

1. PHD PROJECT DESCRIPTION (4000 characters max., including the aims and work plan, all in English)

Project title: New cosmetic formulations based on natural ingredients

- 1.1. **Project goals:** Main goal of the project is to develop new formulations of skin and hair cosmetics based on extracts and oils of plant origin.

- 1.2. **Outline:** Cosmetic ingredients influence the skin properties after topical application. The aim of this project is preparation of several emulsions containing selected active agents extracted from natural sources and to study the skin and hair properties after topical application of the cosmetic formulation. An integral part of the work will be characterization of extracts and oils which will be obtained from plants taking into account their potential as the biologically active compounds (polyphenols, vitamins, antioxidant, antibacterial agents). For chemical study the following instruments will be used: FTIR-spectrophotometer, UV-Vis spectrometer, XRD, SDS-Page electrophoresis, GPC chromatography, HPLC, AFM and SEM microscopy, apparatus for contact angle measurements, apparatus for measurements of mechanical properties of hair, UV-Vis spectrofluorimeter, apparatus for thermal analysis, rheometer, several viscometers, centrifuge for protein purification, lyophilizer. For the study of skin properties the following instruments will be used: corneometer, sebumeter, colorimeter, ARAMO TS for study the skin elasticity and general look.

- 1.3. **Work plan:** **1)** extraction of natural compounds; **2)** purification and characterization of natural compounds; **3)** study of preservative, antioxidant and/or emulsifier potential; **4)** development of new cosmetic emulsions based on selected natural ingredients; **5)** study of the stability of cosmetic formulation in different conditions; **6)** characterization of skin and hair properties after topical application of new product.

1.4. Literature

- A. Sionkowska, B. Kaczmarek, M. Michalska, K. Lewandowska, S. Grabska. Preparation and characterization of collagen/chitosan/hyaluronic acid thin films for application in hair care cosmetics. *Pure and Applied Chemistry* 2017; 89(12): 1829–1839.
- J. Kozłowska, K. Pauter, A. Sionkowska. Carrageenan-based hydrogels: Effect of sorbitol and glycerin on the stability, swelling and mechanical properties. *Polymer Testing* 2018; 67: 7-11.
- A. Sionkowska, B. Kaczmarek. Polysaccharides from natural sources for biomedical and cosmetic applications. *Proceedings of the 13th International Conference on Polysaccharides-Glycoscience*. Czech Chemical Society 2017; 15-17.
- J. Kozłowska, A. Kaczmarkiewicz, N. Stachowiak, A. Sionkowska. Evaluation of sebostatic activity of *Juniperus Communis* Fruit Oil and *Pelargonium Graveolens* Oil Compared to Niacinamide. *Cosmetics* 2017 4(3), 36; doi:10.3390/cosmetics4030036.
- A. Filipiak-Szok, M. Kurzawa, E. Szłyk, M. Twarużek, A. Błajet-Kosicka, J. Grajewski. Determination of mycotoxins, alkaloids, phytochemicals, antioxidants and cytotoxicity in Asiatic ginseng (*Ashwagandha*, *Dong quai*, *Panax ginseng*). *Chem. Pap.*, 2017; 71 no. 6: 1073-1082.
- A. Filipiak-Szok, M. Kurzawa E. Szłyk, Simultaneous determination of isoquinoline alkaloids in medicinal Asiatic plants by ultrasound-assisted extraction and high-performance liquid chromatography – mass spectrometry with principal component analysis, *Analytical Letters*, 2018;16 (51): 2575-2585.

1.5. **Required initial knowledge and skills of the PhD candidate:** basic knowledge on analytical chemistry, cosmetic chemistry, biotechnology, cosmetology, pharmacy. Basic skills in laboratory work, knowledge of speaking and writing English.

1.6. **Expected development of the PhD candidate's knowledge and skills:** It is expected that the PhD candidate will learn new techniques of extraction and purification of natural compounds from plants. He/she will be able to use modern techniques for the characterization of the extracts and get skills of new cosmetic preparations. The knowledge of the PhD candidate will be developed base on international workshops and tutorials.