnight)

- For the calibration and measurements by ChemEye, the RGB readings of blank (0 mg/L) should be below 230.

  (by controlling the light intensity of background lighting)

Experiment 3
Enquiry Study on Food Colorant in Beverages

- Degassed (unknown) sample(s)

- Sunset yellow or Tartrazine?

- New calibration profile or Using the saved profile(s)?

  If the saved profile(s) is used, how is the "blank comparison" achieved?

  (by controlling the light intensity of background lighting)

- Is sample dilution needed?

  If yes, what would be the dilution factor?

Experiment 4
Determination of Ethanol Content in Beverages

- Coloring reagent ($K_2Cr_2O_7$ in H_2SO_4)

- Stock solution of 100% ethanol

- Standard solutions of 0, 5, 10, 15, and 20%

- Alcoholic samples

- Transfer 0.1 mL of each of the standard solutions & sample to glass vials and add 2 mL of coloring reagent.

- Place the solutions in a hot water bath for 15 minutes.

- Cool the solutions and then add 5 mL of D.I. water.

  yellow to green (redox reaction between $Cr_2O_7^{2-}$ and EtOH)

Debriefing and Closing Remarks

- ChemEye – smartphone colorimetry

- Level of Difficulty

  Easy, e.g., food colorants

  Moderate, e.g., organometallic complex

  Difficult, e.g., chemical reactions (redox reaction)

- Hong Kong Innovation and Technology Commission

  - Teaching Kit on Chemical Testing for NSS Curriculum

  - Determination of NO_2 in Air

  - Analysis of Copper in Wastewater

many Thanks!