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ANTIMICROBIAL ACTIVITY OF PHB BASED POLYMERIC COMPOSITIONS

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Abstract

Polyhydroxyalcanoates (PHAs) are naturally biodegradable thermoplastics produced by many bacteria as a carbon and energy reserve. The production of PHA from renewable natural resources is ecologically advantageous, compared with thermoplastics and elastomers production from fossil carbon sources. Carbon source affect not only PHB production but also the polymer extractability and its molecular weight. In our investigations, the selection of suitable row material for production of polyhydroxybutyrate (PHB) was based on the physiological requirements of the strain of *Azotobacter chroococcum* 23 and on the availability of the row material (row sugar, beet molasses, corn starch syrup, potato starch syrup). Starch syrups from corn and potatoes were found to be the most suitable unrefinered carbon sources for polyhydroxybutyrate (PHB) production by A. *chroococcum* 23.

A. chroococcum 23 growth and the cell composition depend on cultivation conditions. It has been demonstrated that regulation of carbon and NH_4^+ concentration in cultivation medium led to lower level of polysaccharides content in *A.chroococcum* 23 cells that promotes PHB granule isolation. Pure PHB recovered by chloroform extraction as well as native PHB granules isolated from the biomass of *A. chroococcum* 23 were used for elaboration of biodegradable PHB based composed materials. Natural and chemically synthesized antimicrobial compounds were used for preparation of antimicrobial polymeric films and polymeric layers on papers surface. Various by structure plasticizers were used for preparation of PHB based polymeric compositions (both from chloroform extracted PHB and water suspension of native PHB granules). Fluorescent dye 3-(1-piperidyl)benzo[a]phenalen-7-one (P8) was incorporated in the PHB composed materials to study its diffusion rate in dependence of the material composition. Investigations showed that films mechanical properties, especially elasticity, were highly affected by films compositions. Temperature application increased composite film's hydrophobic properties. This work was done in cooperation with Riga Technical University scientists. Antimicrobial activity of these materials was assayed by Disk Diffusion method against two Gram positive (*Bacillus cereus*, *Staphylococcus aureus*) and two Gram negative (*E. coli, Pseudomonas aeruginosa*) bacterial strains. Study of the antimicrobial activity showed that the most promising antimicrobial materials are both PHB and PHB/paper systems including Silbiol or benzoic acid.