Circular Economy in Food Industry Waste Management (BIVALIA Workshop2 - 2026)

Editors: Elena Diaz Nieto; Francisco Heras Muñoz; Juan Antonio Melero Hernández; Manuel Gertrudix
Madrid, BIVALIA, UAM-URJC, 2026
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OFFPRINT · PP. 23–24

Advances in the hydrogen valorization of different biorefinery waste streams derived from food industry residues

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aqueous phase reforming, hydrogen, biomass

HOW TO CITE THIS CONTRIBUTION

R. Gutiérrez-Fradejas, F. Heras, J.A. Baeza, L. Calvo, M.A. Gilarranz, S. Arshad, L. Amodio, J. Cueto, D.P. Serrano, M.J. Negro, C. Álvarez. (2026). Advances in the hydrogen valorization of different biorefinery waste streams derived from food industry residues. In: Diaz Nieto, E., Heras Muñoz, F., Melero Hernández, J. A., Gertrudix, M. (Eds.), Circular Economy in Food Industry Waste Management (BIVALIA Workshop2 - 2026), pp. 23–24. BIVALIA, UAM-URJC. https://doi.org/10.5281/zenodo.22206833

Oral Presentations #12

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Keywords: *aqueous phase reforming, hydrogen, biomass*

Within the BIVALIA-CM research network, experimental studies have been conducted using representative streams derived from dairy processing, enzymatic treatments of biomass residues, and thermochemical conversion processes. This contribution presents the main results obtained to date, with emphasis on the influence of feedstock composition on process performance and the challenges associated with the valorization of real waste streams for hydrogen production

The first group of studies focused on raw and concentrated whey from dairy industries. APR experiments were carried out at different feed concentrations using Pt/C catalyst loadings of 3 and 5 wt.%. The results revealed a strong influence of both substrate concentration and catalyst loading on process performance. Maximum carbon conversion to gas (CCgas) values of 76.9 % and hydrogen yields up to 67.6 mmol H_2 $gTOC^{-1}$ were obtained under the most optimal conditions. Gas composition was dominated by H_2 and CO_2, with a maximum H_2 composition of 56%.

In parallel, aqueous streams generated during the enzymatic processing of brewery bagasse and grape stalk residues were evaluated under a common set of APR conditions. Preliminary results demonstrated the suitability of these streams as feedstocks for hydrogen production, reaching carbon conversions of 81.4 % and hydrogen yields of 52.4 mmol H_2 $gTOC^{-1}$. Significant differences were observed among the type of enzymatic treatment used.

Additionally, aqueous fractions of bio-oils obtained from pyrolysis and hydropyrolysis processes are currently being investigated, building upon previous experience within the research group [1]. Owing to their high chemical complexity and broad distribution of oxygenated compounds, these streams represent a challenging substrate for APR.

Overall, the results obtained to date confirm the versatility of APR for the valorization of diverse aqueous waste streams generated in food-based biorefineries. Furthermore, they highlight the importance of feedstock composition in determining hydrogen production, carbon conversion and gaseous product distribution.

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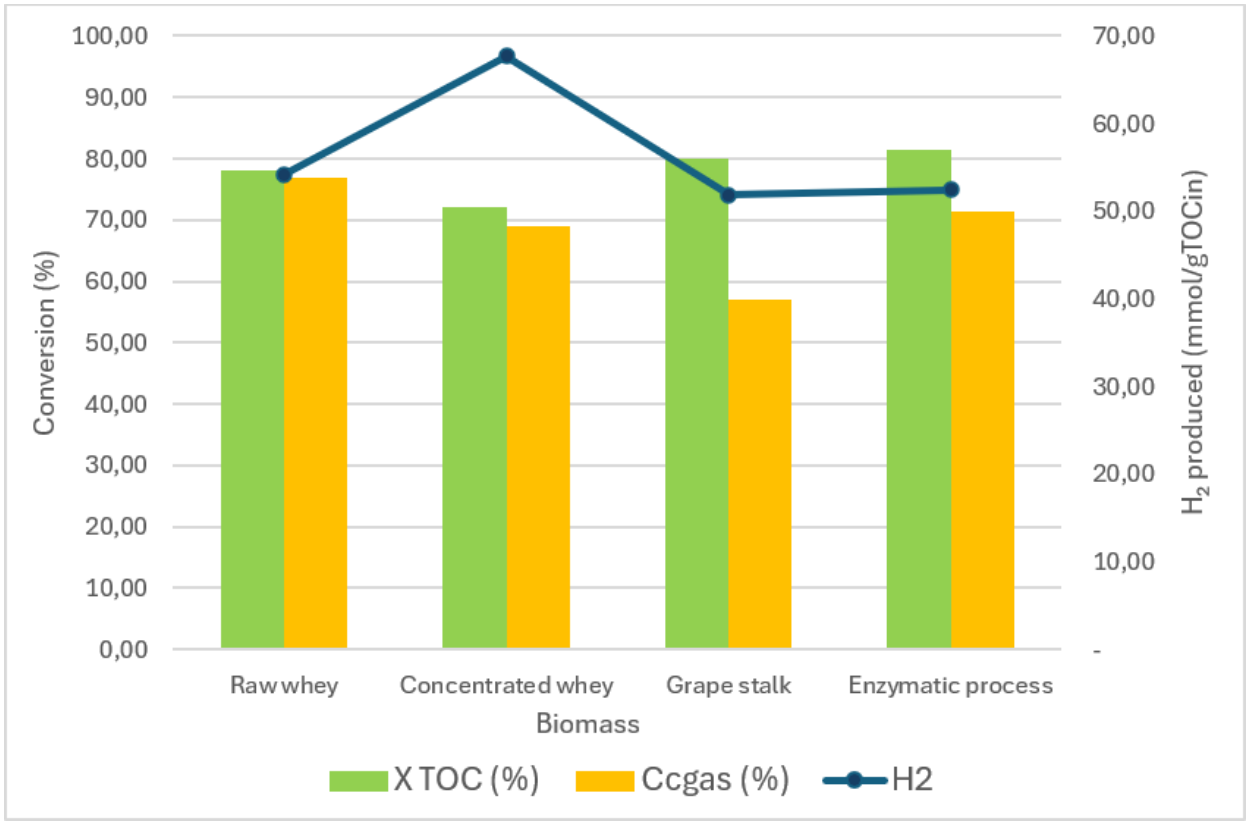


Figure 1. Preliminary results obtained for the different types of biomasses (5 wt.%, 1500 ppm).

Acknowledgements

This work was supported by the Community of Madrid (Research Network BIVALIA-CM TEC-2024/BIO-177).

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