

## Yeast killer toxins: an opportunity for the wine and food industries

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Killer toxins are proteins or glycoproteins, naturally secreted by yeasts, that kill their sensitive targets through a receptor-mediated mechanism. Their spectrum of action includes spoilage yeasts of relevance for the fermentation, food and feed industries, but also pathogenic bacteria and filamentous fungi. Thus, they have a great potential as natural antimicrobials of interest for the agri-food industry but also as therapeutic agents. Accordingly, several inventions regarding the utilization of killer yeasts or yeast killer toxins have been patented so far (Mannazzu et al., 2019). In the wine industry, where SO<sub>2</sub> is the most widely used antimicrobial and antioxidant additive, several authors have proposed the utilization of killer yeasts in partial substitution of SO<sub>2</sub> to control the fermentative activity of undesired wine spoilage yeasts. Accordingly, the killer phenotype is one of the criteria for the selection of wine yeasts (Mannazzu et al., 2002) and some of the commercial starters for enology are killer strains of *S. cerevisiae*. However, while the utilization of killer yeasts is not questioned in the wine industry, a number of constraints, among which the dearth of studies regarding their effect on the consumers, and the production of low concentrations of killer toxins by their native producers, pose a limit to their exploitation at the industrial level in the agri-food sector.

Among killer yeasts, *Tetrapisispora phaffii* produces a killer toxin that has an extensive anti wine-spoilage-yeast activity. This toxin, named Kpkt maintains its killer activity in grape must for at least 14 days under winemaking conditions, showing therefore a great potential as bioactive compound to be used for the control of spoilage yeasts in grape must and sweet beverages.

Based on that, Kpkt was extensively characterized and its mode of action on the sensitive targets was described (Comitini et al., 2004; Comitini et al., 2009). More recently, with the aim of contributing to the development of killer toxins into a new generation of antimicrobial agents with useful application in the food and beverages industries, Kpkt was expressed in *Pichia pastoris* and lyophilized to obtain a ready to use preparation (LrKpkt) for the wine industry (Chessa et al., 2017; Carboni et al., 2020). Here, the spectrum of action of recombinant Kpkt in respect to its native counterpart and its effect on human keratocytes HaCaT cells will be discussed together with the possible applications of recombinant Kpkt in the wine and food industries.

## References

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