

Urine screening is one of the basic medical diagnosis. Urine is a body fluid produced in kidneys, containing metabolic products that are harmful or unnecessary for the body. The daily amount of urine excreted by a healthy person should be in the range of 600 - 2500 ml. This amount is dependent on many factors, including diet, fluid intake, and environmental temperature. Urine consists of 96% water, 2.5% nitrogenous waste products (e.g. urea, uric acid, ammonia), and the rest are mineral salts (phosphates, carbonates, chlorides) and a small amount of substances responsible for the color and smell. Reduced or elevated levels of the selected substances may suggest infection or the initial stage of the disease. A urine testing can help to diagnose problems with the kidneys, liver, and urinary tract. It allows for the assessment of the predisposition to form kidney stones, and also facilitates the diagnosis of diabetes, jaundice and pancreatitis.

Urine testing can be performed with advanced and costly laboratory infrastructure operated by the trained personnel or colorimetric test strips dedicated for the analysis of a few analytes (chemical or biological). The first solution is highly accurate for the price of associated costs where the latter offer extremely low cost at the same time being burden with significant analytical error. The idea of this project is to develop cheap and simple sensing procedure that will be an alternative for widely available strip tests, and at the same time will provide high selectivity together with the quantitative output.

In this project, the electrochemical activity of a few selected biomarkers which can be found in urine will be investigated at the interface between two immiscible electrolyte solutions (water || oil interface). Polarizable liquid-liquid interfaces will be gelled, and combined with a specially designed 3D-printed cell. Created system will be used for electroanalytical studies. The applicability of the fabricated system will be checked. The initial studies will be performed using synthetic urine samples. Optimized procedures will be then employed to detect chosen analytes in real urine samples.

The multidisciplinary nature of the proposed project will affect the development of many fields of science, such as electrochemistry, medical chemistry, 3D printing technology and analytical chemistry. The fundamental knowledge obtained within this project is of highest societal importance.