PRODUCTION OF ACETIC ACID FROM VINE SHOOTS VIA PHOSPHORIC ACID-CATALYZED STEAM EXPLOSION AND FERMENTATION

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INTRODUCTION

To support a circular bioeconomy, this study explores the bioconversion of vine shoots, an abundant lignocellulosic residue, into acetic acid. The process involves phosphoric acid-catalyzed steam explosion pretreatment and detoxification, followed by fermentation with *E. coli* and *S. epidermidis* strains.

MATERIAL AND METHODS

VINE SHOOTS → **STEAM EXPLOSION PRETREATMENT**

- **Temperature: 190ºC**
- **Time: 5 min**
- **H_3PO_4: 2.5% w/v, 12 h (impregnation)**

COMBINED DETOXIFICATION

Activated Carbon + Ion Exchange Resins

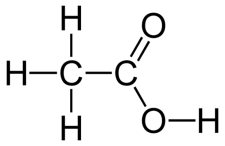
- **Activated carbon: 8% w/v**
- **Ion exchange resins: 10 % w/v**
- **Temperature: 50 °C**
- **Time: 30 min**
- **150 rpm**

MICROORGANISMS

- ***E. coli* SL 100**
- ***S. epidermidis***

FERMENTATION

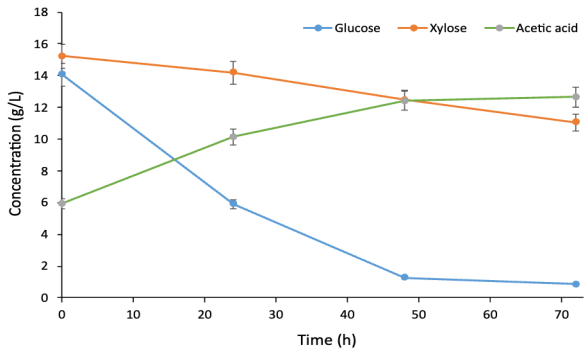
- **pH 6.7**
- **Yeast extract: 10 g/L**
- **$NaHCO_3$: 1 g/L**
- **Temperature: 37ºC**
- **150 rpm**



Acetic acid

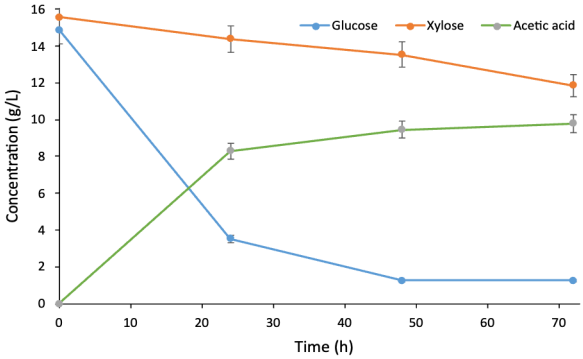
RESULTS AND DISCUSSION

a)



Regarding Figure a, *S. epidermidis* reached the highest total acetic acid concentration at 12.7 g/L. However, its efficiency was lower than it appeared, resulting in a yield of 0.43 g/g. This is because the strain benefited from approximately 5.9 g/L of acetate that was already present in the medium before fermentation began.

b)



As shown in Figure b, *E. coli* SL100 displayed superior bioconversion performance in terms of net production. This strain synthesized 9.8 g/L of acetic acid from 17.3 g/L of metabolized sugars, achieving a higher yield of 0.56 g/g. These results highlight the potential of the SL100 strain, as its efficiency is comparable to that of recombinant strains used on other corn-based hydrolysates.

CONCLUSIONS

- Phosphoric acid-catalyzed steam explosion successfully breaks down the resistance of vine shoots, making them suitable for fermentation.
- While *S. epidermidis* is robust in accumulating the final product, *E. coli* SL100 is more efficient at converting sugar into acid.
- Due to its higher conversion yield, E. coli SL100 is identified as the best candidate for large-scale industrial production.
- This process provides a validated method to turn viticulture waste into a renewable and competitive alternative to fossil-based acetic acid.

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