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Identification of *Saccharomyces cerevisiae* genes involved in the resistance to multiple stresses during Very-High-Gravity and lignocellulosic biomass industrial fermentations

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Most of the current processes for bioethanol production are based on the use of Very-High-Gravity (VHG) technology and the processing of lignocellulosic biomass, limited by the high osmotic pressure and ethanol concentration in the fermentation medium, and by inhibitors resulting from biomass pre-treatments, respectively.

Aiming the optimization of strains for industrial bioethanol production an integrated approach was undertaken to identify genes required for simultaneous yeast resistance to different fermentation-related stresses. The integration of previous chemogenomics data was used to identify eight genes whose expression confers simultaneous resistance to high concentrations of glucose, acetic acid and ethanol, chemical stresses relevant for VHG fermentations; and eleven genes conferring simultaneous resistance to different inhibitors present during lignocellulosic fermentations. The expression of *BUD31* and *HPR1* lead to the increase of both ethanol yield and fermentation rate, while *PHO85*, *VRP1* and *YGL024w* expression is required for maximal ethanol production in VHG fermentations. Five genes, *ERG2*, *PRS3*, *RAV1*, *RPB4* and *VMA8* were found to contribute to the maintenance of cell viability in wheat straw hydrolysate and/or for maximal fermentation rate of this substrate [1]. Moreover, the yeast disruptome was screened for strains with increased susceptibility to inhibitory compounds present in an industrial lignocellulosic hydrolysate obtained from wheat straw. With this genome-wide analysis, 42 determinants of resistance to inhibitors were identified showing a high susceptibility phenotype compared to the parental strain. The identified genes stand as preferential targets for genetic engineering manipulation to generate more robust and efficient industrial strains.

References
 [1] Pereira FB, Guimarães PMR, Gomes DG, Mira NP, Teixeira MC, Sá-Correia I, production in Very-High-Gravity and lignocellulosic biomass industrial fermentations", Biotechnol. Biofuels. (2011) 4:57Domingues L, "Identification of candidate genes for yeast engineering to improve bioethanol