

The aging of society is observed in highly developed countries all over the world. As for lifespan prolonging, the number of neurodegenerative disease cases elevates. According to World Health Organization, around 50 million people worldwide are currently affected by dementia, and there are nearly 10 million new cases every year. Every 3 seconds, there is someone that develops dementia. It is predicted to be 82 million dementia cases in 2030 and 152 million in 2050. The most common form of dementia is Alzheimer's disease and the second major disorder is Parkinson's disease, affecting 10 million people. It is predicted that the number of cases may double soon.

In the time of the COVID-19 pandemic, it is essential to pay attention to the long-term effects of being infected with the SARS-CoV-2 virus. In many cases, the course of the disease is mild. In difficult cases, it may also induce neuroimmune reactions. COVID-19 might impact the central nervous system by direct SARS-CoV-2 infection of neuronal cells. Patients during infection develop cytokine storm, a neuroinvasion which can cause severe central and peripheral nervous system complication. As a result, they can develop post-infection neurological sequelae like Parkinsonism. SARS-CoV-2 can infect anyone, regardless of age, which is why it is so important to prevent affection of the nervous system, for instance, by using strong antioxidants with anti-inflammatory and neuroprotective properties, which are present naturally in plant materials.

The main research goal of the project is the possibility of optimization of the extraction process of turmeric rhizome, cannabis flower/inflorescence, and hop strobile so that it will be targeted to obtain the maximum phenolic composition (curcuminoids, cannabinoids, and prenylflavonoids and flavonols), and according to powderization with an appropriately selected method with carefully chosen excipients will improve biologically active substances physicochemical properties and, additionally, maximize their preventive effect in neurodegenerative processes.

Project implementation is divided into three years. Each year will be dedicated to raw material from one plant species. In the first year, the complex research is planned for turmeric – *Curcuma longa* (*Curcumae rhizoma*), subsequent for hemp – *Cannabis sativa* (*Cannabis flos/inflorescentia*), and during the third year, the studies will be conducted for hop – *Humulus lupulus* (*Lupuli flos*).



The research will be conducted for each plant species in the following areas:

- (1) Optimization of the process extraction with a designed composition to the structures of phenolic compounds
- (2) Powderizing the extracts and obtaining powdered systems of phenolic structures with carriers
- (3) Determination of the biological and physicochemical activity

The research conducted as part of this project will be pioneering, as there are currently no powder systems from optimized, targeted extraction as effective neuroprotective agents. Moreover, prepared systems within the project will enable the later preparation of formulations for people of all ages. This project will also promote the importance of neuroprotective effects in people who may develop a neurodegenerative disease, in people who are already being treated for neurodegenerative diseases, but also in people at risk of post-covid complications related nervous system, including young people.