

A New Cations Sensing Quantification Method In Water Based On Mammea A/AA (MA) Ratiometric UV-visible Absorbance

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I- INTRODUCTION

Metals are vital for all living species since they are playing critical roles in their fundamental process such as osmotic regulation, catalysis, metabolism, biomineralization and signaling. Therefore, many metal ions play vital role in human life and exist in living organism and environment. Consequently, the detection of such targets are of great interest and capital for many chemist, biologist and environmentalist. we introduce here Mammea A/AA (MA) (Fig. 1.) as a new ratiometric chemosensor, operating rather in absorbance mode. Chemosensor is a molecule capable of transforming chemical information, such as presence or concentration of a specific metal ion, into an analytically useful signal [1,2]. On this basis, MA spectroscopic response strongly depend on its microenvironment, thus making it possible to be used as spectral-absorbance based probe for biomacromolecules and ligand analytes interactions studies.

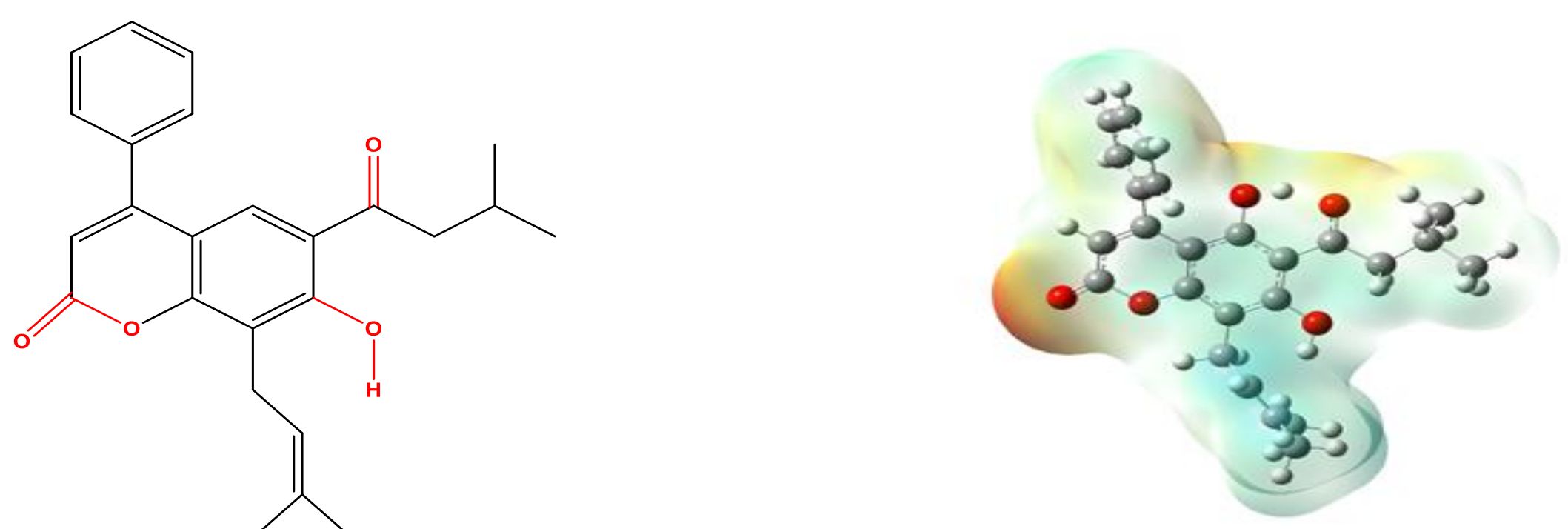


Fig. 1. Chemical Structure of Mammea A/AA (in left) and his molecular electrostatic potential surface (in right).

II- OBJECTIVE

Our aim is to characterized the ability of MA to sense metal ion and elucidate the complexion mode in aqueous media. This could be of practical interest in the detection of environmental, medical and cellular analytes. Practical tests on the estimation of metal ions concentration in mineral water sold throughout the country

III- METHOD

Herein the UV-visible absorbance of MA was recorded in presence of alkaline metal (Mg²⁺, Na⁺, Ca²⁺, K⁺), transition metal (Zn²⁺, Fe²⁺, Co²⁺, Cu²⁺) and Heavy metal(Hg²⁺, Pb²⁺, Sn²⁺) ions. Complex formation was monitored by considering the shift of absorption peaks and the change in optical density. All the experiments were performed at room temperature.

V- CONCLUSION

The absorption spectrum of MA in the mineral water was reconstructed satisfactorily from the spectra of MA in presence of individual alkaline metal ion components, indicating the linearity of the MA response in complex media and hence the potency of MA absorbance to be used in water quality assessment or environment research.

References:

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[3] Ateba, B. A.; Lissouck, D.; Azébazé, A.; Ebelle, C. T.; Nassi, A.; Ngameni, E.; Duportail, G.; Mbazé, L.; Kenfack, C. A (2016) J. Molliq.213, 294 – 303.
[4] Baruch A. Ateba, Daniel Lissouck, Luc M. Mbazé, Mathieu. J. M. Tjegbe, Anatole G. B. Azébazé, and Cyril A. Kenfack (2019) ACS Omega, 4, 4592-4603.

IV- RESULTS

UV-visble absorbance measurements show that **MA** binds these different metal ions. The binding is characterized by a linear decrease in absorbance of the absorption band at 350nm with electron affinity and a linear variation of the OD330/OD350 ratio with standard metal redox potential. We show that the binding is in a 1:1 stoichiometry. The binding free energies and binding constant are of the same order of magnitude as those of other organometallic complexes of the same stoichiometry. The practical use of the method is undertaken by titration of alkali metals in five brands of mineral water.

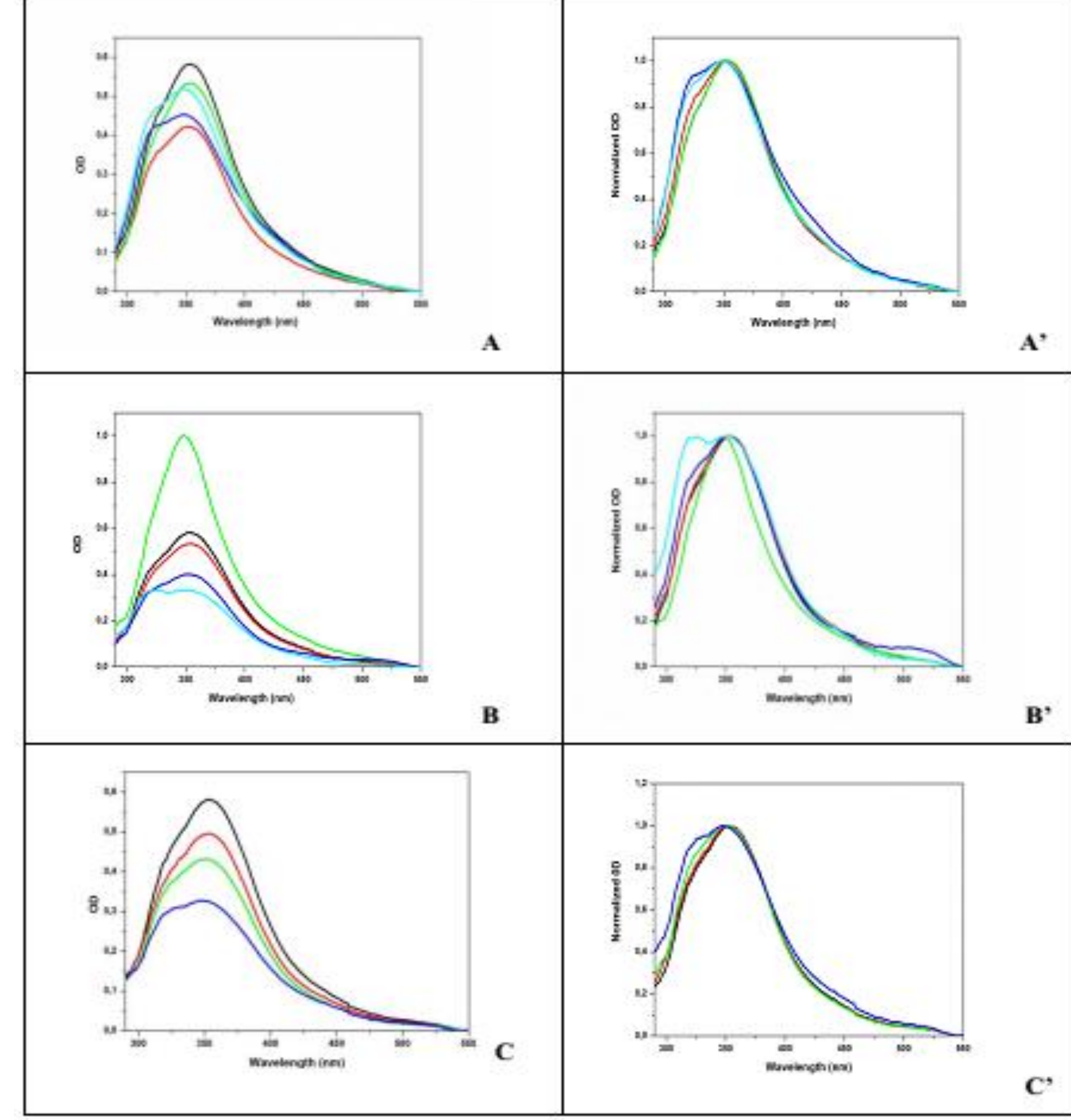


Fig. 2. UV-visible absorption spectra of MA in presence of saturated solution of metal ions: A) alkaline MA+Mg²⁺ (green), MA+Ca²⁺ (scian), MA+K⁺ (blue), MA+Na⁺(red); transition metal MA+Fe²⁺ (green), MA+Cu²⁺ (scian), MA+Co²⁺ (blue), MA+Zn²⁺ (red); heavy metal MA+Pb²⁺ (green), MA+Sn²⁺ (blue), MA+Hg²⁺ (red), A',B' and C') normalized spectra; free MA (black)

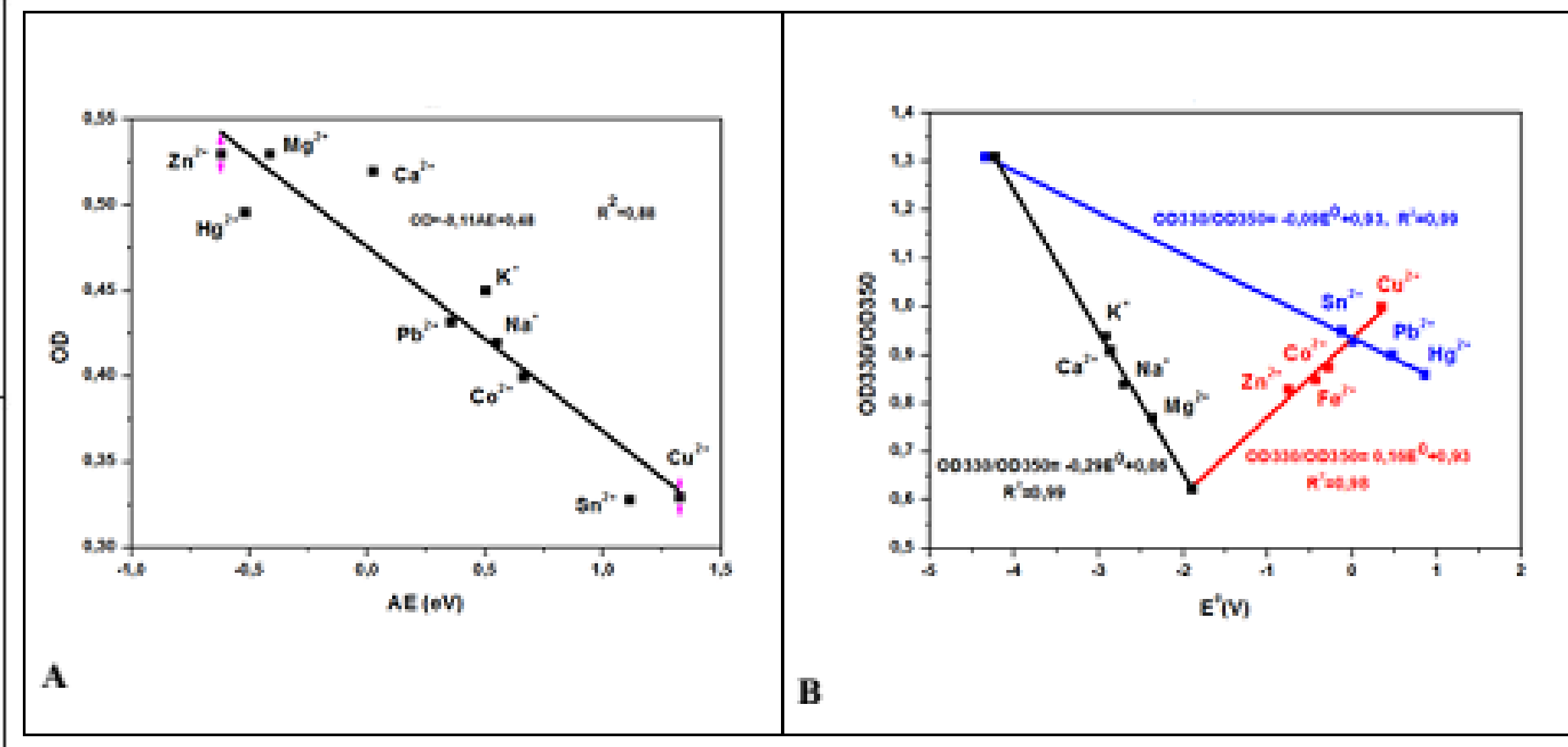


Fig. 3. A) Plot of the optical density (OD) of all the studied metal ion against the electronic affinity (AE), B) Plot of the ratio OD330/OD350 against the standard redox potential (E°) alkaline (Black), transition metal (red) and heavy metal (blue).

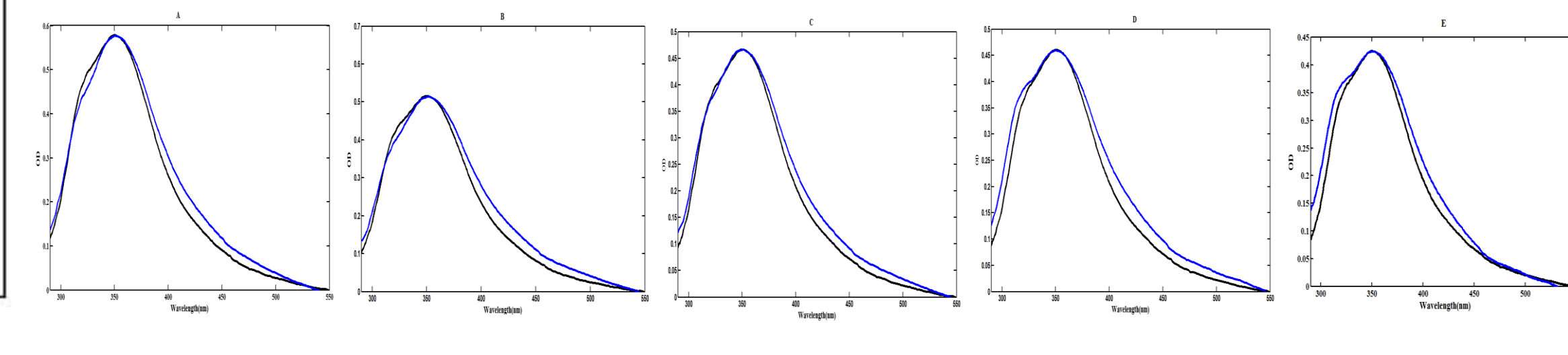


Fig. 5. black) reconstructed spectra OD of different mineral water from metal ions spectra: blue) recorded spectra, A) SA, B) VI, C) OP, D) SP, E) TG

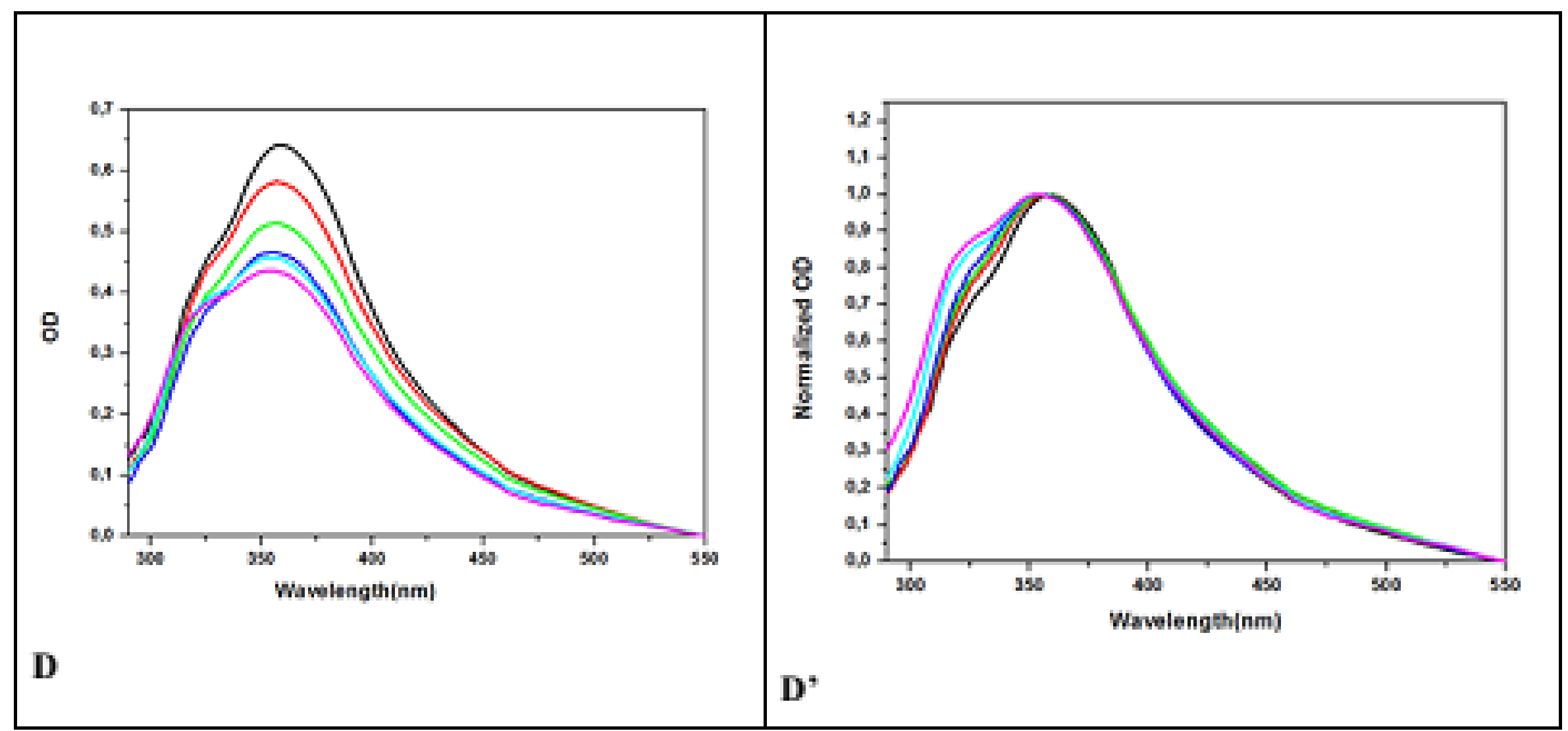


Fig. 4. D) UV-visible absorption spectra solution of MA in presence of saturated solution of mineral water: black) free MA, red) MA+SA, green) MA+VI, blue) MA+OP, scian) MA+SP, pink) MA+TG, D') normalized spectra

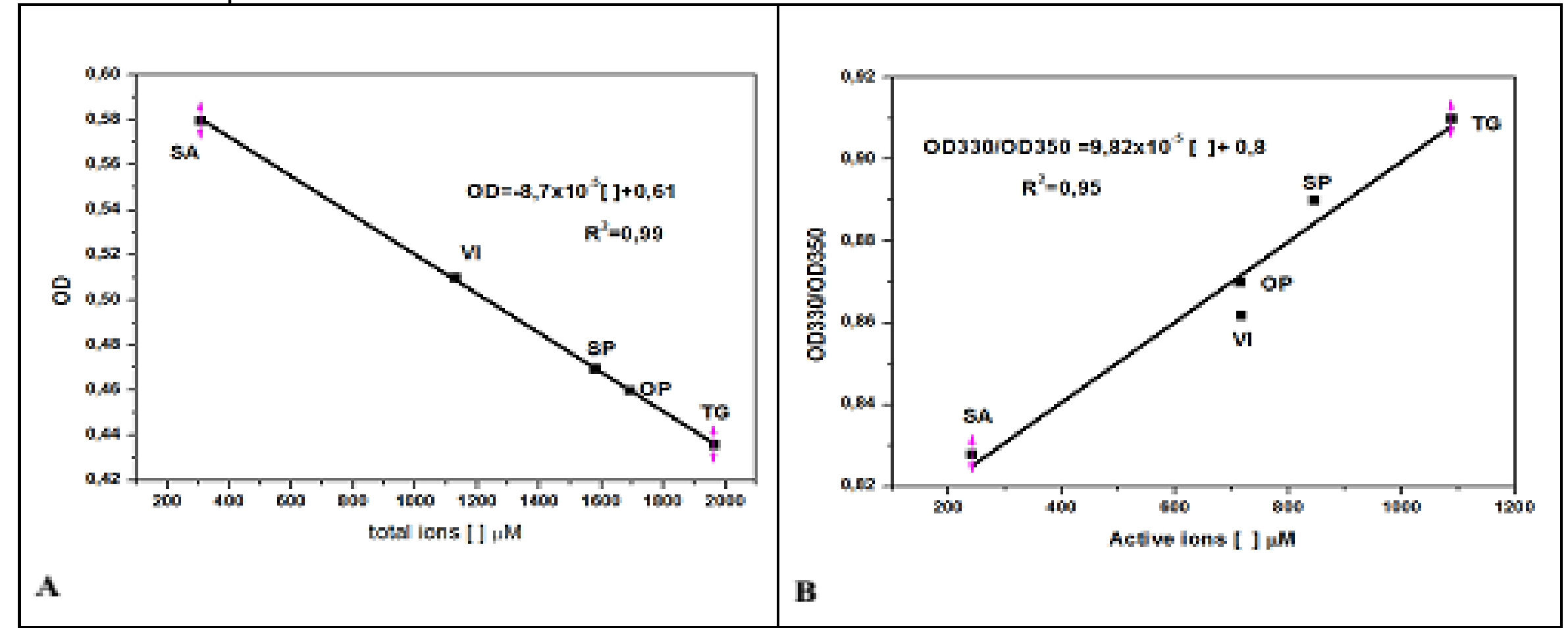


Fig. 6. A) Plot of the OD of all the studied mineral water against the total ions concentration, B) Plot of the ratio OD330/OD350 against total active ions.

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