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International Scientific Conference

**THE IMPACT OF THE COVID-19 PANDEMIC ON THE
ECONOMY AND THE ENVIRONMENT IN THE ERA OF THE
FOURTH INDUSTRIAL REVOLUTION**

BOOK OF ABSTRACTS

Međunarodna naučna konferencija

**UTICAJ PANDEMIJE COVID-19 NA EKONOMIJU I
ŽIVOTNU SREDINU U ERI ČETVRTE INDUSTRIJSKE
REVOLUCIJE**

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INTERNATIONAL SCIENTIFIC CONFERENCE

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APPLICATION OF SENSORS BASED ON MOLECULARLY IMPRINTED POLYMERS FOR VIRUS DETECTION

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Molecularly imprinted polymers (MIPs) are new functional polymers with pre-designed molecular selectivity. Synthesis of MIP is performed using a template added into a polymer matrix. After that, the template is removed, leaving cavities and active binding sites. A template could be a target compound, its fragment or a molecule similar to the target molecule by its size, shape and functional groups (dummy template). In this way, the molecularly imprinted polymers can be bonded to original templates, as well as related template molecules. Due to their robustness, long-term stability, high selectivity, reproducibility, and cost-effectiveness, they are suitable for a wide range of applications such as chemical and biological sensors, solid-phase extraction, selective carriers for various types of chromatography, artificial receptors for drug testing, and human viral pathogens detection. Because of continuous evolution and fast virus mutation, there is a need for technologies that would evolve as fast. So far, MIP has been used for the detection of influenza virus, dengue virus, and human immunodeficiency virus. Detection of different subtypes of influenza virus (H5N1, H5N3, H1N1, H1N3, and H6N1) is obtained using a quartz sensor QCM coated with MIP based on methacrylate and N-vinylpyrrolidone. To detect the dengue virus, a MIP has been developed to recognize the non-structural protein NS1 found in the virus itself. Linear 15-mer peptides derived from NS1 protein of Japanese encephalitis are used as a template (Thr-Glu-Leu-Arg-Tir-Ser-Trp-Lis-Thr-Trp-Gli-Lis-Ala-Lis-Met) based on dengue NS1 virus epitope mapping to antibody D2/8-1. Dopamine is used as a functional monomer for the synthesis of MIP for HIV detection, while a synthetic peptide with 35 amino acid residues similar to the amino acid sequence on the glycoprotein HIV-1 gp41 is used as a template. Based on previous research of similar viruses, this type of polymer is found to have a potential for coronavirus detection. A specific coronavirus aptamer would be used as a template, while the monomers would be acrylate-based.

Keywords: MIP, COVID-19, QCM, synthesis, pathogen, detection.

PRIMENA SENZORA NA BAZI MOLEKULSKI OTISNUTIH POLIMERA ZA DETEKCIJU VIRUSA

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Molekulske otisnute polimere (MIP) predstavljaju nove funkcionalne polimere sa unapred dizajniranom molekulsom selektivnošću. Sintaza MIP-a se vrši korišćenjem šablona koji se dodaje u polimernu matricu, nakon čega se uklanja ostavljajući šupljine i aktivna mesta vezivanja. Šablon može biti ciljno jedinjenje, njegov fragment ili molekul veličine, oblika i funkcionalnih grupa sličnih ciljnom (tzv. lažni šablon). Na taj način molekulske otisnute polimere mogu vezati kako originalne, tako i srodne molekule šablona. Zahvaljujući robusnosti, dugoročnoj stabilnosti, visokoj selektivnosti, obnovljivosti i ekonomičnosti pogodni su za širok spektar primene kao što su hemijski i biološki senzori, ekstrakcija čvrste faze, selektivni nosači za različite vrste hromatografije, veštački receptori za ispitivanje lekova, kao i za detekciju humanih virusnih patogena. Zbog stalne evolucije i brzine mutiranja virusa javlja se potreba za tehnologijama koje će ići u korak sa novonastalim situacijama. U dosadašnjim istraživanjima MIP je korišćen za detekciju virusa gripa, dengue virusa, kao i virusa humane imunodeficijencije. Detekcija različitih podtipova virusa gripa (H5N1, H5N3, H1N1, H1N3 i H6N1) ostvarena je pomoću kvarcnog senzora QCM koji je premazan MIP-om na bazi metakrilata i N-vinilpirolidona. Za otkrivanje virusa dengue razvijen je MIP za prepoznavanje nestrukturnog proteina NS1 koji se nalazi u samom virusu. Linearni 15-merni peptidi izvedeni iz NS1 proteina Japanskog encefalitisa korišćeni su kao šablon (Thr-Glu-Leu-Arg-Tir-Ser-Trp-Lis-Thr-Trp-Gli-Lis-Ala-Lis-Met) na osnovu mapiranja epitopa virusa dengue NS1 prema antitelu D2/8-1. Kao funkcionalni monomer u sintezi MIP-a za detekciju HIV virusa koristi se dopamin, dok se kao šablon koristi sintetički peptid sa 35 aminokiselinska ostatka sličan aminokiselinskoj sekvenci na glikoproteinu HIV-1 gp41. Na osnovu prethodnih saznanja o sličnim virusima, ova vrsta polimera mogla bi da ima potencijalnu primenu za detekciju korona virusa. Kao šablon koristio bi se specifični aptamer korona virusa, a monomeri bi bili na bazi akrilata.

Ključne reči: MIP, COVID-19, QCM, sinteza, patogen, detekcija.