5.2 Synthetic & Systems biology: experimental, theoretical and computational approaches for the analysis of micro and biological systems

111. Predictive oxidative evaluation of lipid samples using Differential Scanning Calorimetry

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Lipids are currently attracting attention due to their pharmaceutical and technological applications (*1*). However, oxidative stability is a main bottleneck in their utilization and application. Thus, this study proposes using Differential Scanning Calorimetry (DSC) technique under oxygen atmosphere as a predictive oxidation status tool, based on the Ozawa-Flynn-Wall method by heating commercial oils at different rates and determining the Oxidation Induction Temperature (OIT) (*2*). The oxidation effective activation energy (Ea) and its kinetic parameters, such as the pre-exponential factor (A; i.e. frequency of molecules collisions) and the constant reaction rate (k) can also be calculated (*3*). Accordingly, olive oil (OL), coconut oil (CO), sunflower oil (SF) and petrolatum (PE) were subjected to dynamic studies performed in a temperature range of 20-350 °C at different heating rates (5, 10, 15 and 20 °C/min) using 50 mL O_2/min. OL, PE and CO presented the following OIT values: 206.2±8.9 °C, 204.5±6.8 °C and 221.6±6.3 °C, respectively. Interestingly, for SF, the OIT value was 184.9±8.7 °C, suggesting that it is oxidized at lower temperatures. In fact, both the kinetic pre-exponential factor ($A=3.18x10^{10}$ min^{-1}) and the calculated Ea (Ea=93.3 KJ/mol) for SF are in agreement with the obtained OIT value. Overall, according to the obtained results, DSC OIT is a fast and reliable method to measure parameters related to oxidative stability of lipophilic samples. The main achieved conclusion was that CO was more resistant to oxidation and therefore more stable than SF, OL and PE.

References

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