

# Fluctuations of the pH shape the microbiome of anaerobic granules during volatile fatty acids production



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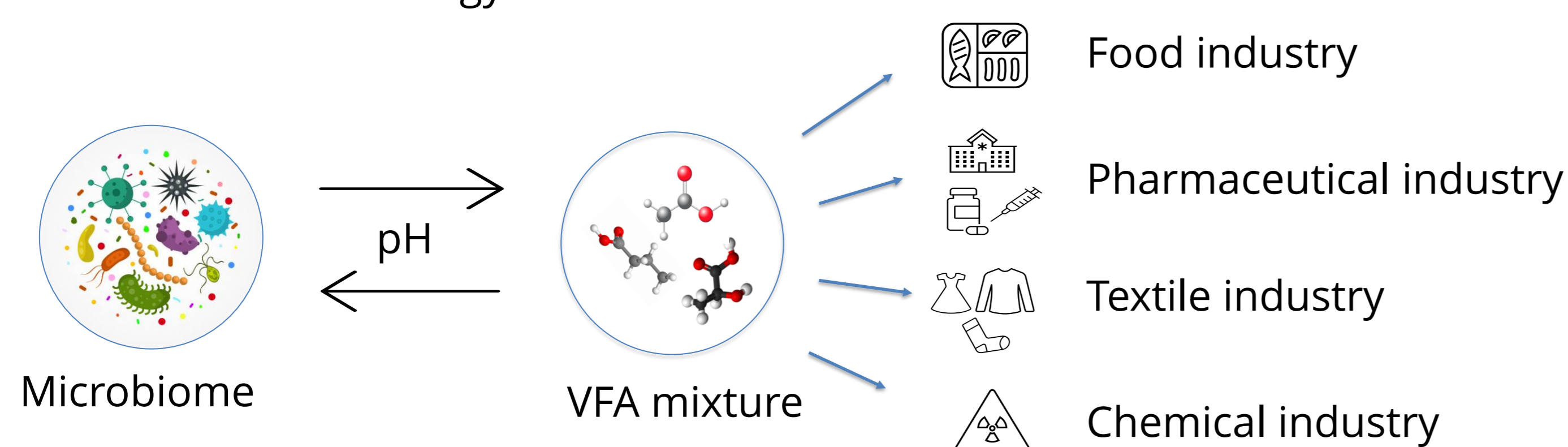
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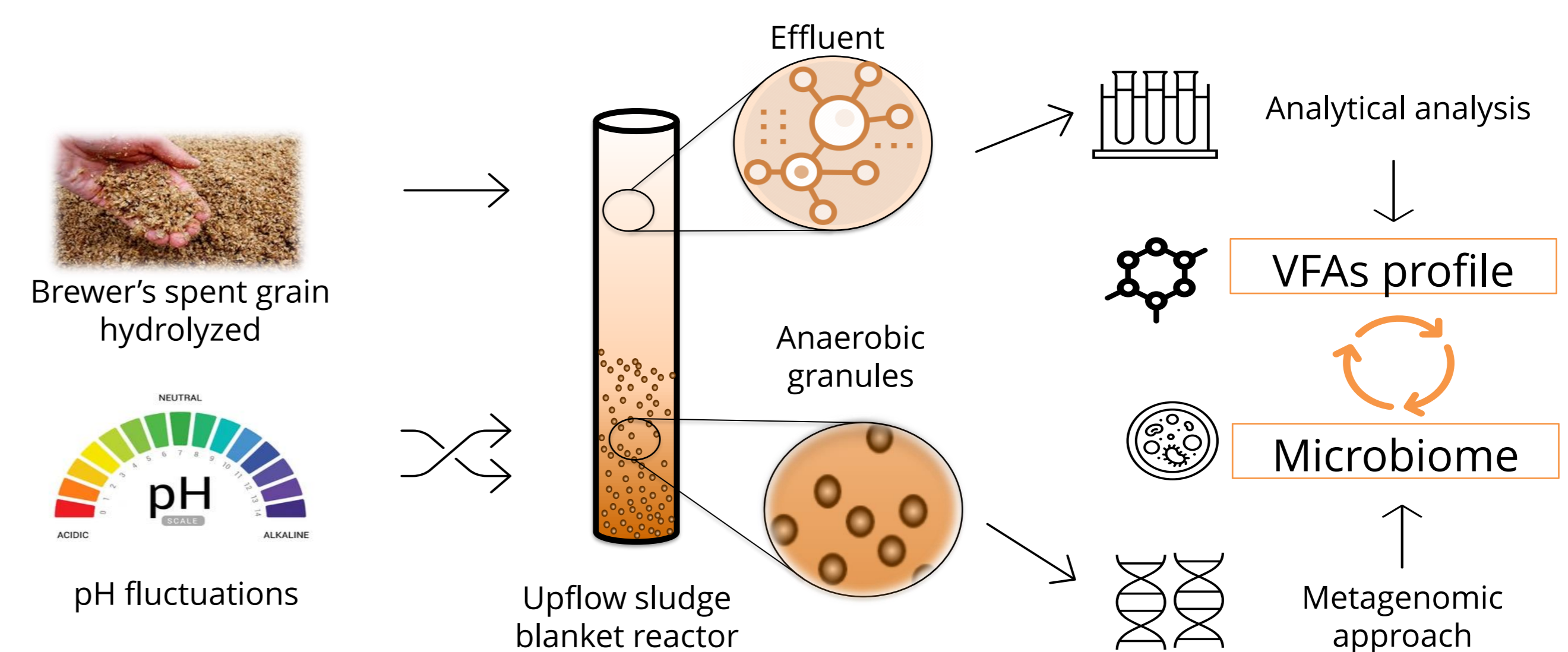
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## Introduction

Volatile fatty acids (VFA) are used on several applications, ranging from the pharmaceutical and textile to food and chemical industries. The bio-based production of VFA from waste-streams is attracting attention as it represents a more sustainable and environmentally friendly approach. VFA production is highly dependent on the microbial community responsible for the process. Therefore, optimization of operational parameters such as pH, for VFA production is crucial but knowledge on the microbiota is needed to further advance the technology.

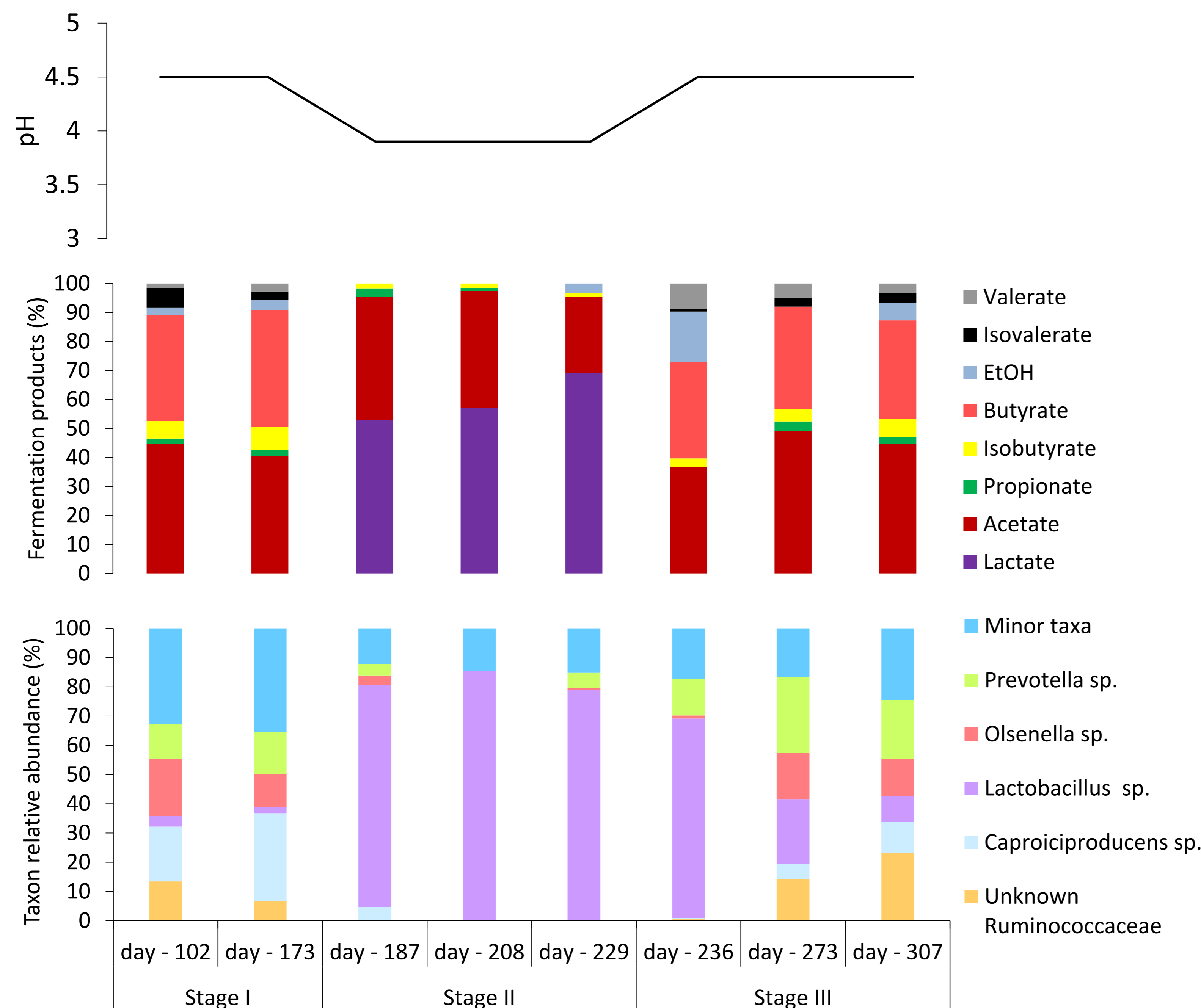


## Graphical methodology



An upflow anaerobic sludge blanket reactor was inoculated with anaerobic granules and fed with hydrolyzed Brewer's spent grain for 311 days (ca. 10 months). After a first period of adaptation, the process was subjected to fluctuations on the pH and their impact on reactor performance and microbiome structure were analyzed.

## Results and Discussion



The changes on the pH shifted the granules microbiome and consequently, the fermentation products released during the process changed.

- I. At pH 4.50 (Stage I), the predominant genera within the biomass were *Olsenella* (11%), *Prevotella* (15%) and *Caproiciproducens* (30%). These taxa belong to families that are known to be involved in the production of acetate and butyrate, which coincided with the main fermentation products obtained during this phase.
- II. When the pH was reduced to 3.90 (Stage II), the fermentation products profile changed, resulting in lactate predominance in the VFA mixture. The microbiome structure at genus level also changed and by the end of this stage, *Lactobacillus* became the dominant bacterial genera (ca. 80% of the overall microbiome) and concomitantly the highest production of lactate was observed.
- III. The restoration of the pH to 4.50 in Stage III led to the restoration of VFA profile, favoring the production of acetate and butyrate. The VFA mixture produced on Stage III was very similar to that of Stage I. A re-structuring of the microbiome also happened with the most abundant taxa resuming its presence in the microbiome although the relative abundance of each taxon was slightly different from that on Stage I.

## Conclusions

- ✓ The pH fluctuations over reactor operation modulated the microbial communities within granules and consequently the VFAs mixture produced.
- ✓ Knowledge on the dominant microbiota under specific process conditions help devising robust approaches for efficient and stable VFAs production.

## Acknowledgements

This work was financed by Fundação para a Ciência e a Tecnologia (FCT) through the project PTDC/BTA-BTA/31746/2017 and the grant SFRH/BD/136300/2018. Authors thank the research centers scientific collaboration under the FCT projects UIDB/50016/2020, UIDP/04378/2020, UIDB/04378/2020, UIDB/50006/2020 and UIDP/50006/2020. The authors also thank Super Bock Bebidas S.A for supplying the anaerobic granules and the brewer's spent grain.

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