VISUAL DETECTION OF QUERCETIN USING GOLD NANOPARTICLES

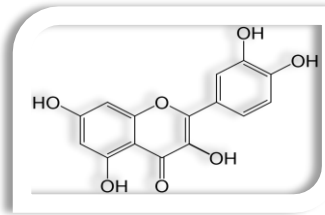
M. Nemoda, M. Pavlović, M. Stoiljković, and T. Momić

"VINČA" Institute of Nuclear Sciences, National Institute of the Republic of Serbia, University of Belgrade, P.O. Box 522, 11000 Belgrade, Serbia

ABSTRACT

We report on the use of gold nanoparticles (AuNPs) as a colorimetric probe for quercetin. The method is based on the aggregation of the AuNPs that is caused by various quercetin concentrations and leads to a visually detectable color change. Concentration-dependent aggregation is confirmed by recording of UV-visible absorption spectra. The method provides a useful tool for the rapid visual quercetin determination.

Quercetin structure
The most abundantly consumed flavonoid.



EXPERIMENTAL

AuNPs were synthesized according to the method of Turkevich [1]. The total gold ion content is experimentally quantified by inductively coupled plasma optical emission spectroscopy (ICP-OES).

Detection of quercetin concentration was done in reaction mixture of 0.7 mL containing 0.1 mL of AuNPs suspension ([Au^{3+}] = 0.26 mg/mL), in the absence or in the presence of various quercetin concentrations (4 mg/L - 15 mg/L). The probes were incubated for 1h at 50° C, followed by absorption spectra recording. Afterwards, the probes were centrifuged, supernatants were discarded, the pellets resuspended in 0.7 mL of water.

RESULTS AND DISCUSSION

As shown in Fig. 1, the solutions color was gradually changed from red to purple with increasing concentration of quercetin, which may be attributed to the interparticle interactions resulting from hydrogen bonding [2]. The corresponding absorption spectra indicated slight widening of the surface plasmon resonance band followed by absorption maximum shift toward longer wavelengths (529-534 nm) compared with the control (527 nm) (Fig. 2A). This type of change indicates that the position of the plasmon band of the AuNPs is influenced by the molar ratio of guercetin to Au^{3+}ions [2, 3]. With the aim to remove the unbound quercetin, the probes were centrifuged, the AuNPs resuspended in 0.7 mL of water, and their spectra were recorded. The appearance of the new absorption peak was observed at 650 nm, along with the original absorption maxima for each probe (Fig. 2B). This type of spectral change is typical for the AuNPs aggregation [3].

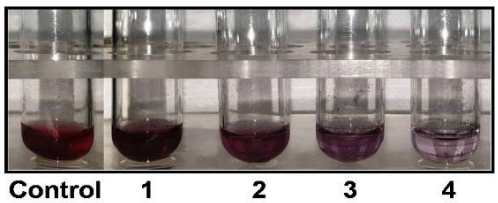


Figure 1. Photography of AuNPs in the absence and the presence of various quercetin concentrations:
1 - 4 mg/L, **2** - 8.5 mg/L, **3** - 13 mg/L, **4** - 15 mg/L.

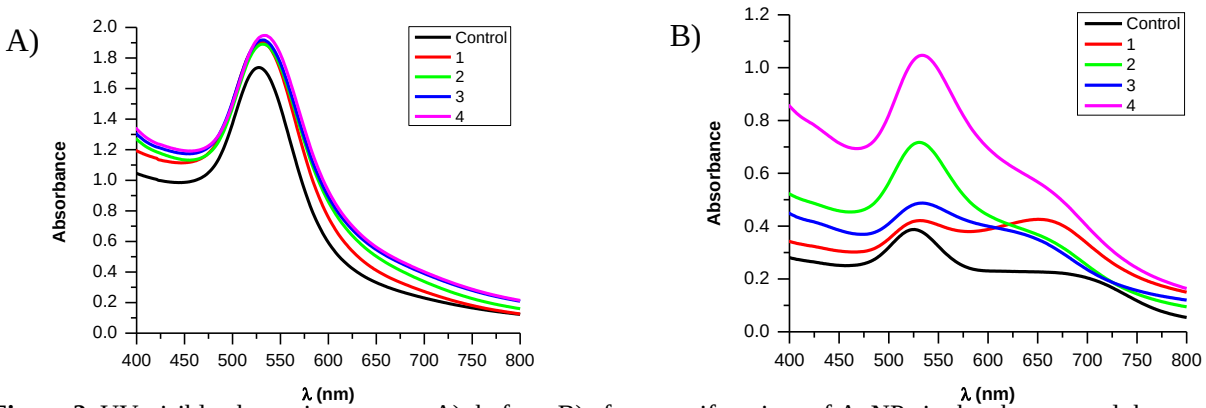


Figure 2. UV-visible absorption spectra A) before, B) after centrifugation, of AuNPs in the absence and the presence of different quercetin concentrations: **1** - 4 mg/L, **2** - 8.5 mg/L, **3** - 13 mg/L, and **4** - 15 mg/L.

CONCLUSION

In this work was demonstrated that AuNPs could be used as a colorimetric probe for quercetin. This feature of AuNPs could be used in the future for the development of semi-quantitative method for quercetin detection in various food samples.

REFERENCES:
1. J. Turkevich, G. Kim, Science, 1970, 169, 873-879.
2. K. Yoosaf, B.I. Ipe, C.H. Suresh, K.G. Thomas, J. Phys. Chem. C, 2007, 111, 12839-12847.
3. K.A. Rawat, S.K. Kailasa, Microchim. Acta, 2014, 181, 1917-1929.

Acknowledgement
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