Extended Abstract Journal of Clinical and Bioanalytical Chemistry 2020
Vol.4 No.1

Analytical Chemistry 2019: Binding of leachable components of polymethyl methacrylate (PMMA) and peptide on modified- M Szaloki - University of Debrecen

M Szaloki
University of Debrecen, Hungary

Many types of polymers are often used in dentistry, which may cause allergic reaction, mainly methyl methacrylate allergy due to the leachable, degradable components of polymerized dental products. The aim of this study was to investigate the interaction between the leachable components of PMMA and peptides by Fourier-transform Surface Plasmon Resonance (FT SPR). In our previous work binding of oligopeptides (Ph.D.-7 and Ph.D.-12 Peptide Library Kit) was investigated to PMMA surface by phage display technique. It was found that oligopeptides bounded specifically to PMMA surface. The most common amino acids were leucine and proline inside the amino acids sequences of DNA of phages. The binding of haptens, as formaldehyde and methacrylic acid, to frequent amino acids was to investigate on the modified gold SPR chip. Self-assembled monolayer (SAM) modified the surface of gold chip and ensured the specific binding between the haptens and amino acids. It was found that amino acids bounded to modified SPR gold and the haptens bounded to amino acids by creating multilayer on the chip surface. By the application of phage display and SPR modern bioanalytical methods the interaction between allergens and peptides can be investigated. Polymers have a major role in most areas of dentistry. Their properties allow a range of clinical applications not possible with other types of materials. The most common applications of polymers in dentistry include impression materials, aesthetic restorative materials, denture teeth, cements, dies, provisional crowns, endodontic fillings, tissue conditioners, pit, and fissure sealants. However, the primary use of polymers in terms of quantity is in the construction of complete dentures, the tissuebearing portions of partial dentures, and the base-plates of removable orthodontic appliances. The polymethyl methacrylate (PMMA) denture base material is cured from methyl methacrylate (MMA) monomer by a free radical polymerization. This polymerization can be activated either by heating or chemically or both. The most often used initiators are benzoil peroxide (BPO) as a heat activated and dimethyl-p-toluidine as chemical activated. The conversion of MMA monomers to PMMA polymer is not complete and some free monomer content remains in the polymer. The residual monomer release from the polymer and can cause allergic reaction. The leachable components were analyzed by some researcher and it was found that the most frequent are (methyl) (meth)acrylate monomers, (meth)acrylic acid, formaldehyde (FA) and benzoil peroxide. The leaching out process of components depends on many factors, like test conditions, medium, pH, thickness of inhibition layer on the surface, method of manipulation, powder-liquid ratio, curing process. The reactive functional group of methacrylate based materials is the unsaturated C-C bond, which is in not only the residual monomer but the formed polymer chain. This group is able to hydrolyze and oxidize. The hydrolysis product of functional group is methacrylic acid and the oxidation product is the formaldehyde. The cytotoxicity of denture base acrylic resin within methacrylate was the most investigated. The formaldehyde as small molecules can cause allergy reaction in low concentration. The formaldehyde has cross linked proteins, which leads to structural changing of peptide. At the dental application of PMMA the residual free monomers together with other components leaching out from dental methacrylate based polymers and may contribute to local allergic reaction. Contact allergy is common among dental practitioners and patients. During the past two decades the incidence of allergies against dental materials has been rising. There is evidence that, while adverse reactions to dental materials are not as frequent, they can occur for many types of materials used in orthodontics, including alloys, resins, etc. Researchers found 2.3% positive patch test results to (methy)acrylate (2- hydroxyethyl methacrylate, HEMA; ethylene glycol dimethacrylate, EGDMA; bisphenol A diglycidyl ether methacrylate, bis-GMA) allergens in dental patients, and 5.8% of the dental personnel. This study reports plant-mediated co-reduction approach for the synthesis of Ag/Ni bimetallic nanoparticles (Ag/Ni BNPs). In view of sustainability development, aqueous leaf extract of an indigenous *Senna occidentalis* (coffee senna) acted as a reducing agent. Cold extraction was carried out on the biodiversity plant using water and methanol as solvent media by way of "green" synthesis. Qualitative analysis was done to identify possible secondary metabolites present in the extract. Synthesis of the nanohybrid was achieved using two different precursor concentrations at 70°C. Techniques including Uv-visible spectroscopy, scanning electron microscopy and energy dispersive X-ray spectroscopy were engaged for optical, morphological and compositional characterisation of the Ag/Ni BNPs, respectively. The reaction colour changed from green to dark brown due to the excitation of electron and change in the electronic energy levels of metal nanoparticles. Presence of nickel in the nanohybrid resulted in blue shift in the absorbance wavelengths when compared with the corresponding monometallic Ag NPs (341 to 327 nm). The optical property displayed by Ag/Ni BNPs is a pointer for potential application as optical material.

Biography:
Melinda Szalóki, chemist, defended her doctoral thesis with the qualification of summa cum laude in 2013. In her PhD thesis she summarized the results of her 10 years research work, the application possibilities of reactive polymer nanoparticles in dentistry. The supervisor was Prof. Csaba Hegedűs MD, LDS,

This work is partly presented at 20th world congress on clinical and bioanalytical chemistry on October 30-31,2019 at Londan (UK)

PhD. Her results was published in international journals, in Colloid and Polymer Science, in Macromolecules and in Reactive and Functional Polymers. In 2013, she has won Ányos Jedlik Doctoral Candidate Scholarship in the framework of TÁMOP4.2.4.A/2-11/1-2012-0001'National Excellence Program'. The topic of the ongoing research is the investigation the bindings of oligopeptides to poly methyl methacrylate (PMMA) surface by phage display and Fourier transformation surface plasmon resonance spectroscopy (FT-SPR). She is involved in the education activities of Dental Materials and in Student's Research Work as a supervisor. Dr. Melinda Szalóki was awarded on the IAAM 2016 (by the International Association of Advanced Materials) in Stockholm. Her research area are immediate repair of resin based composite, characterization of 3D printable dental polymers, application possibility of gold nanoparticles in dentistry and investigation of biomolecular interaction with phage display and Fourier Transformed Surface Plasmon Resonance (FT-SPR) spectroscope.

Email: szaloki.melinda@dental.unideb.hu

This work is partly presented at 20th world congress on clinical and bioanalytical chemistry on October 30-31,2019 at Londan (UK)