SUMMARY

The original method for obtaining spherical nanosilica containing immobilized silver nanoparticles (Ag-SiO_2) has been developed. Prepared Ag-SiO_2 was incorporated into wood fiber filled polypropylene composites. In order to improve the dispersion degree of wood fiber and silica as well as to increase compatibility between the fillers and PP matrix, maleated ethylene-*n*-octene copolymer (MEOC) was used as a compatibilizer. The composites were prepared by one-step melt mixing using a twin-screw co-rotating extruder. Several interdisciplinary research methods, *e.g.*: PSC, BET, AAS, XRD, DSC, TGA, DMTA and SEM were used to evaluate selected properties (physic-chemical, thermal and mechanical properties) and morphology. Furthermore, the adenosine triphosphate (ATP) determination, plate, culture and fluorescence microscopy methods were used to evaluate microbiological properties. XRD results proved the presence of metallic silver in Ag-SiO_2. Furthermore, it has been proven, that Ag-SiO_2 has 100 % biocide effect on *Escherichia coli* and *Staphylococcus aureus*. Composites with Ag-SiO_2 showed bactericidal properties. However, 100 % biocide effect against *Staphylococcus aureus* was observed. Increased compatibility between wood fiber and PP matrix and uniform dispersion of Ag-SiO_2 were observed in the presence of MEOC. The presence of wood fiber significantly increased stiffness and flexural strength of PP. Simultaneously, tensile strength, elongation at break and impact strength are decreased. On the contrary, compatibilizer improved elongation at break and impact strength of wood fiber filled PP due to the enhanced interfacial adhesion. The introduction of Ag-SiO_2 caused a further increase (8–18 %) of impact strength due to the improved dispersion of silica and increased compatibility between wood fiber, silica and PP matrix. Moreover, thermal stability of the composites significantly increased as a function of Ag-SiO_2. The subject matter taken in the submitted doctoral dissertation is interdisciplinary and is part of the so-called green chemistry (environmentally friendly technologies).

Key words: wood fiber nanocomposites, polypropylene, nanosilica, silver nanoparticles, wood fiber