# Article information:

Valorisation of multiple components from residual biomass for food and biofuel applications: A virtual biorefinery evaluation - ScienceDirect
<https://www.sciencedirect.com/science/article/pii/S0960308523000135>

# Article summary:

1. A virtual biorefinery process has been designed to integrate protein extraction and ethanol production from brewers’ spent grain (BSG) and palm kernel meal (PKM).

2. The techno-economic analysis showed that both large-scale biorefineries of BSG and PKM have positive economic potential, with internal rates of return of 24% and 12%, respectively.

3. The integration of the production of high-value products like protein powder for food applications with the production of biofuel like ethanol from residual biomass can valorize a larger portion of the biomass with the same raw material costs.

# Article rating:

May be slightly imbalanced: The article presents the information in a generally reliable way, but there are minor points of consideration that could be explored further or claims that are not fully backed by appropriate evidence. Some perspectives may also be omitted, and you are encouraged to use the research topics section to explore the topic further.

# Article analysis:

The article "Valorisation of multiple components from residual biomass for food and biofuel applications: A virtual biorefinery evaluation" presents a techno-economic analysis of a conceptual biorefinery process that integrates protein extraction and ethanol production from brewers' spent grain (BSG) and palm kernel meal (PKM). The study aims to evaluate the economic potential of integrating the production of high-value products, such as protein powder for food applications, with the production of biofuels, like ethanol, from residual biomass.

The article provides a comprehensive overview of the composition and potential uses of BSG and PKM. It highlights the need for sustainable frameworks that consider all factors related to biomass utilization, including competition for resources, waste reduction, and circularity. The authors argue that adopting an integrated biorefinery approach can lead to more efficient biomass utilization, greater biomass value, and significant waste reduction.

The article's methodology section provides detailed information on how the techno-economic analysis was conducted. The authors explain how they estimated operational expenditure (OPEX) and capital expenditure (CAPEX or fixed capital) based on assumptions about raw material costs, utility costs, consumable costs, labour-related costs, equipment costs, maintenance costs, overhead costs, financing costs, product yields and prices. They also describe how they calculated economic indicators such as average cash flow, simple pay-back period, net present value and internal rate of return.

However, there are some potential biases in this article that should be noted. Firstly, the study only focuses on the economic potential of integrating protein extraction with ethanol production from BSG and PKM. While this is an important aspect to consider when evaluating biorefinery processes' feasibility and profitability, it does not address other environmental or social impacts associated with these processes.

Secondly, the article assumes that BSG and PKM are abundantly available without considering their geographical distribution or availability in different regions. This assumption may not hold true in areas where beer brewing or palm oil extraction is not prevalent.

Thirdly, while the authors acknowledge that their assumptions have an accuracy range between -50% to +100%, they do not provide any sensitivity analysis or explore alternative scenarios to test their assumptions' robustness.

Finally, there is no discussion about possible risks associated with using residual biomass for food applications or biofuels production. For example, using residual biomass for food applications may compete with land use for food crops or raise concerns about food safety if contaminants are present in the residual biomass.

In conclusion, while this article provides valuable insights into the economic potential of integrating protein extraction with ethanol production from BSG and PKM through a virtual biorefinery evaluation process; it has some limitations regarding its scope and assumptions. Future studies should consider broader environmental and social impacts associated with these processes while exploring alternative scenarios to test their robustness.

# Topics for further research:

* Environmental impacts of biorefinery processes
* Social impacts of biorefinery processes
* Geographical distribution of brewers' spent grain and palm kernel meal
* Sensitivity analysis of techno-economic assumptions
* Risks associated with using residual biomass for food applications
* Circular economy and biomass utilization

# Report location:

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