# Technological aspects of beverage production using rice processing by-products: bran and broken rice

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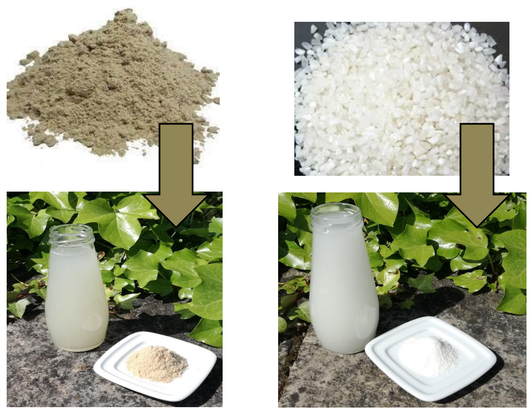
## Introduction

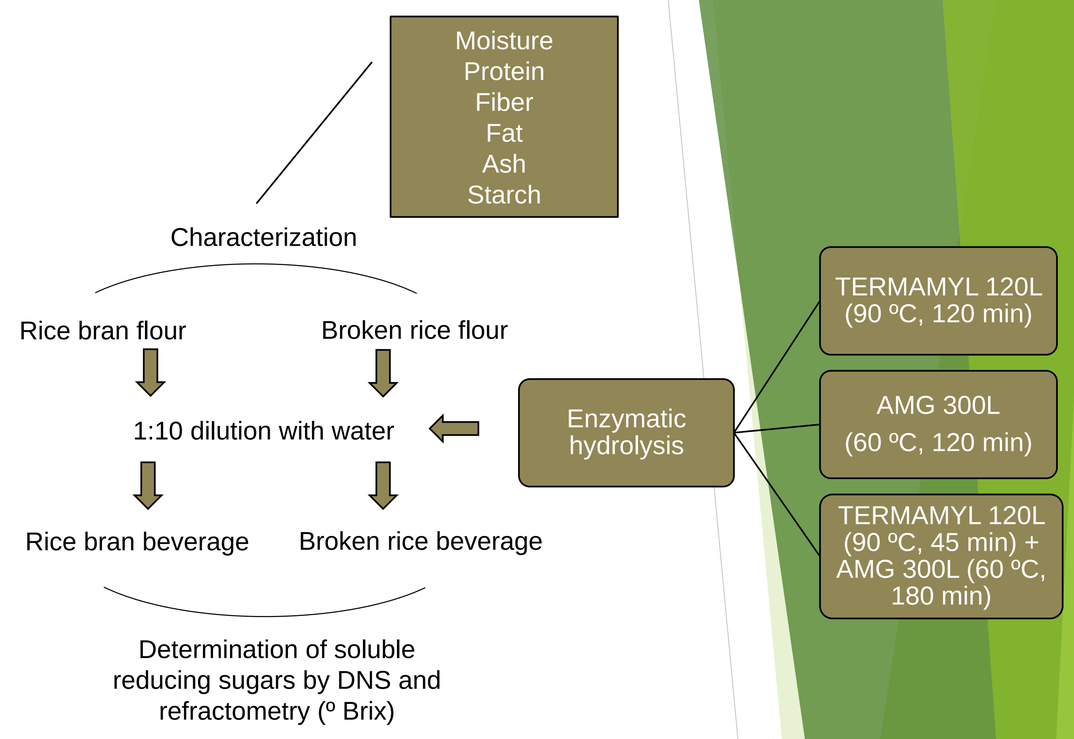
Rice it's a cereal appreciated and consumed all over the world [1]. About 600 Mton are produced annually worldwide, being Asian region the largest producer [2]. In Portugal, rice is the second most cultivated cereal (169289 ton) only exceeded by corn crop (710634 ton) [3].

Rice by-products, like broken rice and rice bran are generated during the industrial rice processing, accounting of 14% and 8%, respectively [4]. Nowadays their most common destination is animal feed [2]. However, their recognized high nutritional properties comparing with polished rice [2] give them a high potential for valorization, especially for vegetable-based drinks development for human consumption.

The increasing concerns about health, allergies and intolerances has stimulated the demand of these type of drinks, that compete directly with the dairy market [5]. The sweet taste of "rice milk" can be obtained using enzymatic hydrolysis. The starch breaks down into simple sugars making the sugar/sweeteners addition unnecessary [6].



## Material and methods




## Results and discussion

### Broken rice and rice bran flours characterization

Broken rice consists essentially of starch and protein, while rice bran is characterized by high content of fiber, fat and ash. This composition is somehow expected because it is intrinsically related with the part of the rice grain from where it was extracted.

Table 1. Chemical composition of rice bran and broken rice

| Composition (%, dry basis) | Rice bran | Broken rice |
|---|---|---|
| Moisture | 3.46 ± 0.01 | 6.37 ± 0.01 |
| Protein | 22.32 ± 0.26 | 10.90 ± 0.35 |
| Fiber | 12.24 ± 0.10 | 0.37 ± 0.08 |
| Fat | 19.84 ± 0.12 | 0.50 ± 0.11 |
| Ash | 9.32 ± 0.01 | 0.60 ± 0.03 |
| Starch | 12.36 ± 5.77 | 60.50 ± 2.76 |

### Enzyme activities for rice by-products hydrolysis

In the case of broken rice (Fig.1), it was observed that the reducing sugars concentration doubles over the reaction. However, after AMG 300L addition the hydrolysis slows down maybe due to the reaction temperature decrease (60 ºC).

In the case of the rice bran, the reducing sugars concentration practically did not change over time. This result can be explained by the low quantity of starch present in this by-product (Table 1).

It was also possible to inferred that the commercial enzymes used in this study were not appropriated for the rice bran starch hydrolysis. For that reason, only the broken rice was used to test the enzymes individually (Fig 2).

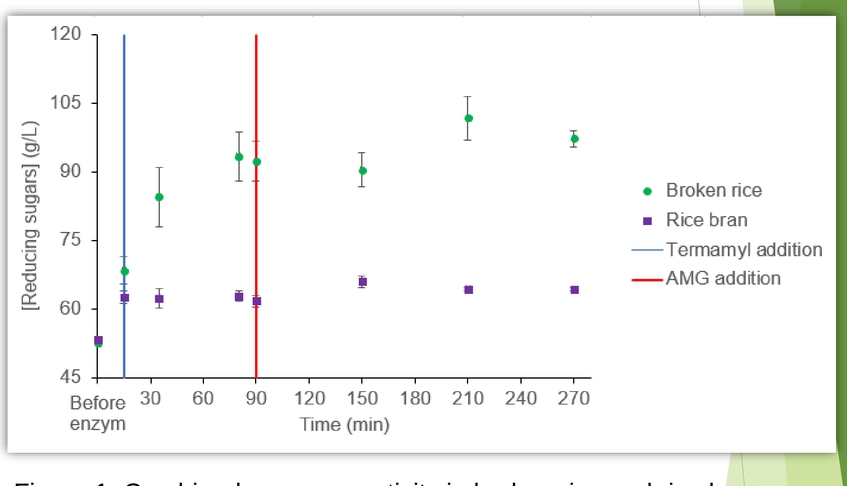



Figure 1. Combined enzymes activity in broken rice and rice bran

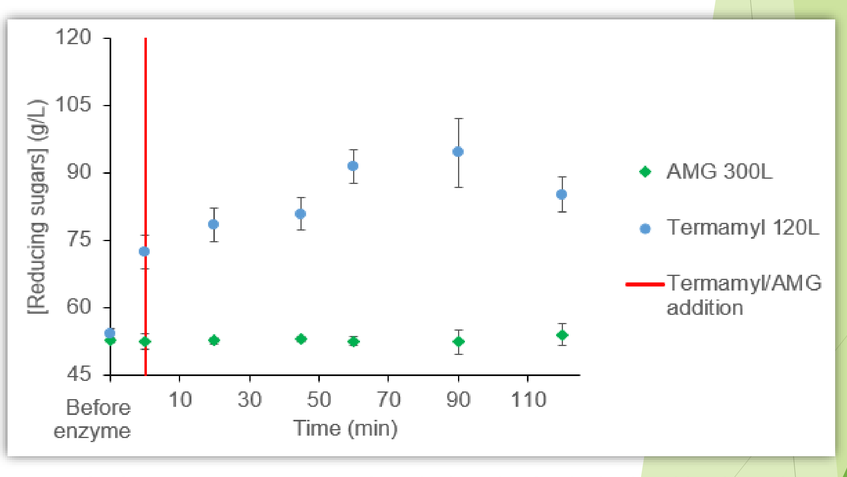



Figure 2. Reducing sugars concentration during the hydrolysis of broken rice using AMG 300 L or TERMAMYL 120L

Using only TERMAMYL 120L (Fig. 2) the reducing sugars profile was similar to the one found where both enzymes were applied, indicating that this enzyme was the main responsible for the hydrolysis. This behavior was confirmed by refractometry (data not shown). In the case of AMG 300L there was no variation in reducing sugars over the reaction time. These results confirm the lack of activity of this enzyme under the tested conditions (time and temperature) and by-products.

## Conclusion

This study allowed to conclude that TERMAMYL 120L is appropriated for the production of broken rice-based beverages leading to higher reducing sugar concentrations. Refractometry is a simple and expeditious method to monitor the starch hydrolysis. It was also found that AMG 300L can be disposed in this case allowing to a processing costs reduction. The smaller amount of starch in rice bran and the absence of enzymes activity in this by-product demonstrated that it is not appropriate for the production of rice-derived beverages.

## References

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