Metschnikowia spp. yeasts as a potential biocontrol factor

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Abstract

The widespread use of chemical pesticides and preservatives has negative effects on humans, animals and natural environment. This fact gives an impulse to search for new, environmentally safe methods of limiting the growth of plant pathogens. In the fight against phytopathogens, fungicides are used, which, despite their good effectiveness, cause controversy, mainly due to the serious environmental threat, increased pathogen resistance and the health risk of food consumers and farm animals. These caveats resulting from the widespread use of fungicides have increased interest in the biocontrol agents.

Yeasts as potential biocontrol agents exist on plant leaves, roots and other structures as epiphytes. They are microorganisms well adapted to changing environmental conditions. Therefore, the search for new, effective biocontrol agents concerned unconventional yeasts of the genus *Metschnikowia*, which exist as epiphytes on the surface of Polish fruits from organic farming.

The main aim of the research was the isolation of yeast strains belonging to the *Metschnikowia pulcherrima* clade with strong antifungal activities. The identification of the isolates was confirmed by molecular methods. The physiological and biochemical characteristics of the strains as well as the formation of pulcherrimine - a metabolite whose synthesis constitutes is the main mechanism of biocontrol were assessed. *Metschnikowia* spp. isolates forming pulcherrimin were characterized by good surface colonization and wide tolerance to environmental factors. These listed features are important parameters of effective biocontrol agents. It has been confirmed in the research that the strains showed a strong activity inhibiting the development of typical phytopathogens, including *Alternaria* sp., *Botrytis cinerea*, *Verticillium* sp. The high efficiency of yeast as biocontrol agents was confirmed in storage tests of soft fruits.

The activity of *Metschnikowia* spp. isolates in vinification processes from domestic fruit raw materials was assessed. The assimilation and enzymatic profiles of the strains were assessed, as well as the chemical profiles of the obtained young fruit wines. The results of the chromatographic analyzes showed that the desired characteristics of the apple wines were obtained by using *M. pulcherrima* yeast as co-starters with *S. cerevisiae*.

The possibility of using the biomass of post-fermentation yeast *Metschnikowia* sp. in other, previously unknown applications was also investigated: obtaining yeast autolysates with a specific aminoacid profile. The obtained lysates of *Metschnikowia* spp. were

dominated by: alanine, proline, hydroxyproline, valine and leucine. Particularly interesting was the several times higher content of hydroxyproline compared to preparations obtained from *Saccharomyces* sp. cells.

The research assessed the effectiveness of the use of the yeast *Metschnikowia* sp. for deoxidation of fermentation broths sterilized with the ozonation method. Yeast biomass was the most effective deoxidizing agent, compared to ultrasounds and of iron (II) sulphate. Thanks to which complete deoxidation of malt and molasses wort intended for anaerobic bioconversion processes was achieved in the shortest time.