chemistry proceedings

MDPI

Abstract

Emulsifying Effect of Fulvic Acids from Shilajit †

Denisa-Ioana Gheorghe [1,2], Diana Constantinescu-Aruxandei [1], Carmen Lupu [1] and Florin Oancea [1,*]

[1] National Institute for Research & Development in Chemistry and Petrochemistry—ICECHIM, 060021 Bucharest, Romania; denisa.gheorghe@icechim.ro (D.-I.G.); diana.constantinescu@icechim.ro (D.C.-A.); carmen.lupu@icechim.ro (C.L.)
[2] Faculty of Biology, University of Bucharest, Splaiul Independentei 91–95, 050095 Bucharest, Romania
* Correspondence: florin.oancea@icechim.ro
† Presented at the 17th International Symposium "Priorities of Chemistry for a Sustainable Development" PRIOCHEM, Bucharest, Romania, 27–29 October 2021.

Keywords: shilajit; fulvic acids; emulsions; thyme essential oil; biostimulants

Shilajit, also known in the north of India as salajit, shilajatu, mimie, or mummiyo, is a blackish-brown powder or an exudate from high mountain rocks, especially in the Himalayans mountains between India and Nepal [1]. Shilajit is composed mainly of humic substances, including fulvic acids, which account for around 60% to 80% of the total nutraceutical compound [2]. The components are divided operationally in humins, humic acids, and fulvic acids according to their solubility in water at different pH levels. Fulvic acids are soluble in water under different pH conditions, because of its low molecular weight (around 2 kDa) [3]. The aim of this study was to determine the ability of shilajit to act as pseudo-emulsifier, forming emulsions such as oil in water (O/W) and with thyme essential oil. The emulsions are tested as plant biostimulants. Shilajit was characterized by FT-IR and UV–Vis spectroscopy. The critical micelle concentration (CMC) was determined by measuring the surface tension of shilajit powder in distilled water up to a constant value of surface tension. The value of CMC was obtained from the plot of surface tension against surfactant concentration. The surface tension was determined with the optical method, the pendant drop technique, and with optical OCA 50 dataphysics. The emulsions with shilajit thyme essential oil were prepared by sonication with an ultrasonic homogenizer. The method used to obtain emulsions with shilajit and thyme essential oil was the low surface tension liquids method, with an ultrasonic probe. The emulsions were visualized, and the sizes of the drops were measured with LEICA DM1000 LED optical microscope equipped with LEICA ICC50 W camera. FT-IR analysis of shilajit exhibited a broad band at about 3382 cm^{-1} which can be attributed to the stretching vibration of the hydrogen-bonded OH group. Three bands, in the region of 1613 cm^{-1}, 1411 cm^{-1}, and 1081 cm^{-1} and a peak at 2930 cm^{-1} were observed. UV–Vis spectra showed absorption in the range 300–500 nm, characteristic to fulvic acids [4], the intensity of which increased with the concentration of shilajit. The CMC was found to be 1% and spherical micelles were observed microscopically starting with this concentration, the size of the micelles being between 3.12 and 32.64 µm. The different concentrations of shilajit induced a reduction in the surface tension of water (72.94 mN/m), which can be used to form emulsions with thyme essential oil. Following sonication, the emulsions acquired a homogeneous, monodisperse macroscopic appearance. Preliminary studies show that fulvic acids are a major component of shilajit. They have pseudo-emulsifying properties and can form (micro) emulsions with essential oils. These emulsions are planned to be tested as plant biostimulants.

Author Contributions: Conceptualization: D.-I.G., F.O., D.C.-A., Methodology: D.-I.G., F.O., D.C.-A., Investigation: D.-I.G., Writing—original draft preparation: D.-I.G., Writing—review and editing: D.C.-A., Visualization: C.L., Supervision: F.O., Project administration: F.O., C.L., Funding acquisition: C.L., F.O. All authors have read and agreed to the published version of the manuscript.

check for updates

Citation: Gheorghe, D.-I.; Constantinescu-Aruxandei, D.; Lupu, C.; Oancea, F. Emulsifying Effect of Fulvic Acids from Shilajit. *Chem. Proc.* **2022**, *7*, 23. https://doi.org/10.3390/chemproc2022007023

Academic Editors: Mihaela Doni, Zina Vuluga and Radu Claudiu Fierăscu

Published: 7 March 2022

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Funding: This work was supported by project POC-A1-A1.2.3-G-2015-P_40_352-SECVENT, My_SMIS 105684, "Sequential processes of closing the side streams from bioeconomy and innovative (bio)products resulting from it, subsidiary project "Nano-amphiphilic biostimulants for plants, based on essential oils recovered from spare biomass (1229/2020). The SECVENT project was co-funded by The European Regional Development Fund (ERDF) and The Competitiveness Operational Programme (POC), Axis 1.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Agarwal, S.P.; Khanna, R.; Karmarkar, R.; Anwer, M.K.; Khar, R.K. Shilajit: A review. *Phytother. Res.* **2007**, *21*, 401–405. [CrossRef] [PubMed]
2. Khanna, R.; Witt, M.; Anwer, M.K.; Agarwal, S.P.; Koch, B.P. Spectroscopic characterization of fulvic acids extracted from the rock exudate shilajit. *Org. Geochem.* **2008**, *39*, 1719–1724. [CrossRef]
3. Carrasco-Gallardo, C.; Guzmán, L.; Maccioni, R.B. Shilajit: A Natural Phytocomplex with Potential Procognitive Activity. *Int. J. Alzheimer's Dis.* **2012**, *2012*, 674142. [CrossRef] [PubMed]
4. Ghabbour, E.A.; Davies, G. Spectrophootometric analysis of fulvic acid solutions-a second look. *Ann. Environ. Sci.* **2009**, *3*, 131–138.