

R.I. Chelcea¹, D. Danis¹ and R. Fechete¹

¹Technical University of Cluj-Napoca, Memorandumului Str. No. 28, R-400114, Cluj-Napoca, Romania.

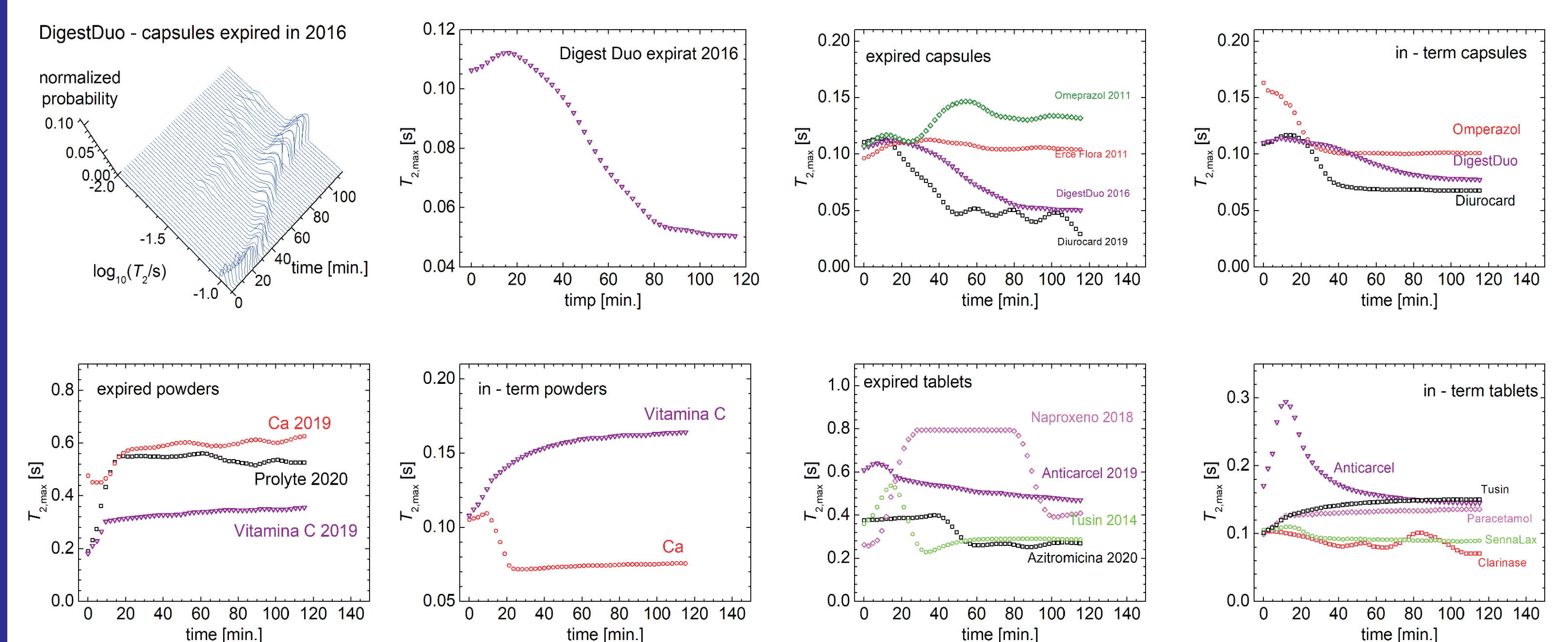
Introduction

The pollution with expired drug of aquatic environments, in particular rivers and lakes, is becoming a current concern both, nationally and internationally. Thus, one can say that the interest in the exact assessment of the quantity of pharmaceutical waste as well as their management after the expiration date is more and more advanced. For the present study were used: I) expired drugs in the form of: 1) tablets: Paracetamol, Clarinase, SennaLax, Anticârcel, Digest Duo, Tusin, 2) capsules: Diurocard, Omeprazol, DigestDuo and 3) powders: Vitamina C, Ca, Prolite, as well as II) non expired drugs within the same form of: 1) tablets: Paracetamol, Naproxeno, Azitromicina, Clarinase, SennaLax, Faringonil, Anticârcel, Tusin, 2) capsules: Diurocard, ErceFlora, Omeprazol, DigestDuo and 3) powders: Vitamina C, Ca. FT-IR spectroscopy is used for the structure characterization while the molecular dynamic characterization of expired and in-term drugs was made from ¹H NMR relaxometry data. For that, the recorded NMR signal (CPMG pulse sequence) was analysed by inverse Laplace transform in order to obtain the distribution of the transverse relaxation time, T_2 . The solubility in liquid mediums with different pH was assessed from the kinetic measurements of i) electrical conductivity of a 200 ml solution with adjusted pH and ii) in time repetitive measurement of T_2 -distribution.

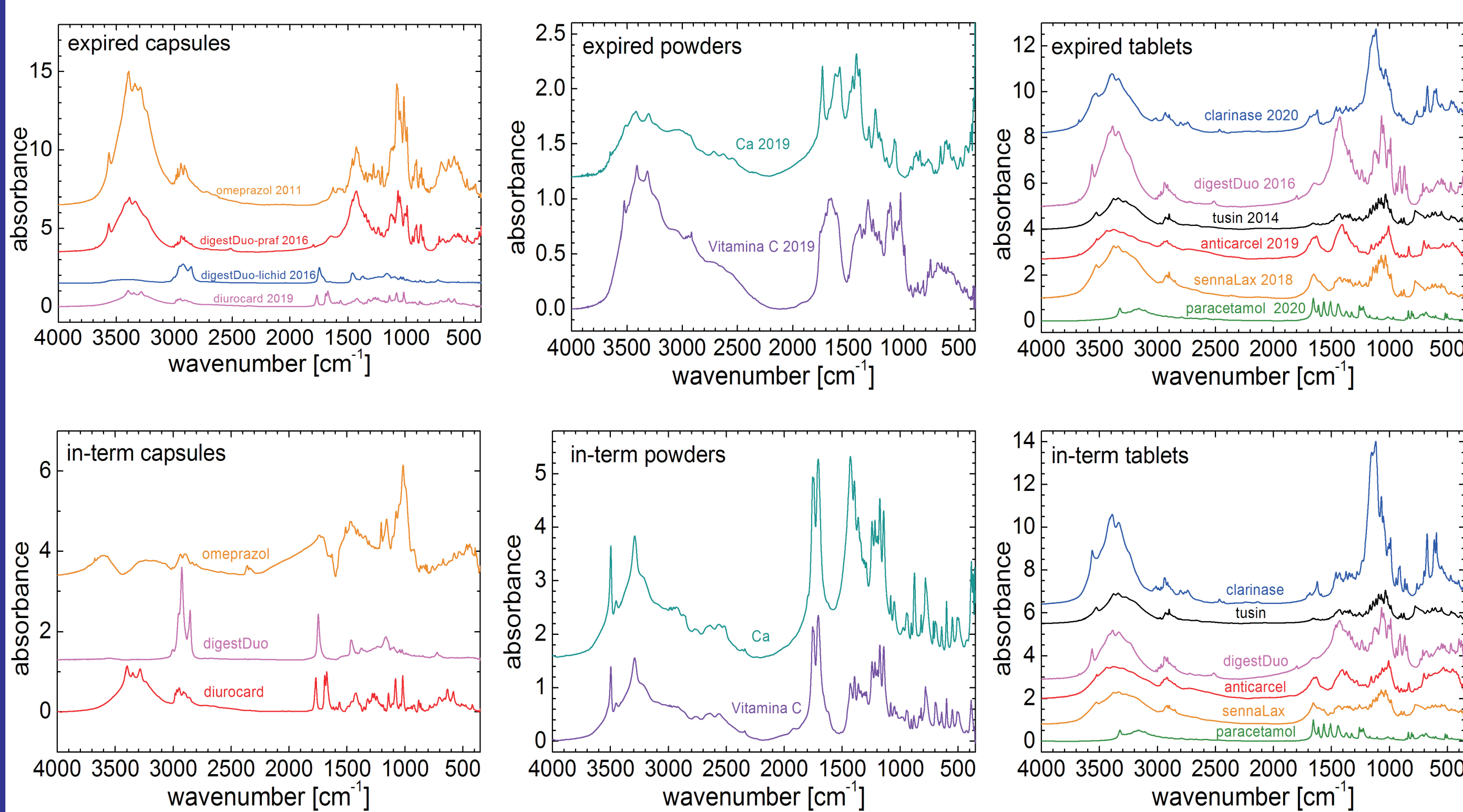
Expired and in-term drugs used of the study



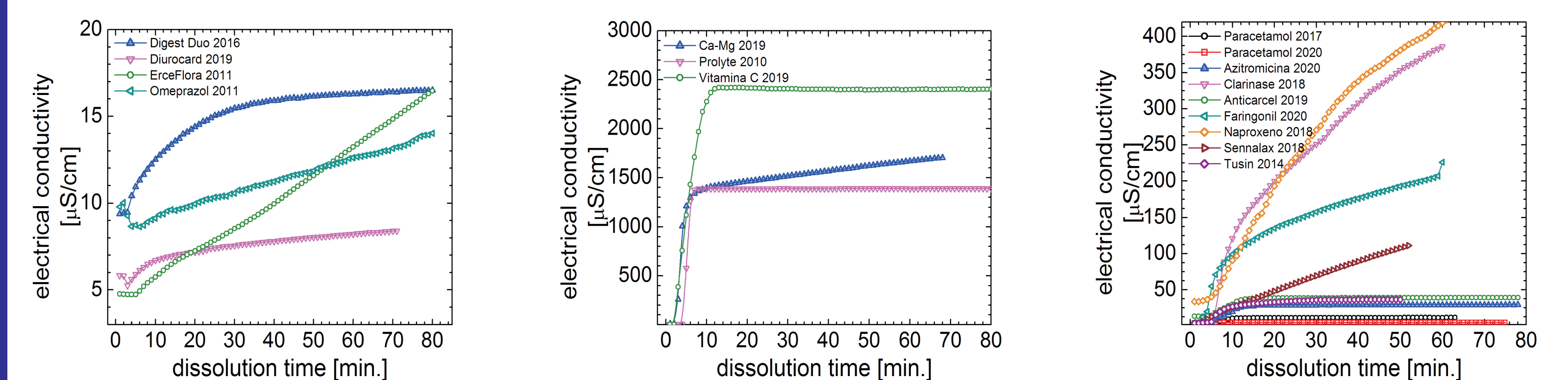
The solubility kinetics measurements by ¹H NMR relaxometry



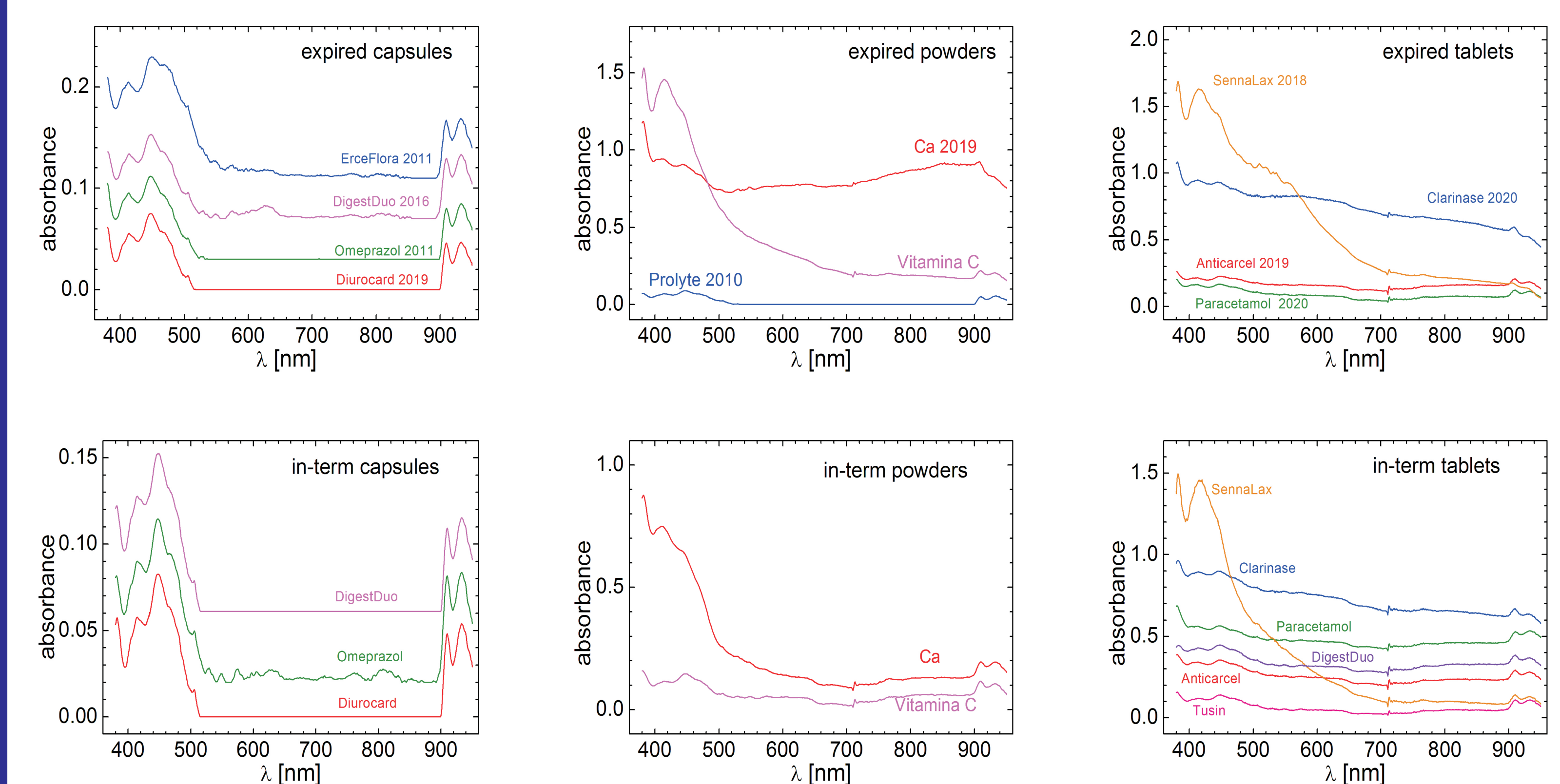
FT-IR spectra of expired and in-term drugs



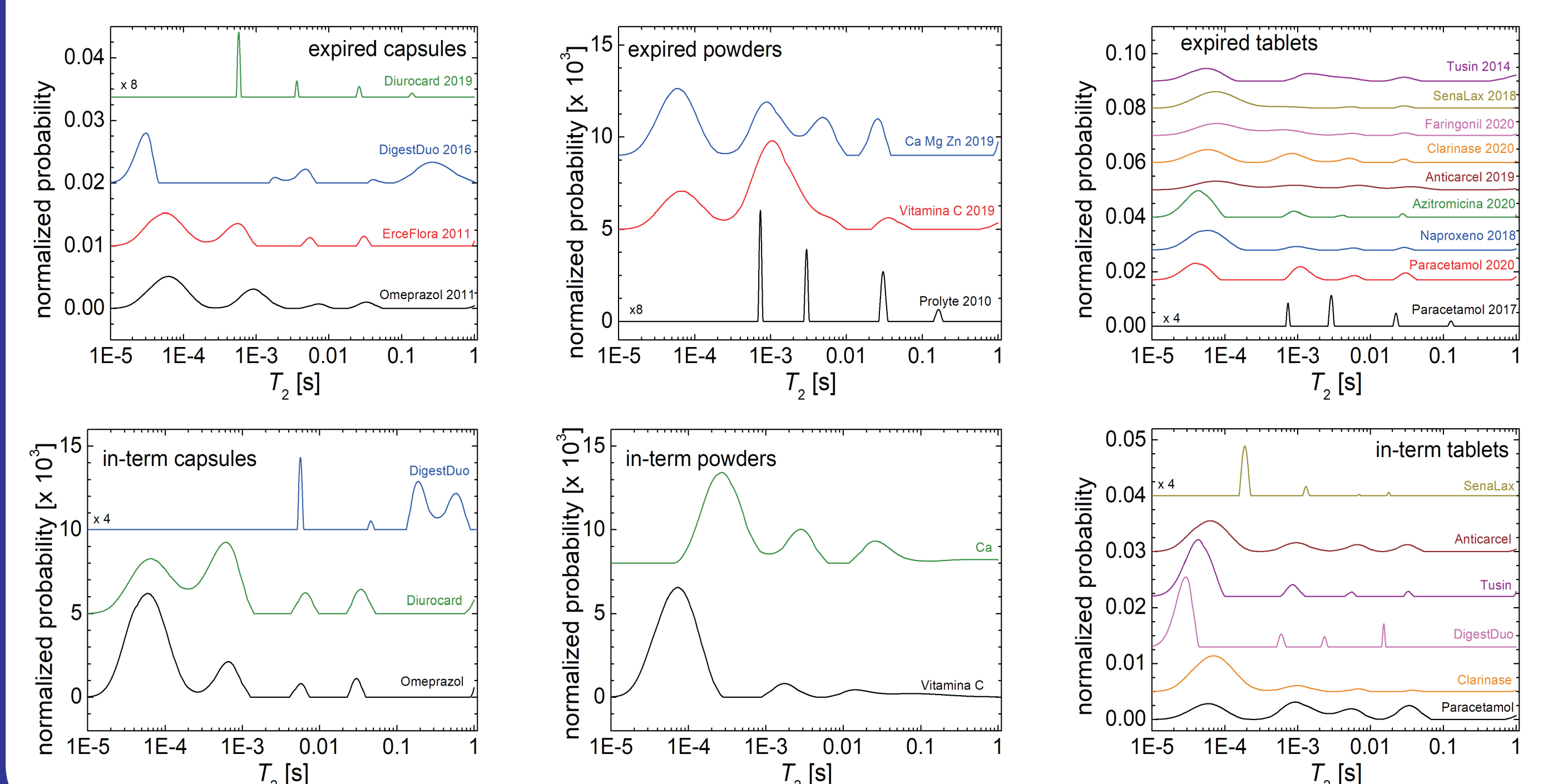
Electrical conductivity measurements of expired drugs



VIS-IR appropriate spectroscopy of expired and in-term drugs



T₂ distribution of expired and in-term drugs



Conclusions

For the investigation and characterization of different drugs, advanced methods were used, such as: proton nuclear magnetic resonance (¹H NMR) combined with Laplace data analysis, FT-IR and VIS-IR-appropriate spectroscopy. Kinetic measurements of electrical conductivity were performed for the assesment of stability in aqueous medium with different pH.

Changes in the molecular dynamics of drugs were observed after expiration. While those in term presents several immobile components.

The FT-IR spectra for in-term and expired drugs were compared and it was observed that from the structural point of view of the base molecule they are similar.

Bibliography

1. P. Shao, J. Tian, F. Yang, X. Duan, S. Gao, W. Shi, X. Luo, F. Cui, S. Luo, S. Wang, Adv. Funct. Mater., 28, 1705295 (2018).
2. Chen, H., Jing, L., Teng, Y., Wang, J., Characterization of antibiotics in a large-scale river system of China: Occurrence pattern, spatiotemporal distribution and environmental risks, Sci. Total Environ., 618, 409–418 (2018).
3. B. Xia, Fang Deng, Shuqu Zhang, Li Hua, Xubiao Luo, Meiyong Ao, Design and synthesis of robust Z-scheme ZnS-SnS2 n-n heterojunctions for highly efficient degradation of pharmaceutical pollutants: Performance, valence/conduction band offset photocatalytic mechanisms and toxicity evaluation, Journal of Hazardous Materials