Pedro Antonio García Encina, Professor of the Department of Chemical Engineering and Environmental Technology and Head of the Research Institute of Sustainable Processes of the University of Valladolid (Spain), issues this **letter of recommendation for the defense of Yerkanat Syrgabek's Ph.D. thesis**, entitled "Development of methods for the determination of pesticides in grapes using solid-phase microextraction"

The Ph.D. thesis of Mr. Yerkanat Syrgabek, supervised by Assoc. Professor Mereke Alimzhanova, is excellent and highly relevant research work in the field of analytical chemistry.

This dissertation is focused on the development and optimization of "green" and sensitive analytical methods for the determination of residual amounts of pesticides in grapes, using vacuum-assisted and miniaturized solid-phase microextraction followed by gas chromatography–mass spectrometric detection. The developed methods address significant challenges in food safety and meet international requirements for pesticide residue analysis, providing rapid, accurate, and environmentally friendly approaches for sample preparation and detection.

During his Ph.D. studies, Yerkanat completed a research internship at the University of Valladolid (Spain), where he worked on the application and optimization of solid phase microextraction techniques for pesticide analysis. Yerkanat's strong academic background enabled him to quickly adapt to a new research environment and collaborate effectively with international colleagues. He demonstrated independence, creativity, and enthusiasm, successfully accomplishing all planned research tasks during his internship.

The research presented in this thesis is novel and significant. For the first time, Mr. Syrgabek has developed and optimized vacuum-assisted and miniaturized solid-phase microextraction methods for a broad range of pesticides in grape samples, thoroughly validated them according to international standards, and assessed their greenness using modern GAPI and AGREEprep tools. The findings have high practical value for laboratories involved in food quality control.

The results of Mr. Yerkanat's research have been published in peer-reviewed journals indexed in the Web of Science and Scopus, including:

1. Y. Syrgabek, M. Alimzhanova, Modern Analytical Methods for the Analysis of Pesticides in Grapes: A Review, Foods. 11 (2022) 16–23. https://doi.org/10.3390/foods11111623 (WoS - Q1, Impact Factor 5.2; Scopus – Percentile 97%, CiteScore 5.8);

2. Y. Syrgabek, M. Alimzhanova, P.A. García-encina, J. Jose, L. Rebeca, Greenness evaluation of sample preparation methods by GAPI for the determination of pesticides in grape: A review, Trends in Environmental Analytical Chemistry. 39 (2023). https://doi.org/10.1016/j.teac.2023.e00206 (WoS - Q1, Impact Factor 11.1; Scopus - Percentile 99%, CiteScore 21.2);

3. Y. Syrgabek, M. Alimzhanova, S. Yegemova, S. Batyrbekova, Vacuum-assisted headspace-solid phase microextraction of pesticides in grape samples, Advances in Sample Preparation. 11 (2024) 1–15. https://doi.org/10.1016/j.sampre.2024.100123 (WoS - Q1, Impact Factor 6.5; Scopus - Percentile 82%, CiteScore 7.5);

4. M. Alimzhanova, Y. Syrgabek, P.A. García-encina, Eco-Friendly Miniaturized Solid Phase Microextraction for Pesticide Analysis in Grapes, Journal of Separation Science. 48 (2025). https://doi.org/10.1002/jssc.702041of14 (WoS - Q2, Impact Factor 2.8; Scopus - Percentile 66%, CiteScore 6.1).

Yerkanat demonstrated deep knowledge in analytical chemistry and method development, carried out comprehensive experimental work including optimization of extraction parameters, validation of analytical performance, and statistical data analysis. He was actively involved in preparing scientific publications and presenting his results at international conferences.

I am highly supportive of Yerkanat Syrgabek's application for the Ph.D. degree. His research meets high international standards and makes a valuable contribution to the advancement of green analytical chemistry and food safety.

Professor Pedro Antonio Garcia Encina

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