Supporting information

Smartphone-based portable device for Ag^+ sensing using eco-synthesized carbon dots from Mandarin peel

Nguyen Ngoc Nghia[1], Dang Thanh Cong Minh[2,3,4], Tran Dang Khoa[2,3,4], Nguyen Huu Hieu[2,3,4*]

[1]Faculty of Applied Sciences, Ton Duc Thang University, Ho Chi Minh City, Vietnam

(nguyenngocnghia@tdtu.edu.vn)

[2]VNU-HCM, Key Laboratory of Chemical Engineering and Petroleum Processing (Key CEPP Lab), Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam

[3]Faculty of Chemical Engineering, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam

[4]Vietnam National University Ho Chi Minh City (VNU-HCM), Linh Trung Ward, Thu Duc District, Ho Chi Minh City, Vietnam

**Corresponding author:* Nguyen Huu Hieu

Email: nhhieubk@hcmut.edu.vn

First author: Nguyen Ngoc Nghia

Email: nguyenngocnghia@tdtu.edu.vn

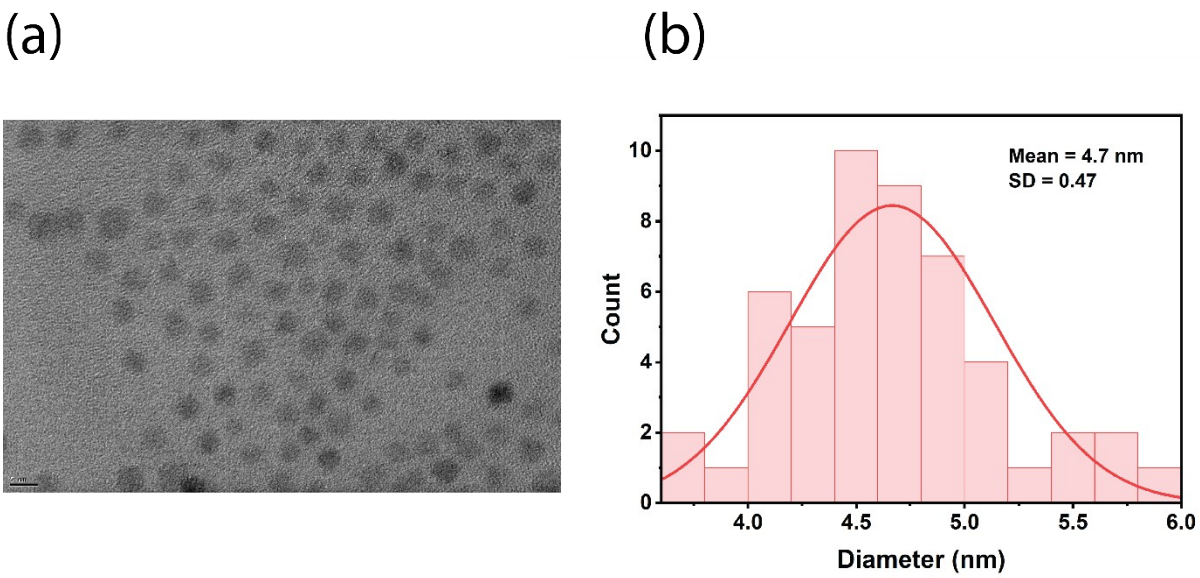

Fig. S1. (a) TEM images showing the nanomorphology of CDs. (b) Particle size distribution histogram of CDs

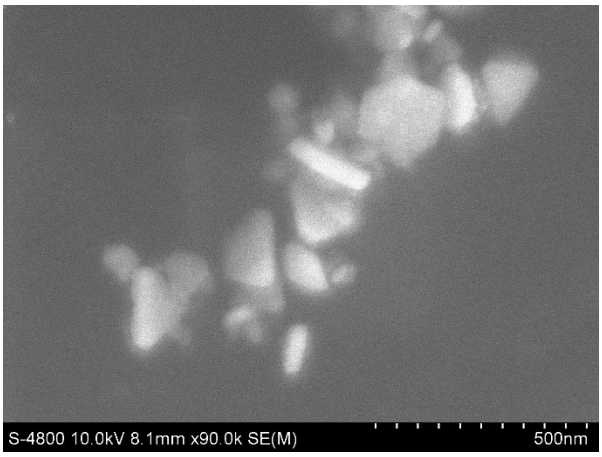

Fig. S2. FE-SEM image of CDs-derived AgNPs

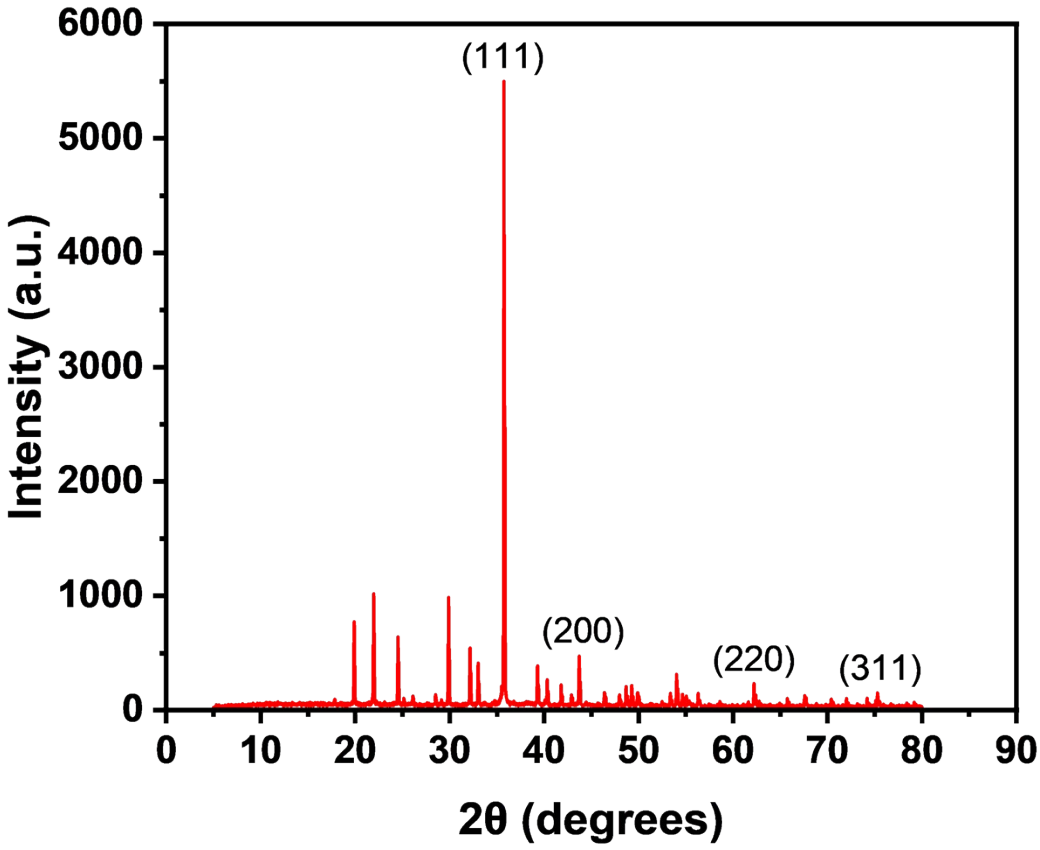

Fig. S3. XRD pattern of CD-Ag NCs

Code for Arduino

```
#include <Adafruit_AS7341.h>

Adafruit_AS7341 as7341;
int pot;
int led;

void setup() {
  pinMode(A0, INPUT);
  pinMode(6, OUTPUT);
```

```
  Serial.begin(9600);

  // Wait for communication with the host computer serial monitor
  while (!Serial) {
    delay(1);
  }

  if (!as7341.begin()){
    Serial.println("Could not find AS7341");
    while (1) { delay(10); }
  }

  as7341.setATIME(100);
  as7341.setASTEP(999);
  as7341.setGain(AS7341_GAIN_256X);
}

void loop() {
   pot = analogRead(A0);
  led = map(pot, 0, 1023, 0, 255);

  analogWrite(6, led);
  // put your main code here, to run repeatedly:
  uint16_t readings[12];
  float counts[12];

  if (!as7341.readAllChannels(readings)){
    Serial.println("Error reading all channels!");
    return;
  }
```

```
for(uint8_t i = 0; i < 12; i++) {
  if(i == 4 || i == 5) continue;
  // we skip the first set of duplicate clear/NIR readings
  // (indices 4 and 5)
  counts[i] = as7341.toBasicCounts(readings[i]);
}

Serial.print("AcX = "); //ve diem linear F5_555 nm theo time
Serial.print(counts[6]);
Serial.print("|");
Serial.print("F1_415nm = ");
Serial.print(counts[0]);
Serial.print("|");
Serial.print("F2_445nm = ");
Serial.print(counts[1]);
Serial.print("|");
Serial.print("F3_480nm = ");
Serial.print(counts[2]);
Serial.print("|");
Serial.print("F4_515nm = ");
Serial.print(counts[3]);
Serial.print("|");
Serial.print("F5_555nm = ");
// again, we skip the duplicates
Serial.print(counts[6]);
Serial.print("|");
Serial.print("F6_590nm = ");
Serial.print(counts[7]);
Serial.print("|");
Serial.print("F7_630nm = ");
```

```
  Serial.print(counts[8]);
  Serial.print("|");
  Serial.print("F8_680nm = ");
  Serial.print(counts[9]);
  Serial.print("|");
  Serial.print("F9_Clear = ");
  Serial.print(counts[10]);
  Serial.print("|");
  Serial.print("F10_NIR = ");
  Serial.print(counts[11]);
  Serial.println("|");

  delay(500);
}
```

Feature of AS7341

With AS7341 visible spectrum sensing IC as the core, this product can sense the visible light component values of different bands in the environment. It is also quite impressive in sensitivity and accuracy. At the same time, its volume is very small. To make a miniature spectrum analyzer, it will be a very good choice.

- Incorporates AS7341 chip, which integrates 8 x visible spectrum channels, 1 x near-infrared channel, and 1 x no filter channel.
- Embedded 6 x independent 16-bit ADC, which allows effective processing of data in parallel.
- Dedicated channel to detect ambient light flicker on the specific frequency.
- 2 x high brightness LEDs, can be used as fill light in a dim environment.
- Interrupt pin to output inner ADC real-time operating status.
- Features spectrum interrupt detection, with programable high/low thresholds.
- Provides general-purpose input/output GPIO pin.
- Onboard voltage translator, compatible with 3.3V/5V operating voltage.

- Comes with online development resources and manual (examples for Raspberry Pi/Arduino/STM32).