

## Board of examiners

### **Prof. El Mostafa Qannari**

Département MSC Management, Statistiques et Communication  
École Nationale Vétérinaire, Agroalimentaire et de l'Alimentation Nantes-Atlantique  
Nantes (France)

### **Prof. Kris De Braekeleer**

Pharmacognosy, Bioanalysis & Drug Discovery Unit, Faculty of Pharmacy  
Université Libre de Bruxelles (ULB), Brussels (Belgium)

### **Prof. Mustapha Bouatia**

Laboratory of Analytical Chemistry, Faculty of Medicine and Pharmacy  
University Mohammed V- Rabat, Rabat (Morocco)

### **Prof. Yahia Cherrah**

Laboratory of Pharmacology and Toxicology, Faculty of Medicine and Pharmacy,  
University Mohammed V- Rabat, Rabat (Morocco)

### **Prof. Debby Mangelings, chair**

Department of Analytical Chemistry, Applied Chemometrics and Molecular Modelling  
Vrije Universiteit Brussel, Brussels, Belgium

## **Promoters:**

### **Prof. Yvan Vander Heyden**

Department of Analytical Chemistry, Applied Chemometrics and Molecular Modelling  
Vrije Universiteit Brussel, Brussels, Belgium

### **Prof. Abdelaziz Bouklouze**

Laboratory of Pharmacology and Toxicology, Faculty of Medicine and Pharmacy,  
University Mohammed V- Rabat, Rabat (Morocco)



Joint PhD VUB & UM5 Rabat  
2019-2020

INVITATION to the Public defence of

**Mourad KHARBACH**

To obtain the academic degree of

**'DOCTOR OF PHARMACEUTICAL SCIENCES'**

**CHEMICAL CHARACTERIZATION, GEOGRAPHICAL TRACEABILITY  
AND QUALITY CONTROL OF MOROCCAN ARGAN OILS:  
ANALYTICAL FINGERPRINTS AND CHEMOMETRIC APPROACHES**

The defense will take place digitally on

**Tuesday, 30 June 2020 at 4 p.m.**

via Teams meeting, accessible through the following link:

[Join Microsoft Teams Meeting](#)

## Summary of the dissertation

Argan oil is obtained from the fruits of the Argan tree (*Argania spinosa* L.) and it is one of the leading cosmetic and edible oils in the world. Argan oil production is considered as an imperative sector for the economy of the Southwestern Moroccan regions. Under that perspective, Argan oil sector modernization, yield increase, geographical origin protection and quality control enhancement, are priorities for the Moroccan agricultural authority. Quality control and geographical characterization of Argan oil have been among the specific objectives of our research for protecting this heritage and increasing its economic value. Our studies have focused on the establishment of efficient instrumental analytical methods, combining the comprehensive characterization of the Moroccan Argan oil composition (by developing fingerprints) and chemometric data treatment in order to develop trustworthy and efficient tracing models for geographical origin, authentication, shelf life and quality control. Briefly, the studies were conducted on more than 600 Argan oil samples, collected from five Moroccan regions (Ait-Baha, Agadir, Essaouira, Tiznit and Taroudant) during the harvest seasons between 2011 and 2018. Geographical classification, quality characterization, authentication and oxidative evaluation of these Moroccan Argan oils were carried out using several fingerprint techniques (FTIR, NIR, Raman, UV-Visible and SIFT-MS) and chemical properties profiling (i.e. free acidity, peroxide value, spectrophotometric indices, fatty-acid composition, tocopherol and sterol contents) associated with chemometric tools. Finally, it should be noted that the results are of great interest for the valorization and protection of the Argan tree, the Argan oil and for the human sustainability in the Southwestern Moroccan regions.

## Curriculum Vitae

Mourad Kharbach was born on 9th January 1989 in Morocco. He obtained his MSc degree in Analytical Chemistry and Chemometrics with distinction in 2013 from the Sidi Mohamed Ben-Abdellah University, Sciences and Technologies Faculty, Fes (Morocco). In 2014 he started his PhD at the Bio-Pharmaceutical and Toxicological Analysis Research Team, Laboratory of Pharmacology and Toxicology, Faculty of Medicine and Pharmacy, University Mohammed V, Rabat, Morocco, under the promotorship of Prof. A. Bouklouze focusing on the "Chemical characterization, geographical traceability and quality control of Moroccan Argan oils: analytical fingerprints and chemometric approaches". In 2015 a joint PhD with the Department of Analytical Chemistry, Applied Chemometrics and Molecular Modelling, Vrije Universiteit Brussel, Belgium, was started under the supervision of Prof. Y. Vander Heyden. He was awarded a grant from the TEAM project Research & Development VLIR-UOS 2017-2020 (Belgium-Morocco). During his PhD he spend 7 months (2019) as Research fellow at the Department of Food Science Quality & Technology, Faculty of Sciences, University of Copenhagen under supervision of Prof R. Bro. His work resulted in 23 co-authored publications (five as first author) in international peer-reviewed journals and 1 book chapter, along with 32 poster and 16 oral presentations at national and international scientific conferences. He cooperated with several national and international researchers. Mourad was also co-promoter of five master theses, and assisted in the Chemometric and Analytical Chemistry courses in the Master "Quality Assurance of the Drug" at Faculty of Medicine and Pharmacy, Rabat.