

Comparison of Mumijo (Shilajit) and Humic Acids (HA) Chemical Composition Using FTICR Mass-Spectrometry

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1. INTRODUCTION

Humic substances (HS) are complex mixtures formed during decay of plant and animal materials. HS are generically classified into fulvic and humic acid fractions according to their solubility properties. The particular features of HS are polydispersity and extreme structural heterogeneity. The biological effects of humic substances can be different, depending on their chemical structure and physicochemical properties. Chemical composition, structure, and functional groups can vary greatly, depending on the origin and age of the humic substance and the conditions of the humification process (humidity, aeration, temperature, mineral microenvironment, etc.) (1). Mumijo has been used in traditional medicine for thousands of years, but there are only a few research devoted to the investigation of humic substances from mumijo.

2. MATERIALS AND METHODS

We used well characterized samples of Suwannee River fulvic and humic acids of the International Humic Substances Society (IHSS). Kyrgyz mumijo from drugstore were used for analysis without further purification. All experiments were performed on a commercial mass-spectrometer 7 Tesla Finnigan LTQ FT (Thermo Electron, Bremen, Germany) equipped with electrospray ion source (Finnigan Ion Max Source). Mumijo samples were dissolved in 1:4 water-acetonitrile solution and analyzed using electrospray ionization both in positive and negative modes. For accurate molecular mass measurements FTICR mass spectra were acquired using selected ion monitoring (SIM) scanning with 100 Da mass range.

For interpretation of FTICR data Kendrick and van Krevelen diagrams were used (2). All FTICR mass spectra were also processed using FIRAN software for determination of stoichiometric formulas (2).

3. RESULTS AND DISCUSSION

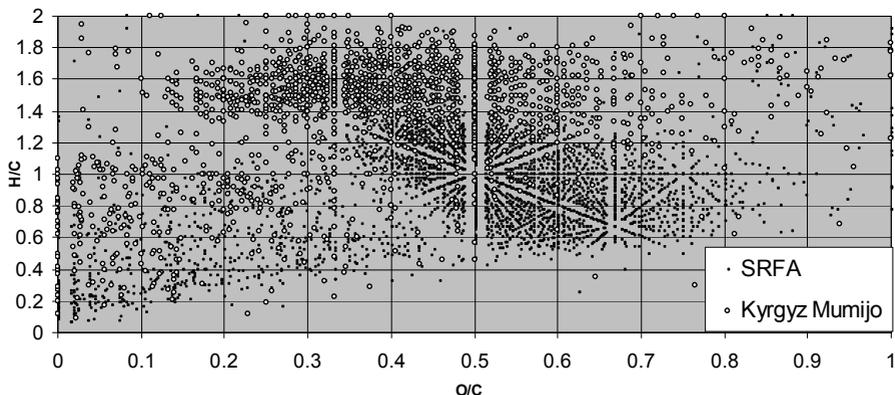


Figure 1 Van Kleveren diagram for kyrgyz mumijo and Suwannee River fulvic acid (for comparison).

Comparison of kyrgyz mumijo with fulvic acid (FA) shown on figure 1. It was found both mumijo and fulvic acid contain a lot of ions tending to form groups in certain region of van Krevelen diagram. This may be interpreted like these substances were formed in stochastic synthesis process and consists of molecules which are close one to each other in their functional composition and differ only by simple structural modifications (e.g., carbon chain length, a number of double bonds, oxidation level). Kyrgyz mumijo seems to differ from humic substances by higher H/C ratio and lower O/C ratio.

4. CONCLUSIONS

Comparison of mumijo composition determined by mass spectrometry with composition of humic substances gives advance in understanding of mumijo origin and its relation with humic substances. Both of these substances seems to be formed from organic remains in slightly different conditions, so, processes which take place during mumijo formation may be very similar to processes of HS formation.

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