An attempt of the quantitative analysis of cyclical constituents in structure of scanning microfluorescence signal from human hairs

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1. The elemental composition of human hairs are widely invesrigated early for finding biological and other markers [1]. However no works exist those are focus to analysing possible cycles in fluorescence signals acquired from micro-XRF scanning experiments. We take a first attempt to avoid these problem.
At first we panoramically study a limited series of human hairs. As the result the stable and legible pseudoperiodical cycles of three main type are found (Fig. 1). The characteristic spacial scales of these are thousands, hundreds and tens microns. They may be interpreted by intraday human metabolic processes as well as some features of human hairs' structures [1].

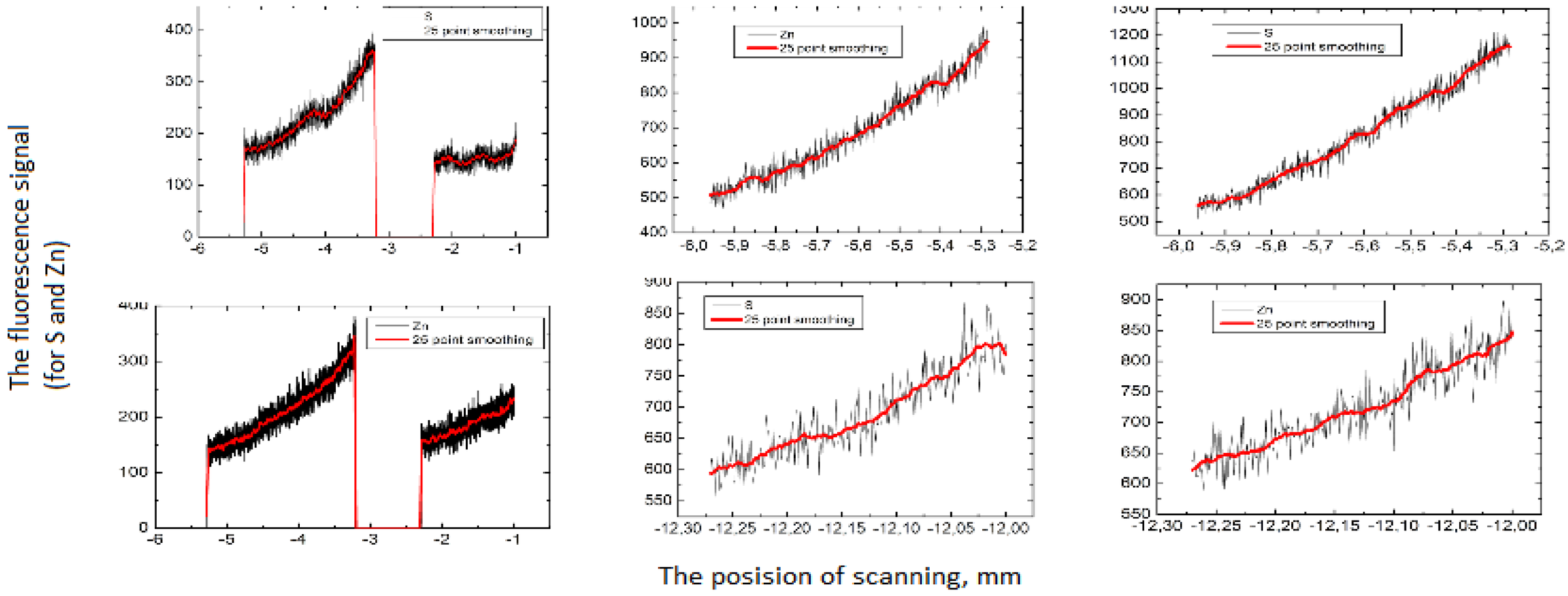

Fig. 1. The results of preliminary experiments of finding preudoperiodical cycles in fluorescence signals obtained from micro-XRF scanning experiments of human hairs.

2. Singular Value Decomposition (SVD) is a decomposition of the matrix to three ones: two orthonormal and diagonal. It is the especial and the unique type of matrix decomposition which is resulted by the special way of the choice of all constituent elements [3]. As result the initial matrix is the sum of a range of specific matrixes' multiplication products. Thus the contribution of these products decrease as fastly as possible.
In some practical cases the columns of those may be interpreted by vectors of peculiar priznaks as well as the rows may be interpreted by the various realizations of these priznaks. (For example, it is commonly used in PCA method.) In **SSA** method [3] the application of SVD helps to retrieve a small range of preudoperiodic cyclic constituents from a initial signal.
Empirical Mode Decomposition (EMD) is also perspective method of finding preudoperiodic cyclic constituents in signals [2]. We have investigated the selected fluorescence signal (from sulfur) by two special methods of analysing time series: SSA and EMD. Also we have studied the results to analyse implicitly it's tolerance and stability.

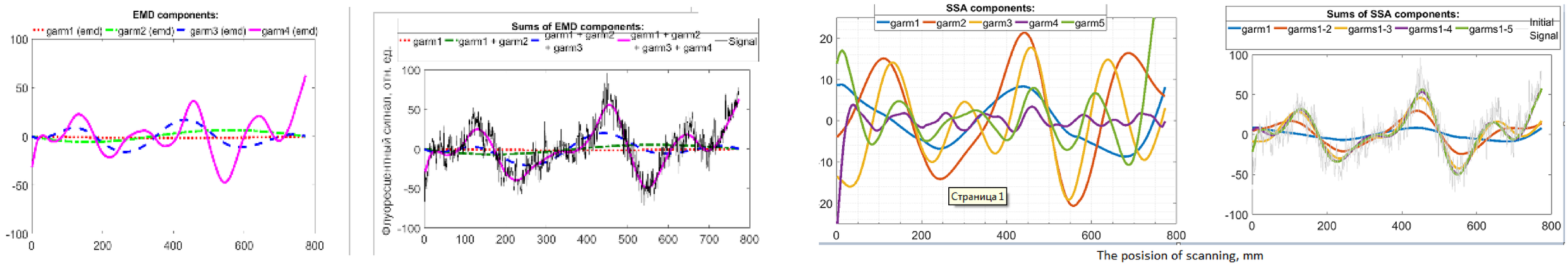

Fig. 2. The results of detail quantitative analysis of the selected fluorescence signal (from sulfur) of preudoperiodical cycles that obtained from micro-XRF scanning experiments of a fragment of the human hair.

At the result it may consider that the problem of the finding and the quantitative analysis of pseudoperiodical cycles is fully feasible and have some perspectives.

[1] Hair in Toxicology. An Important Bio-monitor.Edited by Desmond John Tobin. The Royal Society of Chemistry 2005; [2] https://www.mathworks.com/help/signal/ref/hht.html;
[3] https://www.gistatgroup.com/cat

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