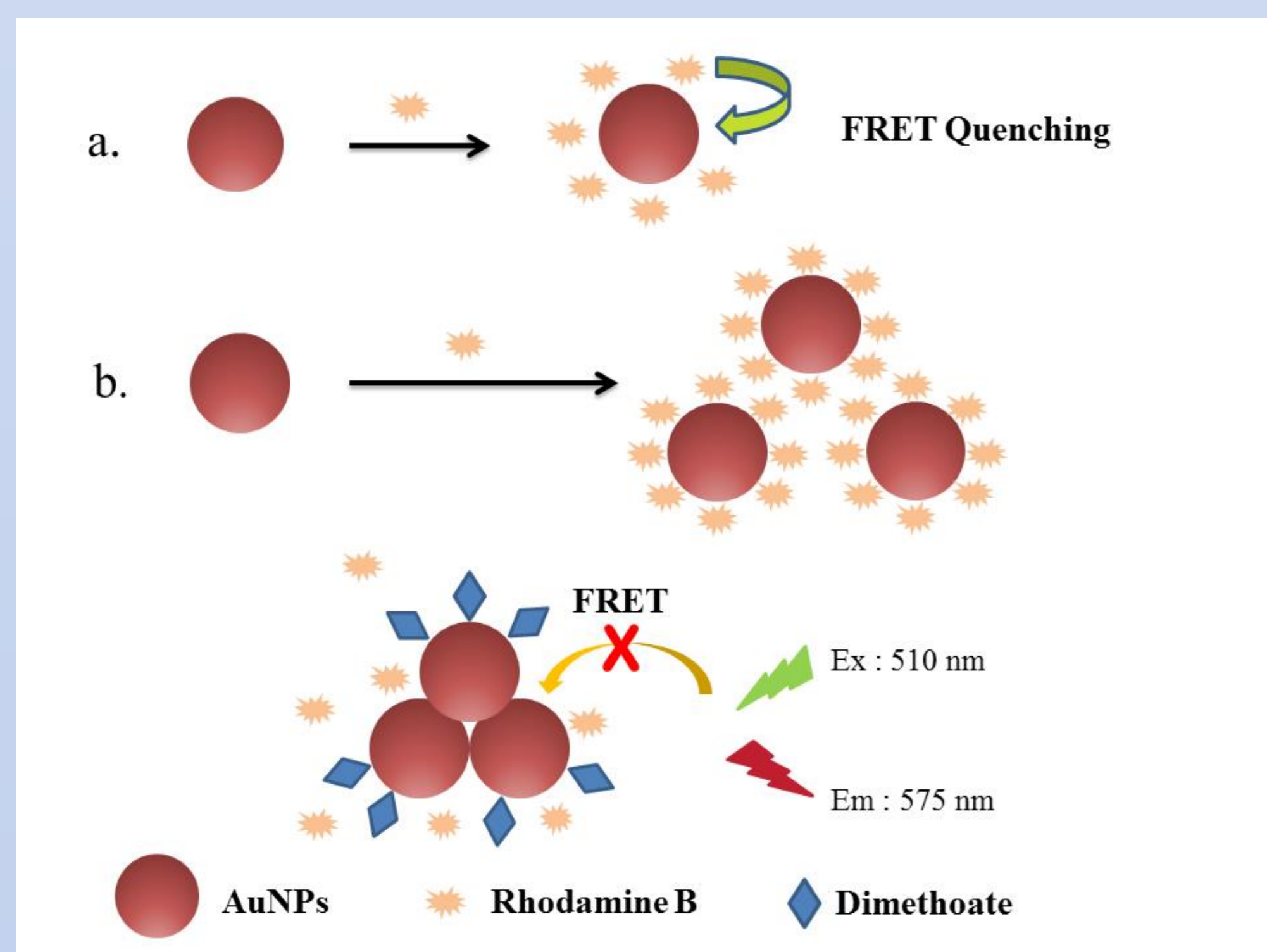


# Detection of dimethoate through the fluorescence resonance energy transfer between rhodamine B and gold nanoparticles

## Abstract

A new fluorescence method for detecting dimethoate based on gold nanoparticles (AuNPs) and rhodamine B (RB) has been developed. It has been observed that the quenching of fluorescence of RB occurs in the presence of AuNPs through the fluorescence resonance energy transfer (FRET). In the presence of dimethoate, the FRET-based fluorescence of RB and AuNPs would be gradually recovered for the reason that dimethoate could displace RB on the surface of AuNPs, leading to a significant increase in fluorescence intensity.

This method has excellent selectivity and sensitivity for the detection of dimethoate in the presence of other pesticides. Owing to its high sensitivity, excellent selectivity and convenient procedure, this method will provide a promising alternative for dimethoate screening.



Scheme 1. Schematic illustration of fluorescent assay for dimethoate on the FRET between rhodamine B and AuNPs.

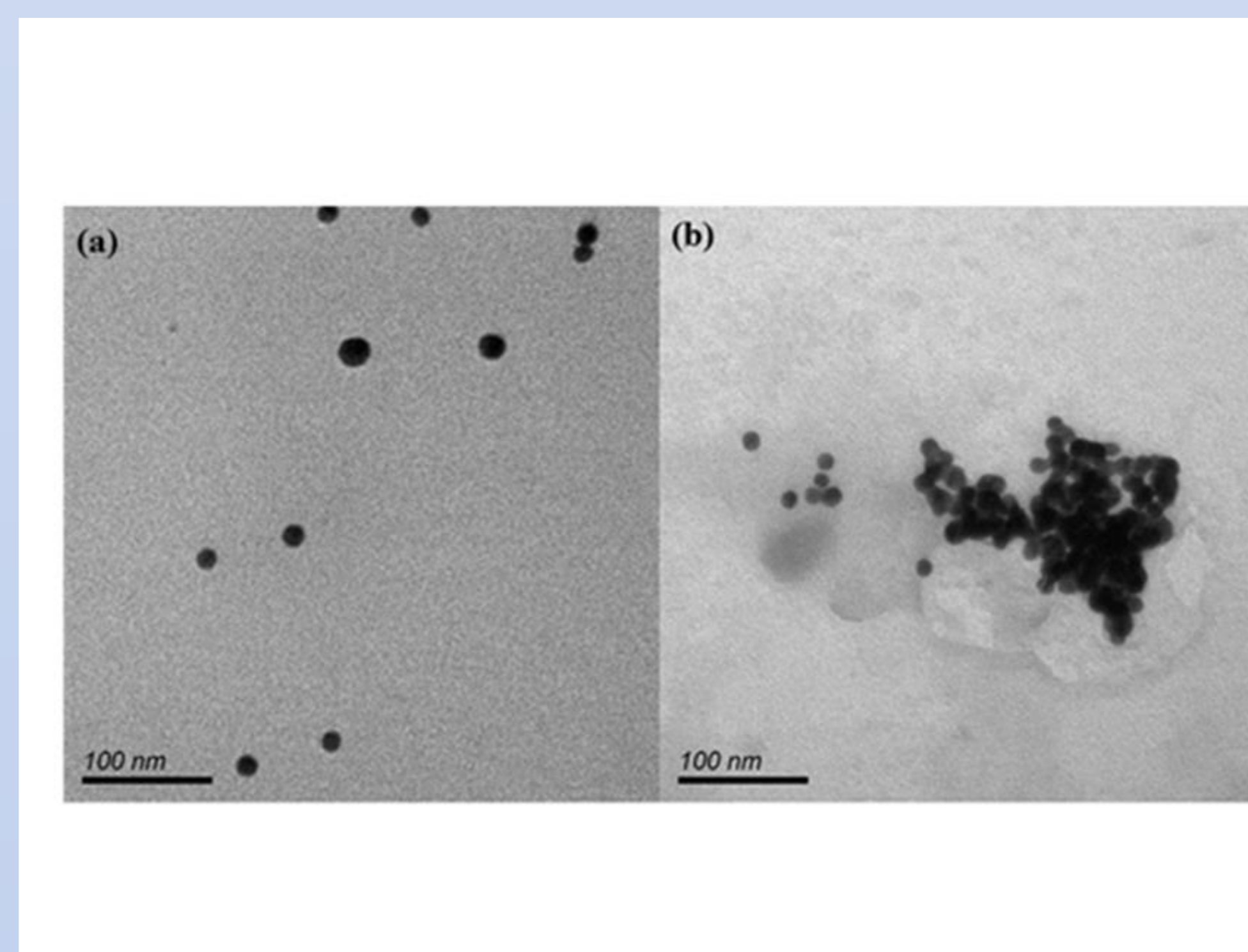


Fig 1. TEM images of solutions containing RB-AuNPs in the absence (A) and presence (B) of dimethoate (1 ppm).

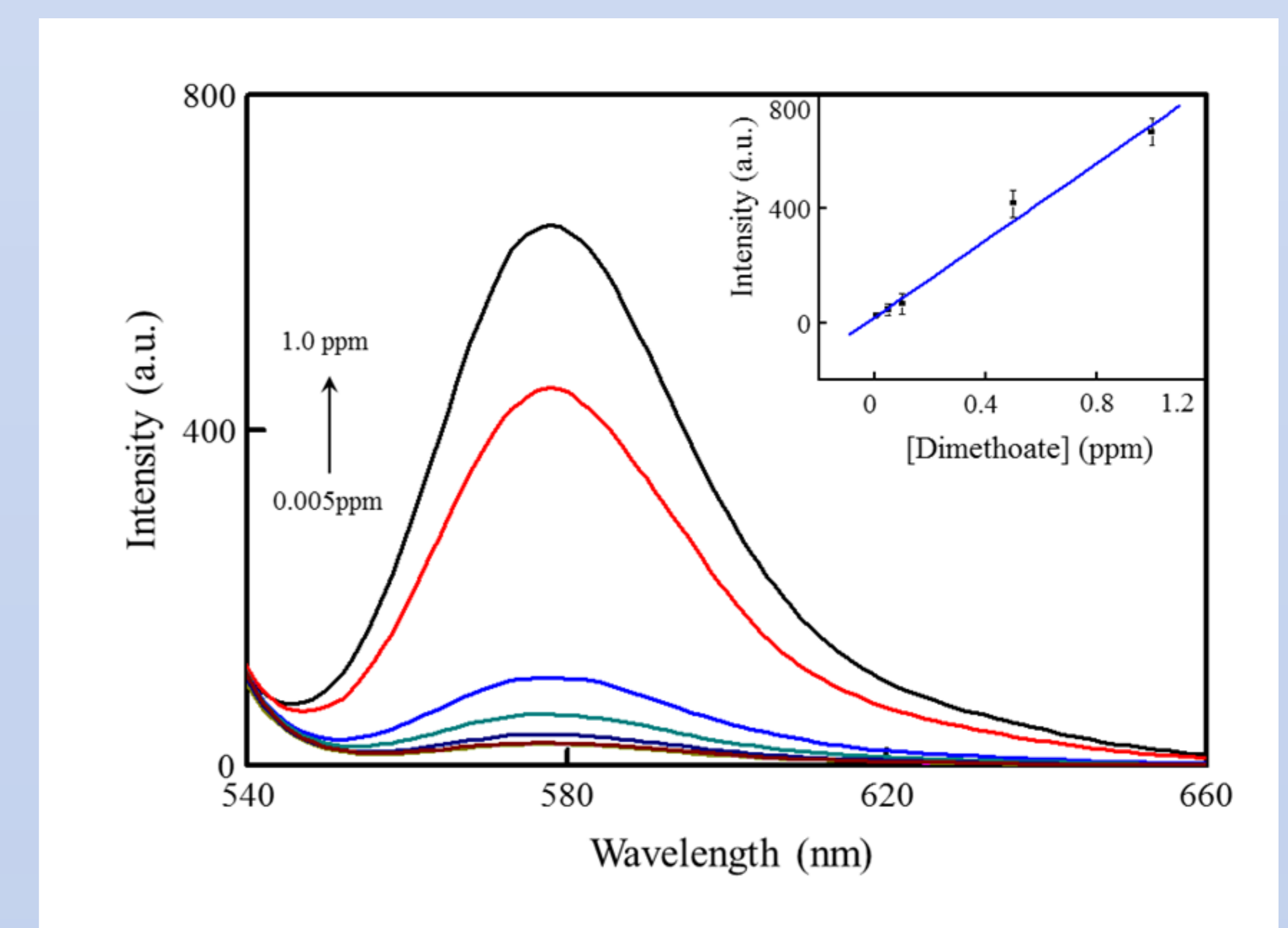


Fig 2. Fluorescence spectra of AuNPs – RB in the presence of various concentration of dimethoate. Inset : the linear of the fluorescence the concentration of dimethoate from 0.005mM to 1 mM.

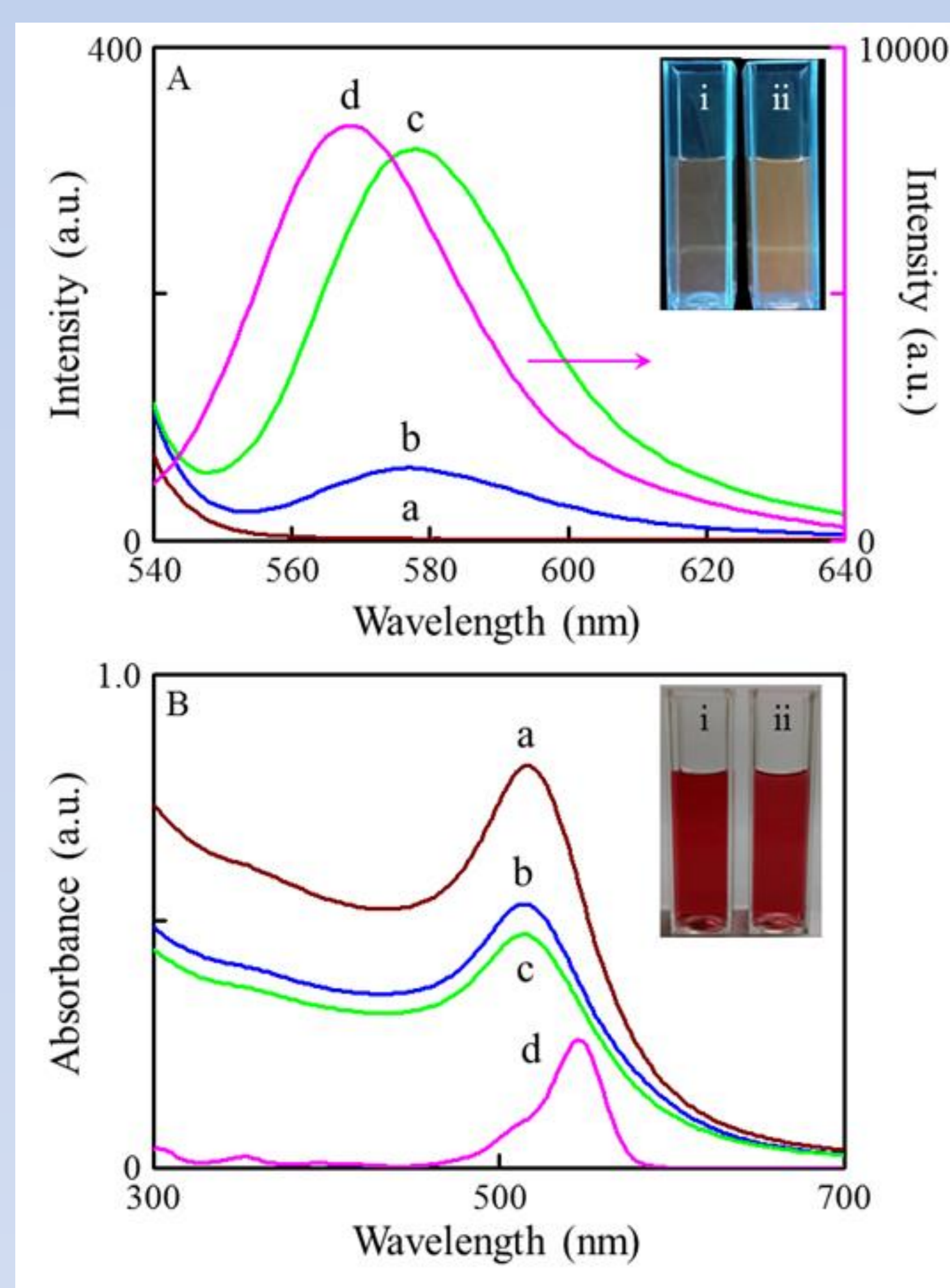


Fig 3. (A) Fluorescence emission spectra.(B) Absorbance spectra. Inset: photograph of (i) RB-AuNPs and (ii) RB-AuNPs with dimethoate.

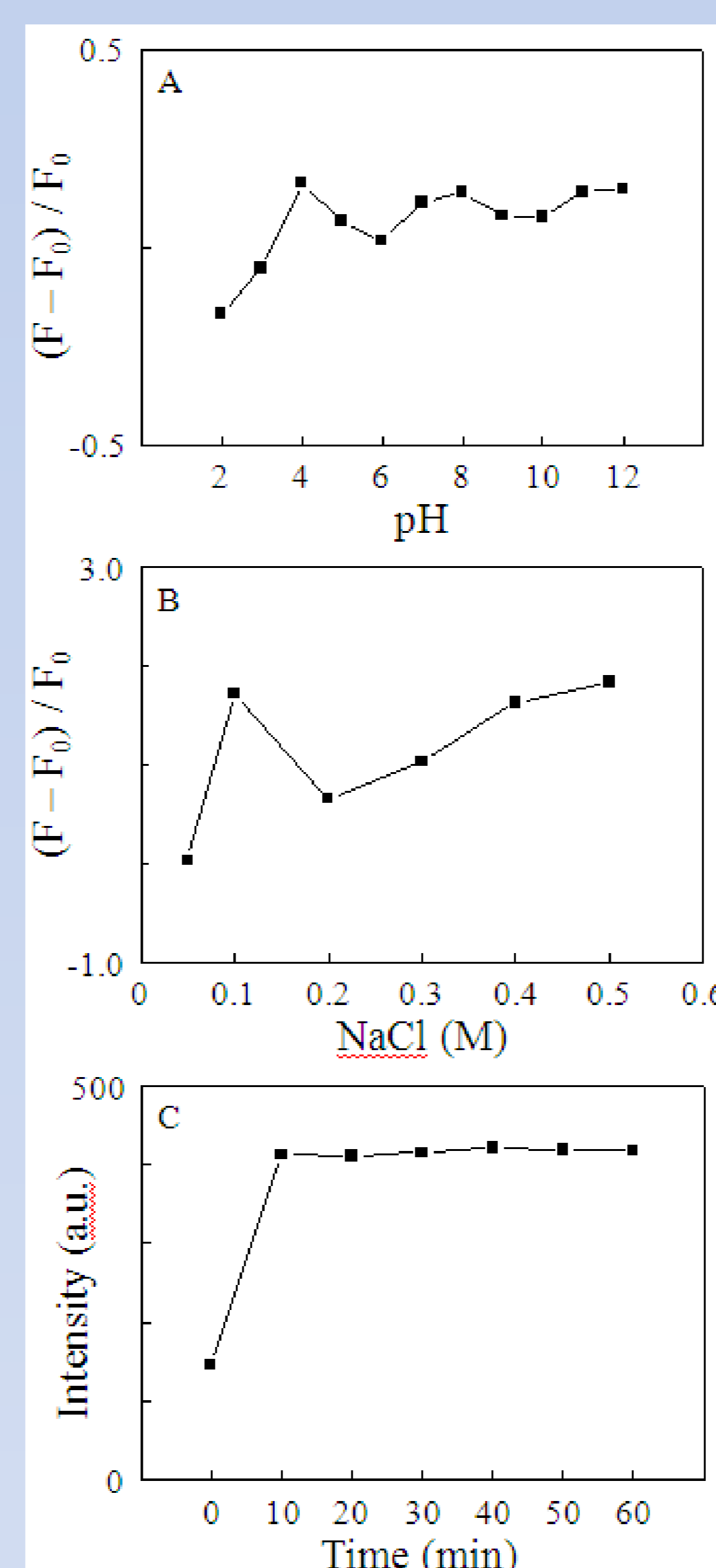


Fig 4. Effect of the (A) pH, (B) concentration of NaCl, and (C) reaction time on the fluorescent intensity of RB - AuNPs.

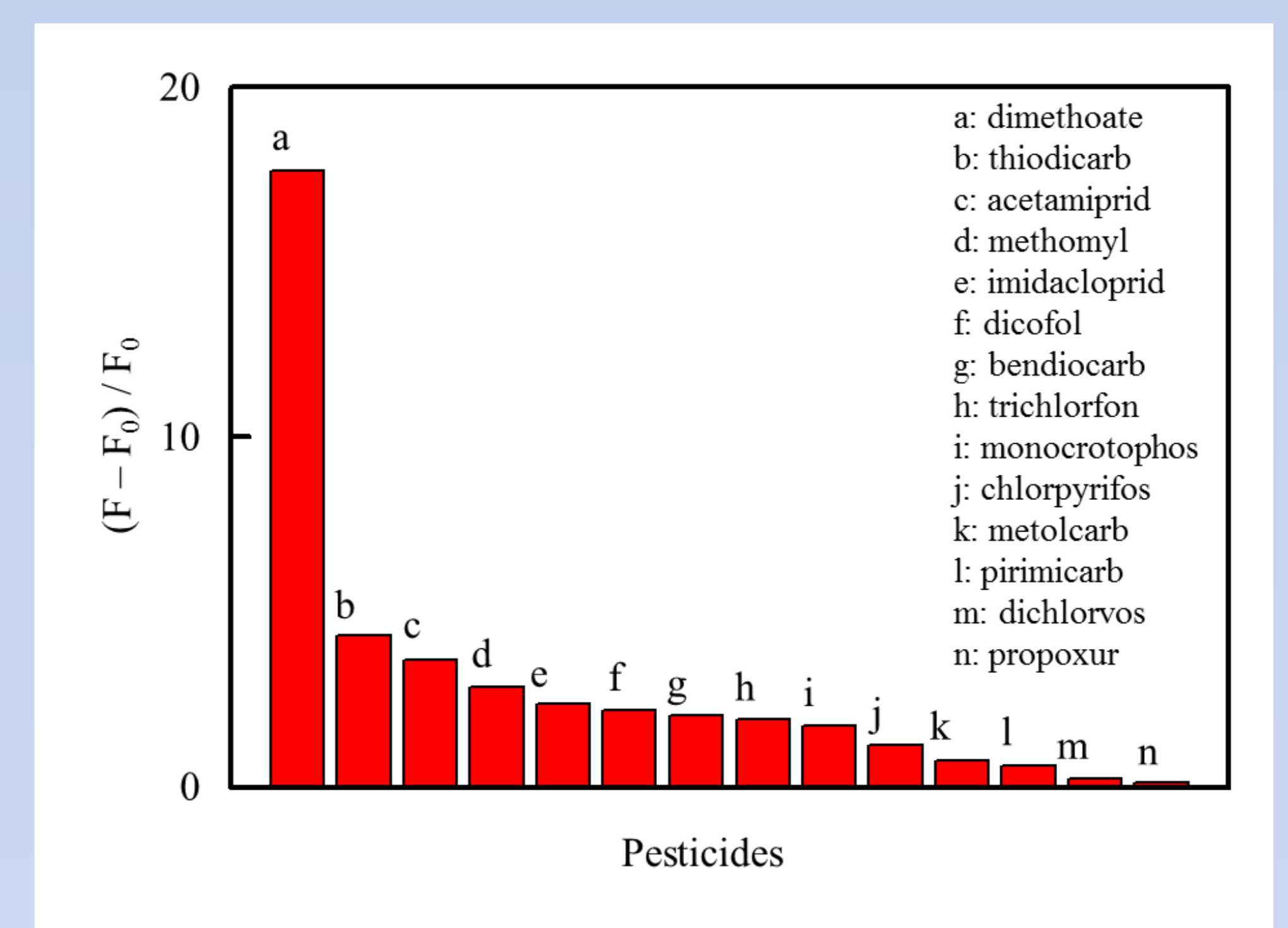


Fig 5. Comparison of the fluorescence recovery ( $F - F_0 / F_0$ ) with different pesticides.

Table 1 Detection of dimethoate in real samples (water and fruits) using the proposed methods ( $n = 3$ ).

Sample	Added (ppm)	Measured (ppm)	Recovery (%)	RSD (% , $n = 3$ )
Tap water	0.50	0.55	110 %	2.20 %
	1.00	1.01	101 %	3.13 %
Lake water	0.50	0.56	112 %	1.11 %
	1.00	1.01	101 %	1.44 %
Tangerine	0.50	0.58	116 %	2.7 %
Lemon	0.50	0.57	114 %	7.2 %

## Conclusions

We have developed a sensitive and selective method to detect of dimethoate through FRET between rhodamine B and gold nanoparticles. In particular, this is the first time that FRET between RB and AuNPs was used for the detection of dimethoate, this approach shows the rapid screening and did not need any expensive instruments.

The fluorescence was used for the detection of dimethoate concentration ranging from 0.005 – 1 mM ( $R^2 = 0.989$ ) and tap water and lake water recoveries were in the range of 100 % - 112 %. Real samples Tangerine and Lemon recoveries were in the range of 114 % - 116 %.

This method was successfully applied to analyze dimethoate residues in water and fruit with satisfied results.