

Biotechnological improvement in wine production: Modification of the ester content by designing new yeast strains



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INTRODUCTION

Wine is a product made from grape juice and fermented by yeasts as *Saccharomyces cerevisiae*. Its market is very demanding and so, a constant improvement is required.

The aroma and flavour of this alcoholic drink is due to infinite interactions between chemical compounds and making “on demand wine” could be seen as a great opportunity.

OBJECTIVES

The goals of this bibliographic research project are:

- How and in which parts of the process can a biotechnological improvement be done.
- Which are the compounds that can affect the aromatic profile of wine.
- Why are esters so important in the final product and how can we improve the aromatic profile of wine through them.

BIOTECHNOLOGICAL IMPROVEMENT FIELDS IN WINE



ALCOHOLIC FERMENTATION AND METABOLITES THAT HAVE IMPACT IN THE WINE AROMATIC PROFILE

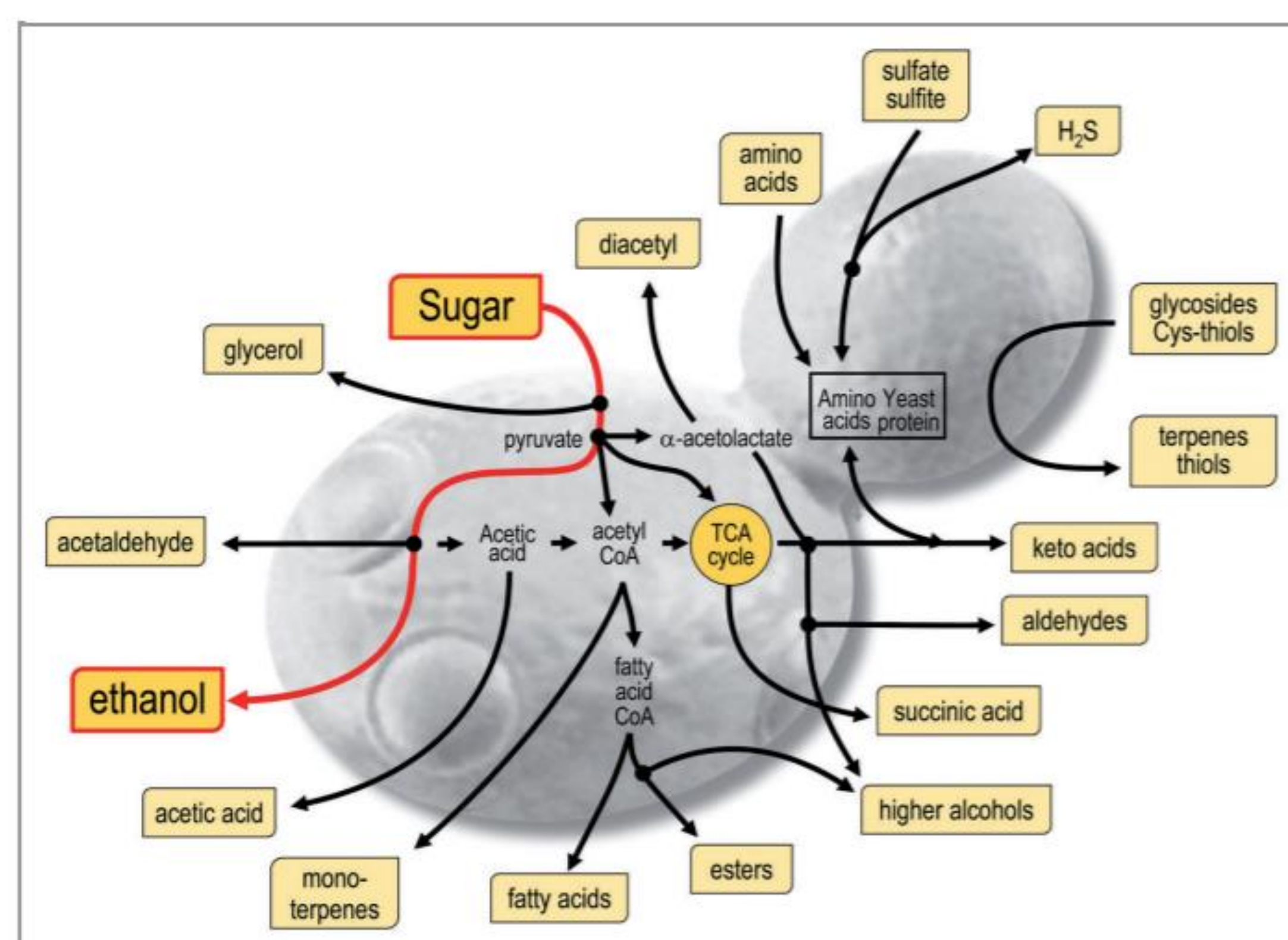


Figure 1. Alcoholic fermentation made by *Saccharomyces cerevisiae* and aromatic compounds that result from its metabolic pathways

grape juice SUGARS

S. cerevisiae

ETHANOL + CO₂

Aromatic compounds:

- Acids: Acetic acid
- Sulphur compounds: Thiols and sulphides
- Monoterpenes: linalool, geraniol,...
- Ethanol and glycerol
- Carbonyl compounds: acetaldehyde and diacetyl
- Fusel alcohols
- ESTERS**

GENE OVEREXPRESSION AND DELETION

ALCOHOL ACETYLTRANSFERASES (Acetate esters)

- ATF1 and ATF2
 - Overexpression: + isoamyl acetate, ethyl acetate
 - Deletion: - acetate esters and 50% less of ethyl acetate
- EAT1: effect on ethyl acetate

ETHANOL ACYLTRANSFERASES (Ethyl esters)

- EHT1
 - Deletion: - ethyl hexanoate, ethyl octanoate
- EEB1
 - Deletion: - ethyl hexanoate, octanoate, butanoate, decanoate,...

ESTERASES

- IAH1
 - Overexpression: - esters
 - Deletion: + esters

OTHERS

- MGL2 and YJU3: effect on substituted esters metabolism
- BAT1 and BAT2: effect on fusel alcohols metabolism

ESTERS

ACETATE ESTERS: ethyl acetate (solvent), isoamyl and hexyl acetate (banana and pineapple), 2-methylbutyl and phenylethyl acetate (fruity and floral).

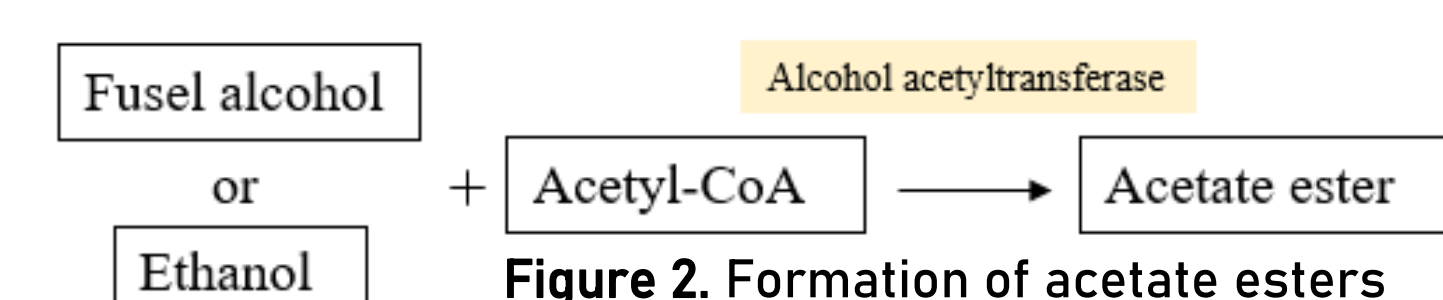


Figure 2. Formation of acetate esters

ETHYL ESTERS: ethyl octanoate (green apple), ethyl hexanoate (red apple)

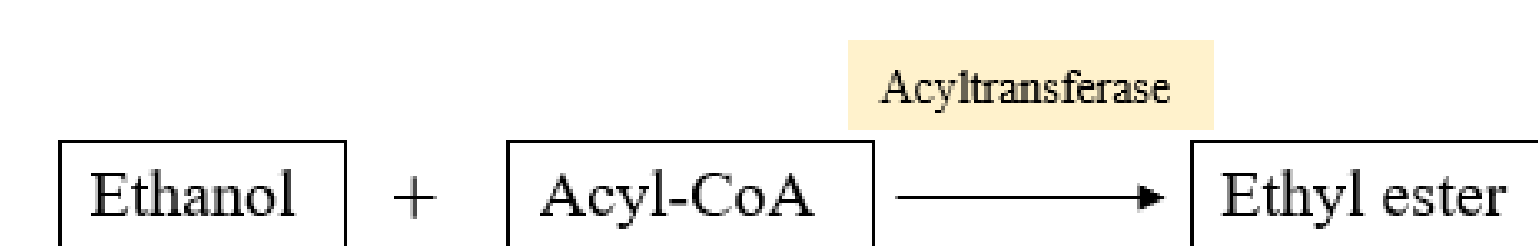


Figure 3. Formation of ethyl esters

CONCLUSIONS

- ATF2 expression could be more desirable than ATF1 expression, we aim to have a suitable aromatic profile and great amounts of ethyl acetate might produce an undesirable effect
- Combinations of overexpression and deletion of some genes could have great effect
- Oenological industry has got an important task on proving that GMOs are safe and that this progress would create the chance to produce better wines