APPLICATION OF KINETIC ANALYSIS OF CHEMILUMINESCENCE DATA FOR PREDICTION OF THE SHELF-LIFE OF FISH OIL

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A common difficulty towards the application of many product formulations results from the fact that their long-term stability is difficult to predict. In the first part of this study, we report the stability and quality testing of fish oil against oxidation. In the present study we report on an advanced kinetic analysis [1,2] of the oxidation reactions of fish oil with and without stabiliser in an oxygen atmosphere at moderate temperatures. The data acquisition of fish oil oxidation was performed under isothermal conditions from 60°C to 80°C in synthetic air with a single channel basic Chemiluminescence configuration from ACL Instruments AG (www.aclinstruments.com/en/) [3,4]. The very good description of the chemiluminescence's signals by the kinetic parameters determined by means of the differential isoconversional analysis [1] indicates the constancy of the multistage decomposition mechanism between 80 and 60°C (Fig. 1).

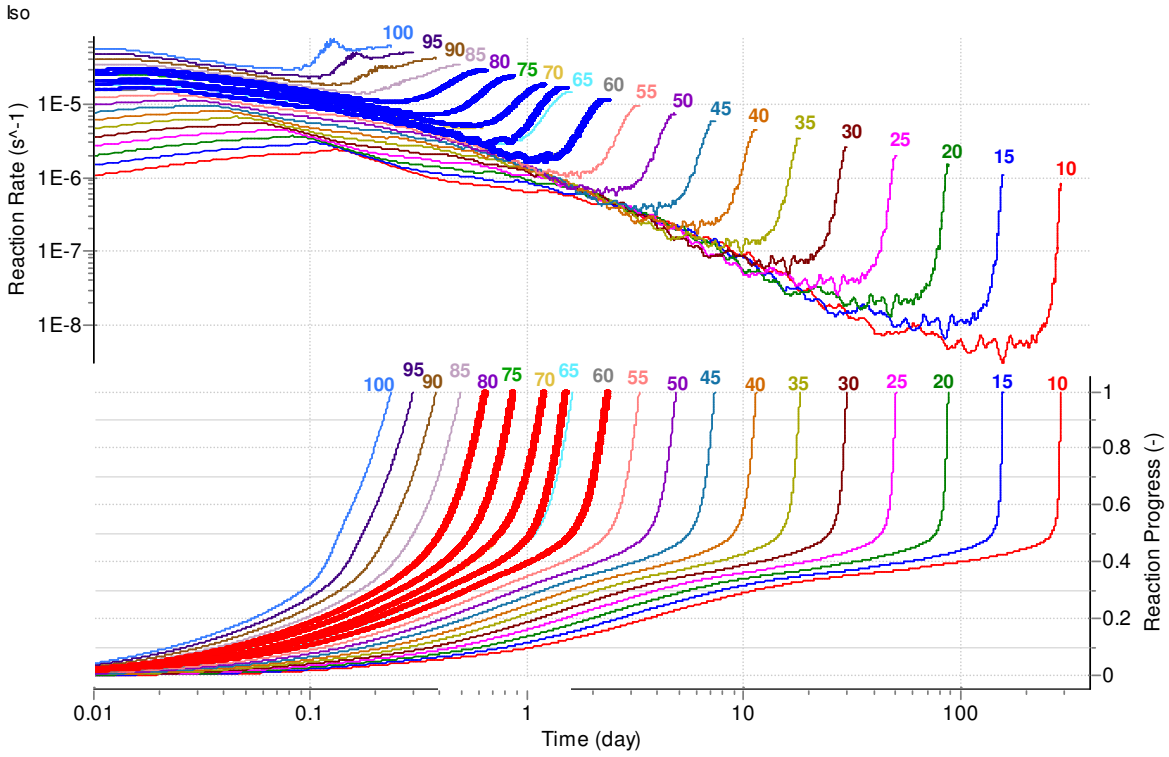

Fig. 1: Experimental (points) and simulated (lines) chemiluminescence's signals of oxidation reactions of fish oil expressed as reaction rate (top) and progress (bottom) in the temperature range of 10 to 100°C. The numbers placed on the curves depict the temperature (in °C).

The kinetic parameters of the oxidation process were subsequently applied for the simulation of the fish oil aging at any temperature mode such in the range 55-10°C (Fig. 1), at different climatic categories and, more generally, at any temperature profile close to the ambient temperature. The end of antioxidant effectiveness such as vitamin E additive results in characteristic change in the CL-curves. In the same way, advanced kinetic analysis of these characteristic changes enables the precise prediction of the shelf life of fish oil products and supplements under different temperature profiles.

1. AKTS AG, Advanced Kinetics and Technology Solutions, CH-3960 Siders, Switzerland: http://www.akts.com (AKTS-Thermokinetics Software for Thermal Aging and Thermal Safety).
2. B. Roduit, L. Xia, P. Folly, B. Berger, J. Mathieu, A. Sarbach, H. Andres, M. Ramin, B. Vogelsanger, D. Spitzer, H. Moulard and D. Dilhan, The Simulation of the Thermal Behavior of Energetic Materials based on DSC and HFC Signals, J. Therm. Anal. Cal., 93 (2008) 1, 143–152.
3. F. Kaeser and B. Roduit, Prediction of the Ageing of Rubber using the Chemiluminescence Approach and Isoconversional Kinetics, J. Therm. Anal. Cal., 93 (2008) 1, 231-237.
4. ACL Instruments AG, CH-3210 Kerzers, Switzerland: http://www.aclinstruments.com