4th WORKSHOP: SPECIFIC METHODS FOR FOOD SAFETY AND QUALITY

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SYNTHESIS OF SILVER'DOPED FLUOROAPATITE AS PERSPECTIVE FILLER FOR FOOD PACKAGE

Vojislav Stanić[a], Ana S. Radosavljević-Mihajlović[a], Vukosava Živković-Radovanović[b], Branislav Nastasijević[a], Jelena P. Marković[a], Marija Janković[a], Karolina Kalić[c], Dragoljub Jovanović[d]

[a]*University of Belgrade, Vinča Institute of Nuclear Sciences, P.O. Box 522, 11001 Belgrade, Serbia*
[b]*University of Belgrade, Faculty of Chemistry, P.O. Box 51, 11158 Belgrade, Serbia*
[c]*University of Belgrade, Faculty of PhysicalChemistry, P.O. Box 137, 11158 Belgrade, Serbia*
[d]*University of Belgrade, Faculty of Veterinary Medicine, 11000 Belgrade, Serbia*

voyo@vinca.rs

Antimicrobial material based on fluorapatite with 0,5% silver, was done by wet method fom CaO, NaF,$AgNO_3$ and H_3PO_4.Characterization studies from XRD, SEM and FTIR spectra showed that particles of the sample is of nano size and they do not contain any discernible crystalline impurity.Antimicrobial studies have demonstrated that the silver-doped fluorapatite sample exhibit excellent antimicrobial activity in vitro against the Staphylococcus aureus. The percentages of viable cells reduction was 98%.

Antimicrobial packaging is one of the innovative foodpackaging concepts that has been introduced as the need to maintain quality of the food for a long-time.Microbial contamination of food reduces the quality of food, limits the shelf life of the food, and increases the risk from illness of the consumer.The use of packaging materials containing antimicrobial agents must meet several conditions: efficiency and and the migration of the antimicrobial agents from the packaging material tothe surface of the productnegligible.

Commercial polymeric composites containing silver-substituted zeolite (Zeomic®,AgIon®, Apacider®, and Bactekiller®) proved to be excellent material for food packaging.

The objective of this research is to synthesize new antimicrobial material based on silver-doped fluorapatite (AgFAP)as polymer composite filler. Antimicrobial activities of the synthesized material was tested for Staphylococcus aureus. That patogen is very important, because it has the ability to make many different toxins that are frequently responsible for food poisoning [3].Antimicrobial materials based on silver-doped apatite haveshown excelent antimicrobial activity, long lasting and physico-chemical stability[4].

The starting materials were CaO, $AgNO_3$, H_3PO_4 and NaF of p.a. grade of purity.The $Ca(OH)_2$ suspension was prepared by stirring a required amount of CaO into 500mL distilled water heated to 60 °C. A required amount of$AgNO_3$ and NaF was dissolved in 300mL of 0.5M H_3PO_4. The Ag fraction is represented at starting atomic ratios, Ag/(Ca +Ag); 0.005 with the atomic ratio (Ag + Ca)/P, fixed at 1.67. Then the solution was added dropwise to a suspension of $Ca(OH)_2$. After the titration, stirring in the suspension at 25 °C was continued for a further 10 h. The obtained precipitate was filtered in a Buchner funnel, washed by distilled water, dried at 105 °C and grained in a mortar.

Antimicrobial activities of the sample was investigated against S. aureus by liquid challenge method in buffer solution (pH 7.4) according to Stanić et al. [4].

Synthesized sample was analyzed by X-ray diffractometry, XRD (Philips PW 1050), using CuK1.2 Ni-filtered radiation.

The FTIR spectra of synthesized apatite sample, was recorded by a Nicolet 6700 FTIR spectrophotometer (Thermo Scientific) using the ATR technique.

The morphology of the obtained powder was studied by scanning electron microscopy (SEM) TESCAN Mira3 XMU at 20 kV. The XRD patterns of the sample is shown in Fig. 1.

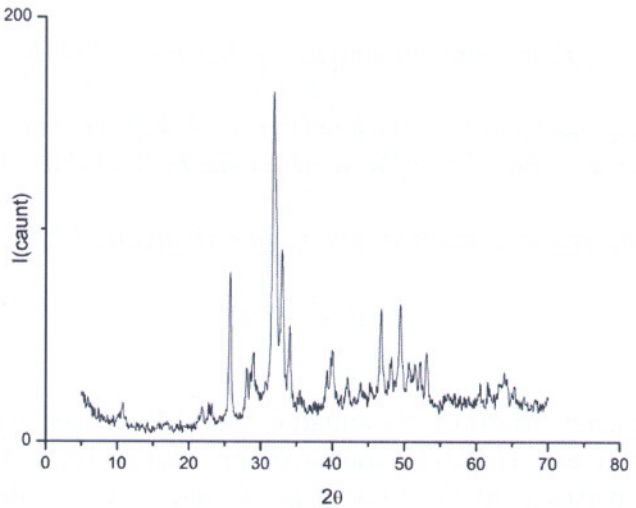

Fig. 1. XRD pattern of the AgFAP sample.

The XRDpatterns of AgFAP sample is was in accordance with ASTM data (Card 15-0876).

All of the diffractionpeaks were sharp and well resolved, indicating the obtainedphase pure, well crystallized silver-doped fluorapatite. Fig. 2 shows the FTIR spectra of the AgFAP sample.

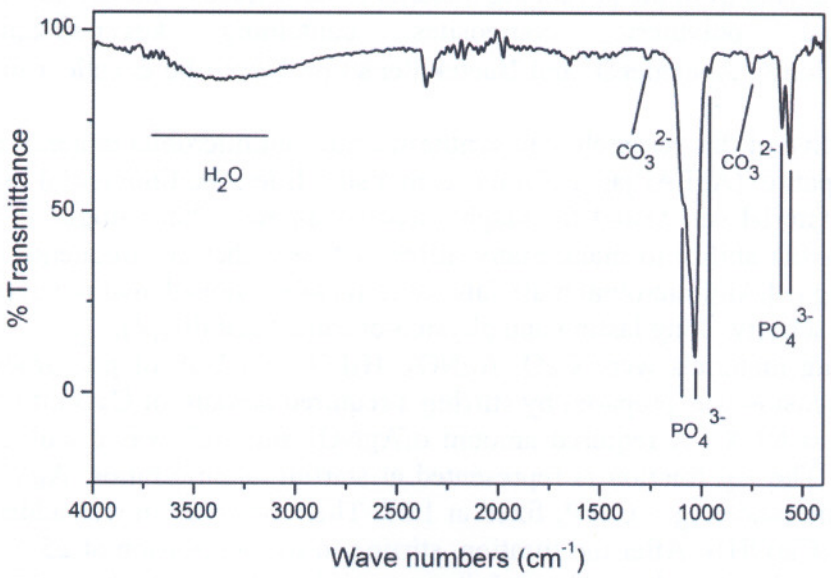

Fig. 2. FTIR spectra of the AgFAP sample

The spectra show the characteristic bands of absorbedwater, carbonate and phosphate species. SEM micrograph of the synthesized sample is presented in Fig. 3.

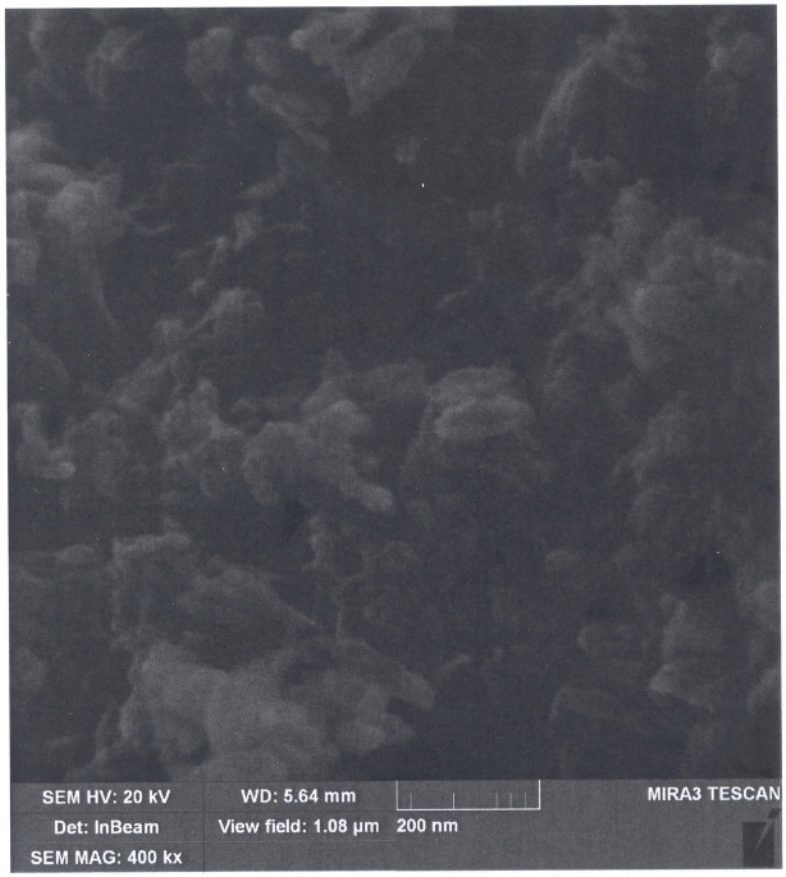

Fig. 3. SEMmicrographs of the AgFAP sample

It can be seen that the particles are more or less uniformed in size andof irregular shape in all cases.The average length of particles in all samples isabout 80 nm and about 15 - 25 nm in diameter.

The results of the quantitative antimicrobial tests in liquid medium demonstrate that the AgFAP sample show viable cellreduction of 98% of S. aureus.

In this study, the wet method has been successfullyused for synthesis of monophase silver-doped fluorapatitenanoparticles, which have antimicrobial properties. The analysis ofXRD, FTIR and SEM showed that particles of silver-doped fluorapatite sample are of nano size and homogenous in composition.Antimicrobial study shows that synthesized sample has excellent activity againstS. aureus.Thus, prepared silver-doped fluorapatite nanopowders can be applied as antimicrobial materials of various purpose such as for synthesys of antimicrobial food packaging, treatment of microbiologically polluted water, for medicine and for general use.

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