Chemical compounds containing fluorine in their structure have been known for many years. In the groups of these compounds are chemicals with a carbon backbone connected to fluorines that saturate most carbons and at least one functional group, such as a sulfonic acid, carboxylic acid, amine, or other. This group has been called per and polyfluoroalkyl chemicals (PFAS). The unique properties of these compounds meant that from around 1950 they began to be used on an industrial scale with great interest. The phenomenon of these compounds results from their structure. The chemical and thermal stability of the perfluoroalkyl structures, as well as hydrophobicity and lipophobicity, make these chemical compounds have very useful and durable properties. The discovery of unique properties of PFAS, such as hydrophobicity, resistance to temperature and chemicals, and surface-active properties, led to its use in a wide range of products. PFAS are currently used widely, for example, in paper food packaging, creams and cosmetics, textiles for furniture and clothing, fire-fighting foams, non-stick metal coatings, paints and photography, chrome plating, pesticides and pharmaceutical products, etc.

Such widespread and obvious use of PFAS began to raise serious global concerns about 25 years ago due to the discovery that, in addition to their phenomenal functional properties, these substances were also suspected of having very toxic effects. The fears were confirmed that due to their thermal inertness and resistance to biodegradation, these compounds, apart from their toxicity, also exhibit environmental mobility, bioaccumulation and environmental persistence. These shocking reports have led some manufacturers in developed countries to phase out dangerous PFAS compounds and replace them with analogues. However, over time, it turned out that the newer generation compounds exhibited just as dangerous properties as their predecessors. These chemicals have been detected everywhere: in surface and groundwater, in soil, and even in human blood. A global policy has begun to raise awareness of the dangers of PFAS, and these compounds have been labelled "forever chemicals". As of August 2021, the U.S. Environmental Protection Agency's (US EPA) CompTox Chemicals Dashboard list of PFAS contains over 14,000 entries. However, the exact number of these compounds is not known. New compounds with similar toxicity but slightly modified chemical structures are constantly emerging.

As the controversy surrounding PFAS continues to spread around the world, work has also begun to remove them from water and soil. In the era of constant environmental pollution by humans, sustainable PFAS elimination technologies seem to be particularly valuable. They assume complete destruction of the material. However, the combustion technologies of these compounds are very energy intensive due to the C-F bond. In the case of drinking water treatment, the amounts of PFAS can be relatively small, which, in order not to increase the energy consumption of the method, requires water concentration. In this case, reverse osmosis is used mainly, but also distillation or, for example, ion exchange. It would seem that due to its molecular weight, PFAS would be successfully removed at the ultrafiltration stage. However, their specific chain structure means that when properly arranged, the molecule is freely transported through the pores in the membrane. Therefore, reverse osmosis membranes are the most commonly used and filtration processes supported by electrolytes, for example, are in the research phase. In the presented project, we will be made to obtain a filter molecularly imprinted filter membrane, MIM, with a layer specific for PFAS. Due to the fact that the carbon-fluoro chain is a common part of all PFAS, the molecular imprint that will be created on the membrane will show an affinity for all such compounds. In this way, it will be possible to remove these harmful chemicals in a process that requires much less energy than reverse osmosis.. Molecularly imprinted polymers (MIPs) are created by simultaneous polymerisation and cross-linking in the presence of a template. This template creates specific molecular cavities in the polymer network that are fitted to it like a lock and key.

In the literature, publications describe the synthesis of MIP specific for PFAS. However, these are not mainly materials used for water purification but primarily for the detection of various types of these compounds. No work was found that describes the production of an MIM membrane for PFAS. This may indicate the lack of such reports and thus the innovation of the proposed water purification method. This seems to be particularly important from the point of view of water treatment or ultrapure water for applications such as medical use. The proposed membrane could play a supporting role in the production process of not only drinking water, but also water polishing for ultrapure water production. In the case of using a stack of MIM membranes imprinted towards various micropollutants, it might even be possible to minimise the reverse osmosis process, which would significantly reduce the energy input required by this process. Cost reduction would fit perfectly into the policy of sustainable development and green chemistry.